

INDIAN STATISTICAL INSTITUTE

ANNUAL REPORT

April 1960—March 1961



203 BARRACKPORE TRUNK ROAD
CALCUTTA-35

INDIAN STATISTICAL INSTITUTE

President in Chintaman D. Deshmukh.

Vice-Pres Dr. P. N. Banerjee, M.A., D.Sc. was one of the Vice-Presidents until his death on 6 September 1960; Dr. S. K. Banerji, D.Sc.; Professor S. N. Bose, F.R.S.; Professor D. R. Gadgil, M.A., M.Litt.; Dr. Q. M. Hussain, M.A., Ph.D.; Dr. Zakir Hussain, Ph.D.; Professor D. G. Karve, M.A.; Professor K. B. Madhava, M.A., A.I.A.; Dr. G. L. Mehta, M.A., LL.D.; Sir Shri Ram.

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Vice-Chairmen: Shri K. P. Goenka; Shri K. C. Mahindra, M.A. (Cantab.); Shri D. N. Mukherjee, M.L.A.; Shri S. C. Ray, M.A., B.L.; Professor N. R. Sen, M.A., D.Sc.

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Members (Nominated by Government of India): 1. Shri Vishnu Sahay, I.C.S., Cabinet Secretary or his representative; 2. Shri A. C. Bose, Joint Secretary, Ministry of Finance (Food & Agriculture); 3. Shri Rajeswari Prasad, Chief Director, National Sample Survey.

GOVERNING BODY OF THE RESEARCH AND TRAINING SCHOOL: 1960-61

Sir D. N. Mitra, Chairman (*ex-officio*); Professor P. C. Mahalanobis, Director-Secretary (*ex-officio*); Shri Baliram Bhagat, M.P., Union Deputy Minister; Shri Vishnu Sahay, I.C.S., Secretary to the Cabinet, (Government of India), Dr. N. S. R. Sastry, M.A., M.Sc., Ph.D. (Reserve Bank of India); Dr. Ram Behari, M.A., Ph.D. Sc.D. (Cantab.), Professor and Head of Mathematics Department, Delhi University (Inter-University Board); Mr. George Barrell, Managing Editor, Capital (Private) Ltd., (Associated Chambers of Commerce of India); Shri G. Basu, B.A., F.C.A., F.S.A.A., F.C.I.S., F.I.C., W.A., M.L.C., J.P. (Federation of Indian Chambers of Commerce and Industry); Professor N. B. Prasad, D.Sc. (Paris), Ph.D. (Lond.), Head, Mathematics Department, Allahabad University, (National Institute of Sciences of India); Dr. S. N. Sen, M.A., Ph.D. (Indian Economic Association); Professor S. N. Bose, F.R.S.; Shri S. Basu, M.Sc.; Shri N. C. Chakravarti, M.A.; Professor K. B. Madhava, M.A., A.I.A., F.N.I.; Shri Pitambar Pant, M.Sc.; Sir Shri Ram; Dr. C. R. Rao, M.A., M.Sc., Ph.D. (Cantab.) [*Council of the Indian Statistical Institute*].

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Twenty-ninth Annual Report : April 1960—March 1961

INTRODUCTION : CONSTITUTION AND ACTIVITIES

GENESIS

Work on mathematical statistics had started nearly forty years ago, in the early twenties, in the room of P. C. Mahalanobis in the Presidency College, Calcutta, where he was professor of physics at the time. In the course of the next ten years a small group of young men gathered together in what came to be known as the Statistical Laboratory which by 1930 was receiving an annual research grant of about Rs. 2,500 from the Imperial (now Indian) Council of Agricultural Research. This group conceived the idea of starting a statistical society in India and it was as a result of their initiative that the Indian Statistical Institute was brought into existence by a resolution passed at a public meeting held in December 1931 under the chairmanship of the late Sir R. N. Mookerjee, who was elected the first President of the Institute and held that office for 5 years (1931-36). The Institute was registered as a non-profit distributing learned society under Act XXI of 1880 in April 1932. Against a single worker, a part-time computer and a total expenditure* of Rs. 238 in the first year, the Institute had, at the end of the twenty-ninth year (31 March 1961), a staff of about 2,000 paid workers, the total expenditure during the year being over Rupees 90 lakhs.

CONSTITUTION

Object : The basic object of the Institute is the advancement of knowledge of statistics and allied subjects related to planning for national development and social welfare, and the collection of information for purposes of planning and the improvement of the efficiency of management and production.

Membership : The membership is open to all persons irrespective of sex, nationality, race, creed, or class. No part of the Institute funds can be distributed in any form among the members but workers of the Institute are not debarred from receiving remuneration because of their also being its members.

Control : The supreme control of the Institute is vested in the general body of members of the Institute which includes ordinary, life and honorary members, and honorary fellows. It is this body which has the authority to make and amend the rules of the Institute. The Annual Report and Audited Accounts are presented at the Annual General Meeting; other General Meetings are held whenever necessary. The number of members entitled to vote was about 428 at the end of March 1960.

Management : The management of the Institute is vested in the President, Vice-Presidents and a Council consisting of the Chairman, Vice-Chairmen, Treasurer, Secretary and other office-bearers, and twenty members, elected by the members of the Institute, besides representatives of regional branches, three representatives of the Government of India, and co-opted members. Subject to overall coordination by the Council, the management of the Research and Training School is vested in a Governing Body constituted with elected representatives of the Council of the Institute, of the Government of India, and of a number of public bodies. The International Statistical Education Centre is administered by a Board of Directors consisting of the representatives of the International

* Excluding the grant of Rs. 2,500 from the ICAR mentioned above.

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Statistical Institute, the Government of India and the Indian Statistical Institute. There are two Finance Committees, one of the Governing Body and the other of the Council, an *ad hoc* Committee for the allocation of expenditure on which the Government of India is represented, a Journal Committee and an Examinations Committee, and several other committees, executive and technical, for day-to-day administration and coordination.

Sri C. D. Deshmukh has been functioning as the President since 1945, Sir D. N. Mitra as the Chairman since 1955, Dr. S. C. Law as Treasurer since 1936 and Professor P. C. Mahalanobis as Secretary and Director from the inception of the Institute.

Audit: Chartered Accountants, qualified to audit accounts under the Indian Companies Act and appointed at the Annual General Meeting, have been auditing the Institute's accounts every year since its formation. In recent years the auditors are being selected with the approval of the Government of India.

Indian Statistical Institute Act: The Indian Statistical Institute Act, empowering the Institute to confer degrees in Statistics, was passed by Parliament in December 1959.

DEVELOPMENT OF THE WORK OF THE INSTITUTE

Expansion: Four stages: The expansion of the Institute's activities, both in volume and range, has taken place since its foundation, broadly speaking, in four stages, bearing in mind that there has always been considerable overlapping in the process so that no date-line can be fixed for the passage from one stage to another. During the first few years of its existence, the Institute functioned as a scientific society and also served more or less as a laboratory for analytical studies including the use of design of experiments in agricultural experiments on a fairly large scale. Even during this early tentative period, the Institute was commissioned by the Government as well as some private concerns to carry out several economic enquiries on a small scale.

Professional training started in the very first year on a small scale and on an individual basis. To meet with increasing demand the Institute was obliged gradually to offer organized instruction at various levels, in theoretical and applied statistics and computational work. These activities later on developed into the Research and Training School with excellent facilities for advanced studies and research in many subjects. In 1938 the Institute started external examinations for the award of Statistician's Diploma and Computer's Certificate which are now held all over India. From that year the Institute also started receiving a research grant from the Government of India.

The Institute passed on to the second stage with an increase in the number and scope of economic enquiries, the most important among them being crop-estimation surveys conducted on behalf of the Government of Bengal and later the Government of Bihar, which led to the development of specialized techniques necessary for large-scale sample surveys. During this period, at the instance of the Government of India, the Institute prepared most of the tables for 1941 census of population on the basis of two per cent *Y*-sample.

A small workshop was started during the war through an associated non-profit making organization for the repair and maintenance of calculating machines and other equipment. This made it possible for the Institute to design and construct the first electronic computer in India in 1953, which led to the creation of an Electronic Computer Division.

The third stage followed as a logical consequence to the second when the Institute was called upon by the Government of India in 1950 to take a leading part in organizing

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the National Sample Survey. The next big step was the inauguration by Prime Minister Nehru in 1954 of studies relating to planning for national development. This led to the formulation of the "Draft Plan-Frame" of 1955, which was accepted as the basis for the preparation of the Second Five Year Plan. Since then the Institute has been actively engaged in work on planning in both Calcutta and New Delhi in close collaboration with the Planning Commission and Central Statistical Organization.

The enactment of the Indian Statistical Institute Act in December 1959 marked the beginning of the fourth and the present stage of the Institute's history. This Act declared the Institute to be an institution of national importance and conferred on it the right to hold such examinations and grant such degrees and diplomas in statistics as might be determined by the Institute from time to time. Facilities were already available at the Institute for training courses in statistics, and diplomas and certificates were being awarded on the results of examinations held periodically. But the Act gave the Institute the status of a University, and arrangements have been made with effect from 1 July 1960 for regular courses of study for the degrees of Bachelor of Statistics (B. Stat.) and Master of Statistics (M. Stat.). A feature of both these courses is the highly integrated teaching of natural and social sciences as the foundation for the training of professional statisticians.

CURRENT ACTIVITIES

The more important among the current activities of the Institute, which cover a very wide field, are briefly outlined below.

1. *Learned Society*: The Institute continues to function as a learned society and publishes the internationally known Journal, *Sankhyā: The Indian Journal of Statistics*, as its official organ. It has society branches at Aligarh, Bangalore, Bombay, Madras and Poona.

2. *The Research and Training School (RTS)* has sections for mathematics, theoretical and applied statistics, biometry, psychometric research and service, demography, sociological studies, regional (geographical) surveys, geological studies, and flood research.

Several courses of professional training are given for candidates who have taken the Master's Degree, besides in-service training for statisticians in collaboration with the Central Statistical Organization in New Delhi and technical training for computers, field investigators and operators of machine tabulation.

Since July 1960, the RTS has been conducting regular classes for Bachelor of Statistics (B. Stat.) and Master of Statistics (M. Stat.) degrees.

3. *The International Statistical Education Centre (ISEC)* is maintained jointly by the International Statistical Institute and the Indian Statistical Institute with the support of the Government of India and the UNESCO.

4. *Statistical Examinations*: The Institute is conducting examinations on a country-wide basis for the award of the Statistician's Diploma and Certificates for Computers and Field Investigators.

5. *The Planning Division* has units in Delhi and Calcutta. The Delhi Unit is working on the outline of the Third Five Year Plan and scientific and technical manpower in collaboration with the Perspective Planning Division of the Planning Commission and the Central Statistical Organization. The Calcutta Unit is working on problems of economic development.

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6. *The National Sample Survey* : The Institute is in charge of design of surveys, the technical work, and the tabulation and processing of the primary data collected by the Field Branch of the NSS which works under the direct control of the Cabinet Secretariat. The tabulation work is done at three centres, Calcutta, Giridih and Delhi.

7. *Electronic Computer Division* : An analogue computer was designed and constructed in the Institute in 1953; a digital computer of British make was purchased in 1959; and a Russian digital computer was installed in 1969. Computation service is being offered to many scientific institutions; and developmental research is also proceeding to construct electronic adjuncts and equipment.

8. *The Development Workshop* services the machines and equipment in the Institute and is also engaged in developmental research. Fourteen high-speed electronic "sorters" were designed and constructed and have gone into batch production; and prototypes have also been constructed of desk calculating machines.

9. *Statistical Quality Control* : The Institute maintains seven units at Bangalore, Bombay, Baroda, Calcutta, Coimbatore, Delhi and Madras, which work under the guidance of an SQC Policy Advisory Committee appointed by the Government of India.

10. *Publications* : In addition to *Sankhyā: The Indian Journal of Statistics* the Institute publishes important scientific and statistical books in collaboration with the associated non-profit distributing Statistical Publishing Society which has a well-equipped press (the Eka Press) in Calcutta. Arrangements have also been made to publish another research journal to be named '*Nikasha*'.

RESEARCH AND TRAINING SCHOOL

The Research and Training School (RTS) may be described as the hard core of the Institute. Before the Institute came into existence, statistics, in its scientific sense, was practically unknown in the country, the widely prevalent notion being that statistics meant just the compilation of figures. From the very beginning, therefore, the Institute had to train up its workers in methods of statistical analysis. As early as 1932, the Central and State Governments began to depute officers for training in the Institute. Such training in the earlier years was largely on an individual basis. In 1930 the Institute started organized courses of instruction which gradually led to the development of the present Research and Training School.

Training Courses : The Institute offers at present about twelve courses, at different levels, in Calcutta, Bombay and Delhi in cooperation with the Central Statistical Organization and the Institute of Agricultural Research Statistics. Some of these are degree courses, while others are courses for producing trained statisticians. The School also organizes the training of statistical computers at different levels. Up to 1960-61 organized training was given to nearly 3,500 persons including 375 foreign trainees in theoretical and applied statistics and, in addition, apprenticeship training was given to about 2,000 persons through participation in project work.

NEW DEGREE COURSES

The Indian Statistical Institute Act passed by the Parliament in December 1959 empowered the Institute to confer degrees in statistics. The Institute decided to conduct, with effect from 1 July 1960, courses of study for preparing candidates for examinations leading to the degrees of Bachelor of Statistics (B. Stat.) and Master of Statistics (M. Stat.).

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The two higher degrees of Ph.D. and D.Sc. have also been introduced. With effect from the same session, the two-year advanced professional statistician's course has been discontinued. Almost all the other training courses and examinations that were being conducted up to 1960 are continuing with modifications in the syllabus wherever necessary.

From its inception the Institute realized the need for courses of training at different levels for turning out professional statisticians in much larger number than theoretical statisticians who are competent to do only teaching or research work. It also realized in organizing the various courses conducted at the Institute that a purely academic type of education imparted through lectures on theory and through laboratory work would not be sufficient for the making of competent professional statisticians, and that field-work in connection with small and large-scale statistical investigations and actual in-service experience should form an essential part of the training. In this respect it has been held that education and training in statistics should be similar to those in medicine or engineering. It was in accordance with these ideas that several professional courses in statistics were organized a few years ago.

Statistical methods as they are known to-day are a powerful tool in other branches of knowledge and in various fields of human activity, particularly in the natural and social sciences, including economics. For the correct and efficient use of statistical methods, it is therefore necessary that the professional statisticians should be equipped with basic knowledge at least in the more important fields of application. In regard to imparting this basic knowledge, exclusive specialization in a few of the fields will not only fail to achieve the necessary comprehensiveness, but also may not be feasible in a course which is primarily one in statistics. It has, therefore, been held that an integrated approach in this respect would be optimal. Incorporation of the professional elements in teaching, and an integrated education in the fields of application of statistics, are two important features of the new B. Stat. and M. Stat. degree courses.

COURSES, EXAMINATIONS, DEGREES, ETC. FROM JULY 1960

With effect from 1 July 1960, the activities of the Institute relating to educational courses, training and research facilities, and the conduct of all-India examinations fall under the following categories. (The intake capacity of each of the courses is given in brackets).

Research (Guidance)

- (i) Research and advanced studies, general (8)
- (ii) Research leading to the Ph.D. degree of the Institute (15)

Degree Courses

- (i) Four-year course leading to the B.Stat. degree (class of 30 yearly)
- (ii) Two-year course leading to the M.Stat. degree (class of 25 yearly)

Training Courses (for specialized studies, training of personnel, and for candidates preparing for Diploma and Certificate examinations)

- (i) Short-term Statistician's Course at Calcutta : Junior, 6 months (50)
- (ii) Short-term Statistician's Course at Calcutta : Senior, 6 months (25)
- (iii) One-year Evening Course in Statistics at Delhi : in collaboration with CSO (40)
- (iv) One-year Evening Course in Statistics at Bombay (30)
- (v) Statistical Officer's Training Course : Jointly with CSO, 6/8 months (25)

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- (vi) Special Short-duration individual training for officers on deputation (10)
- (vii) Computer's Training Course at Calcutta : Junior, 6 months (50)
- (viii) Computer's Training Course at Calcutta : Senior, 6 months (25)
- (ix) Occasional courses on special subjects (short-duration)
- (x) Courses at the International Statistical Education Centre : 9 months (30)

Diploma and Certificates Examinations (all-India examinations open to external candidates)

- (i) Statistician's Diploma Examination
- (ii) Computer's Certificate Examination, Part I
- (iv) Statistical Field Survey Certificate Examination, Part I
- (v) Statistical Field Survey Certificate Examination, Part II

Awards for Higher Professional Attainments

- (i) Associateship of the Indian Statistical Institute (A.I.S.I.) on the basis of report submitted of professional work.
- (ii) Associate Fellowship of the Indian Statistical Institute (A.F.I.S.I.) on the basis of report/thesis submitted of professional work.

Awards for outstanding contributions

- (i) D.Sc. degree of the Institute in recognition of outstanding published work in the field of statistics.
- (ii) Fellowship of the Indian Statistical Institute for fundamental contributions in the field of statistics.

RESEARCH

A brief account of the current research programme covering a variety of subjects is given below.

1. *Theoretical Research* : Extensive researches have been done by the workers of the Institute on Mahalanobis's D^2 or the Distance Function and multivariate analysis particularly for purposes of classification; design of experiments with the application of the theory of Galois fields; the theory of estimation, including the Rao-Blackwell theorem; large sample theory including frequency chi-square tests; and advanced probability including the use of the theory of topology. Much important work has also been done on the theory of design of sample surveys, the use of interpenetrating samples and fractile graphical analysis.

2. *Biometric Unit*: The Biometric Unit, which was greatly strengthened when Professor J. B. S. Haldane and Mrs. Haldane (Dr. Helen Spurway) joined it in 1957, is at present engaged in research of both scientific and economic interest. Among some of its interesting studies are those on regeneration in rice, growth and survival rate of fish (Indian carp), paddy-cum-fish culture, synthetic plant hormones, human blood groups, and ascent of sap in palms.

3. *Psychometric Research and Service* : This Unit was set up in 1954 to work on psychological measurements with particular emphasis on the development, application and analysis of psychological tests for educational and vocational selection.

4. *Demographic Research and Training* : Apart from the continuing demographic surveys conducted by the NSS, important studies have been carried out in the Institute since

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1957, with the assistance of the Ministry of Health, in which special emphasis is laid on studying factors associated with fertility and mortality.

5. *Sociological Studies Unit* : This Unit is carrying on sociological studies with special reference to the village as a local unit and on various aspects of changing social conditions. Some field studies are being carried out at Giridih.

6. *Regional Survey Unit* : Dr. A. T. A. Loarmouth of the Department of Geography, Liverpool (UK), who came to the Institute in August 1956, initiated in Mysore State a pilot project in regional survey for planning the development of new techniques for economic surveys by a combination of geographical with statistical methods.

7. *Geological Studies Unit* : Dr. Pamela L. Robinson of University College, London, organized the Unit in 1957-58, and led two expeditions to different parts of the country resulting in the collection of important fossil material. In 1960-61 another expedition was organized under the guidance of Dr. Robinson and Dr. Alec Smith, also of the University College, London, which led to some remarkable new finds including extensive fossil bones of dinosaurs. The Royal Society of London sanctioned a grant of £ 1200 (Rs. 15,000) in support of this expedition. The work of this Unit is generally concerned with the application of statistical method to geological studies.

8. *Flood Research Unit* : Important statistical investigations were carried out by the Institute in its early days about floods in North Bengal and in Orissa. In May 1958 a small new Unit was organized to study the basic factors responsible for the frequent occurrences of floods in North-East India. The Flood Wing of the Central Water and Power Commission, New Delhi and the Indian Meteorological Department have taken the help of this Unit in carrying out some preliminary studies.

INTERNATIONAL STATISTICAL EDUCATION CENTRE (ISEC)

This Centre was opened in 1950 by the International Statistical Institute in collaboration with the Indian Statistical Institute under the auspices of the UNESCO. It is being maintained with the support of the Government of India. The main purpose of the Centre is to provide courses in theoretical and applied statistics at various levels to selected participants from the countries of South and South-East Asia, the Far East and the Middle East. The teaching at the Centre is undertaken by members of the staff of the Indian Statistical Institute, statisticians from the Government of India and visiting teachers provided by the International Statistical Institute and the United Nations. The Centre has held fourteen sessions, since its inception, training altogether 378 persons from 21 Asian Countries, of whom 270 are from outside India.

STATISTICAL EXAMINATIONS

The Institute has been holding all-India examinations at a number of centres in India for the award of the Statistician's Diploma and Computer's Certificate since 1938 and Certificates of Proficiency in Field-survey since 1950. The certificates and diplomas, issued as a result of these examinations, are recognized for employment purposes by the Government as well as non-Government institutions and commercial organizations. Up to 1961 about 13,841 candidates registered, 11,512 appeared and 3,630 passed in one part or another of these examinations.

The Institute has been instrumental in making available about 9,500 trained persons of whom about 3,500 (including about 300 trainees from outside India) received organized courses of instruction, 2,700 received apprenticeship training, and nearly 3,300 became qualified through external examinations conducted by the Institute.

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PLANNING DIVISION

The Institute has been carrying out studies relating to planning for national development since 1954 when a section for such studies was inaugurated by Prime Minister Jawaharlal Nehru. The first phase of the work led to the preparation of the "Draft Plan Frame", submitted by Professor Mahalanobis to the Government in March 1955 and was accepted as the basis for the formulation of the Second Five Year Plan. Since then, one Unit, located in Delhi, is cooperating with the Perspective Planning Division of the Planning Commission, in the preparation of an outline of the Third Five Year Plan and a series of studies on scientific and technical manpower. It has also taken part in statistical and economic researches on problems of planning in India in collaboration with a number of foreign experts. The Unit in Calcutta is engaged in studies in national income, economic growth, and is also in charge of the teaching of economics in the Research and Training School. An experimental Unit for the study of the economics of cottage industries, called *Kalyansari*, which was started in Calcutta in 1956, is being maintained on a self-supporting basis.

THE NATIONAL SAMPLE SURVEY (NSS)

The Institute has for many years been carrying out sample surveys, both small and large-scale, for the collection of information on agricultural crops and social and economic conditions of the people, on behalf of different Government and other organizations, with the help of block grants sanctioned by the sponsoring authorities. It has also been functioning as a computational laboratory for the scientific processing and analysis of statistical data for various authorities.

Since 1950, the Institute has been handling, on a continuing basis, the vast project of the design and technical work and a part of the field work of the Indian National Sample Survey which is financed by the Government of India. The Field Branch with a large staff of investigators covering the whole country is under the direct control of the Cabinet Secretariat, Government of India.

A very large portion of the Institute's staff is at present engaged in this project which has for its objective the collection of comprehensive information relating to the social, economic and demographic conditions of the country. The survey is carried out in rounds, each round of field investigation extending over a period varying from four to twelve months. The method used is that of canvassing suitable questionnaires in sample households, by trained field investigators. Several thousands of households covered by the NSS every year are selected from both urban and rural areas all over the country. Information is also collected in respect of several organized industries. The results are being increasingly used for the planning of the country's economy and for policy decisions.

Fifteen rounds of survey were completed by June 1960 and the field work for the Sixteenth round was in progress when the year under review ended. Reports and technical papers are also published for the information of the public. Seventy-eight reports have been prepared, out of which forty have been printed and the remaining reports are in the press.

Machine Tabulation Section: The Machine Tabulation Section of the Institute is perhaps the largest in Asia, and has twenty-two Accounting Machines, two Electronic Statistical Machines, thirty-two Sorters, six Calculating Punches (Multipliers), six Collators, and twenty-seven Reproducers and Gang Summary Punches. On an average, over five million cards are punched and fed into the machines every year with about fifty million of card-passages through the tabulators.

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ELECTRONIC COMPUTER DIVISION

Analogue Computer : A small workshop had been started during the war through an associated non-profit organization (to which reference is made later) for the repair and maintenance of calculating machines and scientific equipment. In 1950 a small section was started to promote the use of modern electronic computers. In 1953 a small analogue electronic computer was designed and constructed in the Institute for the solution of a system of linear equation in ten variables which is giving useful service. This was the first electronic computer designed and built in India.

Digital Computers : A digital computer, HEC-2M, of British make was installed in 1956 by Institute engineers and is being maintained since then by them. In 1958 a much bigger digital computer, URAL, was received from USSR through United Nations, and was installed by Soviet engineers, and is being maintained by ISI engineers since February 1959. The URAL machine was working two shifts towards the end of 1959.

Computation Service : The electronic computers are being used not only for the Institute's own work but also to solve computational problems sent by other scientific institutions among whom may be mentioned the Indian Institute of Science, Bangalore; the Tata Institute of Fundamental Research, Bombay; the Indian Institute of Technology, Kharagpur; and the Indian Association for the Cultivation of Science, Calcutta.

DEVELOPMENT WORKSHOP

The Institute has a well-equipped workshop which is responsible for repairs and maintenance of different types of calculators and other equipment in the Institute. It is also giving assistance to other organizations for repair work; for example, it has successfully redesigned and fabricated a vital part of the radar equipment at the Calcutta airport at the request of the Civil Aviation Directorate.

Apart from maintenance and repair work, the workshop carries out developmental research for the manufacture of precision scientific instruments such as desk calculators, punched card sorters and improved parts of calculating equipment, and has already designed and constructed some very efficient high-speed "sorters" for punched cards. The workshop is now engaged in the batch production of such improved sorters.

It may be mentioned that in November 1960 the Ministry of Commerce and Industries, Government of India has issued a license to the Indian Statistical Institute for the manufacture of calculating machines.

STATISTICAL QUALITY CONTROL

Statistical Quality Control is one of the management techniques that has contributed to the efficiency of production in the principal industrial countries during the last decade. The objectives of SQC are ensuring conformance of specifications; increase in productivity; and optimum utilization of men, machines and product.

The Institute became interested in SQC as early as 1935 and started organizing training courses in SQC from 1945. The visit in 1947-1948 of Dr. W.A. Shewhart of the USA who is regarded as the father of SQC, gave a great impetus. This was strengthened by the visit of a team of experts deputed by the United Nations Technical Assistance Administration which conducted training courses at different centres in India in 1952-53. As a follow-up, SQC units were set up in 1953-54, under the administrative control of the

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Institute, at Bombay, Bangalore and Calcutta. Since then four more units have been established at Coimbatore, Delhi, Baroda, and Madras. These units, which are maintained with the help of grants from the Government of India, are engaged in three types of activities, promotional, training and servicing. A Policy Advisory Committee, constituted by the Government of India, guides the activities of these units. The number of member factories on the rolls of the seven units was fifty-eight at the end of March 1961.

GENERAL ACTIVITIES

Library : The Institute has one of the most well-equipped statistical libraries with more than 87,500 books, 1,800 periodicals, about 23,000 reprints, monographs and microfilms and a collection of over 2,50,000 maps. It has a well-equipped Photographic unit for reproduction of documents. There is a Translation Unit for the translation of scientific literature in foreign languages. Besides translations from Russian, Chinese and Japanese, facilities are also available for translations from French, German and other European languages. A separate translation unit is working in Japan for the systematic translation of research material in Japanese.

Visiting Scientists : Since 1938 the Institute has been inviting foreign scientists and scholars to visit India. Since the initiation in 1954 of studies on planning for national development, the Institute has become an important meeting place for visiting scientists from all over the world.

Guest Houses : The Institute maintains guest houses at Baranagar for visitors, many of whom stay at the Institute for fairly long periods for lectures, research work and technical consultation. There is a separate hostel for students of the International Statistical Education Centre in Calcutta, and a guest house at Giridih.

Welfare Activities : The Institute maintains hostels for students, canteens for supplying subsidized refreshments, mess for workers, a circulating library, medical units including a health home at Giridih, its own transport service, and a workers' club for sports, recreation and cultural activities. There is also a workers' cooperative credit society. The Institute provides a good deal of 'in-service' training and also publishes a house-journal, *Samsadadhnam*.

The Guest House, arrangements for guests, medical units and certain residential units are in the charge of a Hospitality Committee under a chairman elected by the Council.

Associated Organizations : In addition to the work done under the direct control of the Institute, the following associated organizations, located within or near the Institute premises, work in close cooperation with it.

The Statistical Publishing Society was established in 1935, on the initiative of the Institute, as a non-profit association, and registered under Act XXI of 1860, mainly for the publication of *Sankhyā : The Indian Journal of Statistics*, which is the official organ of the Indian Statistical Institute. The Society maintains the Eka Press, which is adequately equipped for undertaking the printing of scientific and technical work.

The India Calculating Machine and Scientific Instrument Research Society, which was established in 1934, on the initiative of the Institute, as a non-profit society registered under Act XXI of 1860 with the object of promoting research, production and use in India of calculating machines and statistical, mathematical, scientific and engineering instruments, apparatus and appliances, is now working in association with the Institute Workshop.

PART I : GENERAL REVIEW OF THE WORK DURING THE YEAR

1. RESEARCH AND TRAINING SCHOOL

During the period under review, the activities of the Research and Training School (RTS) consisted of (i) research in different theoretical and applied fields, (ii) conducting the two new degree courses, viz., B.Stat. (four year) and M.Stat. (two year), (iii) providing about ten other courses of training at different levels, including organization of a new advanced course at Delhi, (iv) starting a summer school for teachers, research scholars and professional statisticians, (v) conducting all India professional examinations for statisticians, computers and field investigators, and (vi) offering consultation and other technical services.

The Research and Training School carried out its work with C. R. Rao as the head of the division of theoretical research and training. J. B. S. Haldane, as Research Professor, participated in teaching and also guided research workers in Statistics, Biology and Mathematical Genetics. A. Mathai was in charge of the International Statistical Education Centre, which provides courses for trainees deputed from South East Asian and other foreign countries. Research was carried out in several applied units, attached to the Research and Training School, under the following heads: N. K. Bose (Flood Research), B. C. Das (Physiology), T. A. Davis (Crop Science), R. K. Mukherjee (Sociology), S. J. Poti (Demography), Usha S. Das (Psychometric Research and Service), B. Raychaudhuri, (Geological Studies), V. L. S. Prakasa Rao (Regional Surveys) and S. K. Roy (Botany).

RESEARCH

Research work was carried out during the year in many branches of Theoretical Statistics such as: Probability, Information Theory, Statistical Inference, Design of Experiments, Sample Surveys, and Economic Planning. The units for applied research in Biometry, Psychometry, Sociology, Demography, Regional Surveys, Geology and Flood Research undertook a number of research projects, mainly of applied interest besides some basic research. Research was mainly carried out by the staff of the different units and also by the research scholars attached to them. A brief outline of the important contributions is given below under different fields of research. Details are given in the "Research Summary"; and research papers and other documents published or prepared during the year are given in Appendices 5.1 to 5.5.

An outstanding achievement of the year is the discovery by the Geological Unit of a rich fossil bone deposit in the Pranhita-Godavari region. The importance of the discovery is partly national and partly international, as it provides India with the first really good remains of four large dinosaurs, and the world with a "missing link" in our knowledge of dinosaur evolution. The discovery was made during a geological expedition in support of which the Royal Society of London sanctioned a grant of £1200 (Rs. 15,000).

Theoretical Statistics: Investigations have been undertaken and some important results achieved in information theory, advanced probability and distribution. The researches carried at the Institute on estimation have led to a clarification of a number of controversial issues regarding the method of maximum likelihood applied to large samples. Fractile graphical analysis, introduced four years ago, has received attention from a number of leading mathematical statisticians all over the world, while it has been found extremely useful in the routine tabulation and interpretation of large-scale survey data.

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Biometry : Experiments were continued for the study of interaction of varieties of rice when sown in mixtures and second harvesting of rice. The results, if confirmed by further experimentation, would be of great economic significance as it would be possible to increase rice production in the country with little extra cost. The Unit has also expanded its activities on fundamental research, such as study of human genetics, floral dimorphism, root pressures in pumping water up the trunks of palm trees, accurate estimates of cost of natural selection, and theory of evolution under selection of slowly changing intensity.

A "Crop Museum" was organized within the Institute premises in which over eighty species of plants of economic importance to India are grown. The Museum is used for demonstration purposes in the different courses at the Institute.

Psychometry : The Unit for psychometric research and service was engaged in activities concerning occupational and educational selection, educational selection assessment and psychometric tests and analysis. The Unit also assisted in the various selection tests conducted in connection with admission to the degree and training courses in the RTS.

Demographic Research : The Unit is actively engaged in problems such as the determination of age-specific death rates in Calcutta city on the basis of special data collected by them. A study on the validity of 'cause of death statistics' has been completed.

Sociological Studies : The Unit carried out, besides continuing its major projects reported last year, exploratory studies in motivational and communication aspects of family planning. The investigation yielded information regarding usefulness of introducing action programme centres for family planning in urban, rural, and tribal sectors of society.

Regional Planning : The Unit is oriented, to a large extent, to research needed for economic planning in India. Improved cartographic techniques were designed to prepare synthetic maps in the study of natural regions, crop regions, patterns of industrial development and population growth. Studies relating to power, coal and heavy industries are in progress.

Geological Studies : The research programme and activities of the Geological Studies Unit have been greatly expanded incorporating new lines of research and consequent expansion of staff and laboratory facilities. Besides continuing work on vertebrate palaeontology the Unit has now started research on sedimentological, structural, tectonic, petrogenetic and geo-chronological problems in and around the Godavari-Pranhita valley, where the dinosaur fossils have been unearthed.

Flood Research : The Unit made a number of studies on the hydrological conditions of the Ajay river. A relationship between discharge of water in cusses and the river level in feet has been established and a technique has been developed for the estimation of daily run off in the Ajay at a given place from a knowledge of the precipitation over a catchment up stream.

Research Seminars : Several research seminars were conducted by the members of the staff on topics such as Measure Theory, Characteristic Functions and Topology. Besides these, the School arranged from time to time lectures and seminars by eminent visiting scientists and experts for the benefit of the staff and trainees.

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Publications : The following five publications were issued during the current academic year : (1) *Statistica Workbook* by J. Roy, E. M. Chakraborty and R. G. Laha; (2) *The Work of the United States Bureau of the Census with Emphasis on Sample Design and Control of Errors in Censuses and Surveys* by M. N. Murthy; (3) *Elements of Algebra—a self-study Course for Statistics Students* by S. K. Mitra; (4) *Planning Regions in the Mysore State—The Need for Readjustment of District Boundaries* by V. L. S. P. Rao and L. S. Bhat; and (5) *Introduction to Sampling Theory, Part II* by M. N. Murthy.

NEW DEGREE COURSES

B. Stat. and M. Stat. Degree Courses : After the passing of the ISI Act (No. 57 of 1959) empowering the Institute to award degrees, the Institute lost no time in implementing the programme of integrated science course at the under-graduate level, plans for which had been evolved during the last few years. The two-year advanced course for statisticians, which the Institute was conducting for a long time has been converted to the M.Stat. degree course. The new degree courses were inaugurated by Professor S. N. Bose at a function held on 17 August 1960, at which addresses were given by Professor J. B. S. Haldane and Professor P. C. Mahalanobis.

Admission of Students : Selection tests were held in July 1960 at nine centres : Banaras, Bombay, Calcutta, Delhi, Hyderabad, Madras, Nagpur, Trivandrum and Waltair. The selection of candidates to the courses was made by a Committee consisting of representatives of the Indian Statistical Institute (ISI), inviters from the Central Statistical Organization (CSO) and the Institute of Agricultural Research Statistics (IARS). Those admitted to the M.Stat. course included candidates who would proceed, on satisfactory completion of the First year M.Stat. course in ISI, to the Professional Statistician's Certificate Course in agricultural research statistics at the IARS, New Delhi.

The number of candidates who sat for the tests and who attended the courses during the year are given in Table I on page 15.

Lists of students who attended the courses together with their academic qualifications, are given in Appendices 10.6 and 10.7.

Syllabus : A first draft of the syllabus for the different subjects proposed to be taught in the B.Stat. and M.Stat. courses was discussed at a meeting held on 21 March 1960 at the Central Statistical Organization (CSO), New Delhi, with P. C. Mathew (Director, CSO) in the Chair. About thirty-two experts from universities, research institutions and government departments attended the meeting on invitation from the Institute. After discussion, the programmes of the integrated science teaching of the B.Stat. course and professional training in the M.Stat. course were generally approved. Some modifications were, however, suggested in the syllabus of the B.Stat. course.

The proceedings of the above meeting were presented at the joint meeting of the Governing Body of the Research and Training School and the Council of the Institute, held at Delhi on 25 March 1960. The proposals were generally approved but there was further discussion on the syllabus of the B.Stat. course and it was decided to form an Expert Committee to advise the Institute on the syllabus of the B.Stat. course.

A meeting of the Expert Committee was convened at Calcutta on 29 April 1960, when some tentative decisions were reached regarding the syllabus for Biology, Statistics,

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Mathematics, and Economics. Professor Mahalanobis, on his return from abroad had a number of discussions with Professor S. N. Bose, Dr. D. S. Kothari and some other members of the Expert Committee. As a result of such consultations it has been decided to revise the original draft of the syllabus for physics and chemistry so as to make it more suitable for the integrated teaching of science; this is expected to be completed at an early date.

Laboratories: A biological laboratory to accommodate about thirty students, was constructed and equipped with such apparatus as could be readily purchased in India. Orders have been placed for some special apparatus for which import licenses had to be obtained; this involved some delay, and a large part of the equipment, for which orders were placed, has not yet been received. Available equipment are being used to conduct the courses in botany and zoology for B.Stat. students.

Introductory teaching in geology was given by the staff of the Geological Studies Unit which has a laboratory of its own. The first-year B.Stat. students were taken out on a three-day field trip to Giridih for practical training. They were introduced to some elementary geological settings and to some methods of making observations and of collecting data. The laboratory facilities and staff of the Geological Studies Unit have been expanded during the year.

Progress in the construction of laboratories for the physico-chemical sciences has been somewhat slow due to lack of funds. It was felt that the traditional type of laboratories and practical exercises would not be entirely suitable for integrated teaching of science contemplated in the B.Stat. course; the revised syllabus would have to be necessarily designed in relation to the equipment which are likely to be available. Also, most of the present batch of students of the B.Stat. course had completed I.A. or I.Sc. courses before joining the B.Stat. course; there was no need to repeat some of the experiments which they had already done. It is hoped that the laboratories for physics and chemistry would be equipped very soon to undertake the experiments which are being planned now.

TRAINING

Besides the degree courses mentioned in the previous section ten different training courses were conducted by the Research and Training School in 1960-61, including the training given in the International Statistical Education Centre (ISEC) about which details are given in the next Section. For admissions to the courses in Bombay and Calcutta special selection tests are held, while for the course in Delhi admissions are decided in consultation with the CSO, giving suitable representation to the various government departments.

Details of the different training courses, such as the type of course, location of course, number of trainees are given in Table 1 and the lists of trainees are given in Appendix 10.

Officers on Deputation: There were three officers on deputation during the year, two of whom were foreigners deputed by the Government of Thailand, and the other from India. Their names, subject of study and period of stay are given in Appendix 10.2.

Statistical Officers Courses (jointly with CSO): The session commenced in October 1960 and was attended by twenty-five trainees. Four of them came for a six months' general course on statistical theory and application; twentyone stayed for another three months to undergo training in machine tabulation or for special training in some branch of statistics or other. This course was started in 1955 to provide opportunities for the statisticians

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working in statistical departments of State and Central Governments to have refresher courses in current developments in statistical techniques. The list of officers is given in Appendix 10.3.

TABLE 1: NUMBER OF APPLICANTS, THOSE APPEARING AT SELECTION TESTS AND THOSE ADMITTED

course	number		
	applicants	appeared	admitted
1. Research and Advanced studies	127	87	14*
2. Two-year advanced statistician's course, Second year	—	—	12 ^b
3. M.Stat., first year	288	215	28 ^c
4. B.Stat., first year	436	310	27
5. Statistical Officer's Course (jointly with CSO.)	—	—	25
6. Officers-on-deputation	—	—	3
7. International Statistical Education Centre	31	—	30
8. Short-term Course : March-September 1960			
<i>Junior</i>	171	77	47
<i>Senior</i>	—	—	11 ^d
9. Short-term Course : September 1960-March 1961			
<i>Junior</i>	203	110	46
<i>Senior</i>	—	—	10 ^d
10. Computer's Training Course : March-September 1960			
<i>Junior</i>	130	50	28
<i>Senior</i>	20	20	14
11. Computer's Training Course : September 1960-March 1961			
<i>Junior</i>	189	77	48
<i>Senior</i>	18	18	10
12. One year Evening Course, Delhi (jointly with the CSO) March 1960-February 1961	—	—	41
13. One-year Evening Course, Bombay : May 1960-April 1961	125	105	32
total	1,671	1,070	432

* including 12 research scholars continuing from the previous year

^b 19 trainees successfully completed the first year, 12 are continuing at the ISI for specialization in various subjects while 7 have been sent to IARS (Institute of Agricultural Research Statistics) for specialization in Agricultural Statistics.

^c includes 7 students who will proceed to the IARS course on completing 1st year M.Stat. Course.

^d Mostly by promotion from the Junior course.

Advanced Studies : There were fourteen stipendiary research scholars working during the year. They were attached to different units according to the topic of research. Some of them also participated in teaching. Appendix 10.4 gives details of these research scholars.

Two-Year Advanced Statistician's Course : Although this course has been discontinued from 1960, training was provided for the second-year for the nineteen trainees who had successfully completed the first-year of the course which commenced in 1959. Their training consisted mostly of specialization in subjects such as Planning and Econometrics, Statistical Quality Control and Geology. Seven of the trainees had their training at IARS in agricultural statistics. The list of trainees is given in Appendix 10.5.

Short-term Statistician's Course in Calcutta (junior and senior) : These courses held in the evening, continued to attract persons in employment desiring to qualify themselves in statistics. Two sessions of six months' duration were held for each course - junior and senior. Altogether twenty-seven trainees for the senior course and ninety-three for the junior course attended. The list of trainees is given in Appendix 10.8.

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Evening Course in Delhi (jointly with CSO): The trainees admitted in the previous year's session completed the course in February 1961. Fortyone trainees attended. The list of trainees is given in Appendix 10.0.

Evening Course in Bombay: The evening course in Bombay was started in March 1960. There were 125 applicants for this course out of which thirtytwo were selected and admitted. Appendix 10.10 gives the list of trainees.

Computer's Training Course (junior and senior): Two sessions for computers (junior and senior) each of six months' duration were held with a total of twentyfour students for the senior course and seventy six for the junior course. The list is given in Appendix 10.11.

2. INTERNATIONAL STATISTICAL EDUCATION CENTRE, CALCUTTA

The International Statistical Education Centre (INSEC) which was started in 1959, has conducted up to April 1961 fourteen terms and has trained 378 candidates representing twentyone Asian countries. Candidates trained in INSEC have been statisticians in government departments, officials in other fields interested in statistics, or teachers of statistics. Reports have been received that the candidates trained at the Centre are proving themselves to be very useful in carrying out statistical activities in their countries.

In the earlier terms the Centre used to conduct regular courses of six months, but the last few terms have been each of nine months duration. In view of a certain amount of difference in requirements by the candidates who came from different countries of Asia, it was decided in 1959 to provide training at least for three different categories: (i) teachers in statistics, (ii) persons engaged in statistical work, and (iii) persons working in other fields in which a knowledge of statistics is necessary. The training that is now given caters to all the three groups although the majority of the candidates belong to the second category.

In recent years there has been a demand for specialized training at the Centre on an individual basis. Provision has been made for such training for which some candidates have already offered themselves.

Since 1959 the Centre has arrangements for accepting a limited number of senior student participants and visiting senior statisticians for specialization. Senior statisticians may also participate in the research and teaching work at the Institute.

With regard to the type of instruction provided, particularly for the regular nine months course at the Centre, the training in governmental statistics had been extended to a period of six to eight weeks with effect from the Fourteenth Term.

The system of examination followed at the Centre includes periodic examinations and a final examination for each. Two categories of certificates are being awarded: (i) certificate of merit and (ii) certificate of attendance, depending upon the performance of the candidates at the examinations.

There are arrangements at present for training in each year about thirty students for the regular course and about six candidates for the different specialization courses including senior course.

Participants: The Thirteenth Term, in which twenty six participants from ten countries had attended, concluded in April 1960. The Fourteenth Term started on 25 July 1960. In all the fourteen terms together, training was imparted to 378 students from the

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following twentyone Asian countries: Afghanistan (2), Burma (32), Cambodia (2), Ceylon (15), India (108), Indonesia (27), Iran (8), Iraq (1), Japan (17), Laos (1), Malaya (4), Nepal (7), New Zealand (1), Pakistan (84), Philippines (51), Sarawak (1), Singapore (4), South Africa (1), Syria (1), Thailand (25), and Viet Nam (6). Besides these 378 individuals who attended the regular courses, three others, from Iran (1) and United Arab Republic (2) went through special courses.

Joint Board of Directors: The Centre was supervised by a Board of Directors composed as follows: *Chairman:* P. C. Mahalanobis; *Members:* M. Boldrani, R. G. D. Allen, E. Lunenberg (ex-officio members representing the International Statistical Institute); V. Sahay (Cabinet Secretary, representing the Government of India), S. Basu, C. R. Rao, and A. Mathai, *Member-Secretary* (representing the Indian Statistical Institute).

THE FOURTEENTH TERM

The announcement of the Fourteenth Term was issued early in 1960 from the Permanent Office of the International Statistical Institute, at The Hague, and the different countries in the region were invited to nominate candidates for training at the Centre.

Fellowships: The Government of India made available twenty fellowships for the term under the scheme of Technical Cooperation of the Colombo Plan. Two other fellowships were also awarded by the Government of India to two students from Iran; another student from South Africa received a scholarship from the Ministry of Education, Government of India.

Selection of Trainees: Thirtythree applications from twelve countries were received for admission to the Fourteenth Term. Selection for admission, as well as for fellowships, was made by the Board of Directors of the Centre. In all thirty candidates were selected, all of whom joined. Of the thirty candidates, twentytwo were statistical officials, two were teachers and six officials in non-statistical fields. The number of applications received, number selected, etc., from the different countries, are shown in Table 2. A list of the thirty participants is given in Appendix 10.1.

TABLE 2. NUMBER OF APPLICANTS, THOSE SELECTED, JOINED AND AWARDED FELLOWSHIPS FOR FOURTEENTH TERM

country	number of			
	applicants	selected	joined	awarded fellowships
1. Burma	1	1	1	1
2. Ceylon	2	2	2	2
3. Indonesia	3	3	3	3
4. India	10	7	7	-
5. Iran	2	2	2	-
6. Japan	2	2	2	2
7. Malaya	1	1	1	1
8. Nepal	1	1	1	1
9. Philippines	8	8	8	8
10. Sarawak	1	1	1	1
11. South Africa	1	1	1	-
12. Thailand	1	1	1	-
	33	30	30	20

Note: Two fellowships outside Colombo Plan schemes were awarded to Iran by Government of India and one scholarship was awarded to South Africa by the Ministry of Education, Government of India.

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Instruction : The Term opened on 25 July 1960. The training imparted, in accordance with the curriculum of the Centre, consisted of lectures, laboratory work, project training, assisted reading and field work. The first two months were mainly devoted to training at Calcutta in general statistical methods, including the theory of probability, computational techniques, and statistical organization and procedures. In previous terms, training in governmental statistics was given towards the end of the term but during the Fourteenth Term, a six-weeks' training in governmental statistics was arranged at the Central Statistical Organization, New Delhi, during the period October-November, 1960. Following this a two weeks' programme was conducted at the experimental station of the Indian Statistical Institute at Giridih (Bihar). At Calcutta, further training in sampling theory and practice and advanced statistical techniques was given during the period up to the end of January 1961. During the months, February and March 1961, individual training through specialization courses was given in the following fields : agricultural surveys, data processing techniques, national income estimation, biometry, statistics for economic planning and mathematical statistics. While the specialization courses were in progress, a few lectures and some laboratory work in selected subjects were also arranged. For this purpose, depending on the requirements of the trainees, instruction was imparted in three different groups. One group of students was mainly concerned with review of topics already taught; the second group covered more ground in statistical principles; while the third group went on to more mathematical and advanced topics in statistics.

Examinations and Certificates : During the Term, periodical examinations were held on various topics, the total number of tests conducted in different subjects being twelve. The final examination consisted of two papers on general methodology, one on economic statistics, one on governmental statistics and two papers on subjects of specialization. On the basis of the final examination, the Board of Directors awarded Certificates of Merit to twenty-nine candidates and Certificate of Attendance to one candidate.

Educational Tours : The students were taken on educational tours to places of interest in India, like Agra, Delhi and Santiniketan, besides places in and around Calcutta.

Teachers : Much of the teaching at the Centre was undertaken by the staff of the Research and Training School and Project Divisions of the Indian Statistical Institute. A number of government statisticians took part in the training at the Central Statistical Organization, New Delhi, during October-November 1960.

Visiting Teachers : The International Statistical Institute arranged for Mr. M. Sibuya of the Institute of Statistical Mathematics, Tokyo, to teach at the Centre for about four months towards the later part of the Term. Among other visiting teachers were : Morris J. Solomon (USA), Professor Gerhard Tintner (USA), Dr. Enrique T. Virata (Philippines). The students of the Centre also attended a number of lectures and seminars by other statisticians and scientists like Mr. M. D. McCarthy (Ireland), Dr. T. H. Dobzhansky (USA), Sir Ronald A. Fisher (UK), Dr. Milos Macura (Yugoslavia) and Dr. Frank Yates (UK).

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3. STATISTICAL EXAMINATIONS

Statistician's Diploma : The Statistician's Diploma examination was held once from 18th April to 28th April 1960 at Bangalore, Bombay, Calcutta and New Delhi, and again from 7 to 16 September 1960 at the same centres and Poona. During the April session, 123 candidates registered in one or more papers, 108 appeared and 54 passed. In September, 117 candidates registered, 104 appeared and 50 candidates passed in one or more papers.

The Examination was again held in March 1961 at the following centres : Bangalore, Bombay, Calcutta, New Delhi and Poona and 130 candidates registered in one or more papers.

During the year the Statistician's Diploma was awarded to fourteen candidates who passed completely in all the papers prescribed for the examination. The total number of candidates who have been awarded the Statistician's Diploma upto the end of March 1961 is fiftytwo.

Computer's Certificate : Part I of the Examination for this Certificate was held once from 18 to 21 April 1960 and again from 8 to 12 September 1960 at Bangalore, Bombay, Calcutta, Giridih (April only) and New Delhi. In April, seventyseven candidates registered, seventy appeared and thirtyfour passed in one or more papers. Similarly in September, seventyfive candidates registered, seventythree appeared and twenty-nine passed.

In March 1961, the examination was again held at Bangalore, Bombay, Calcutta and New Delhi. Sixtyseven candidates registered in one or more papers. Also, one candidate had registered to appear in the Computer's Certificate Examination Part 2A.

Statistical Field Surveys Certificate (junior and senior) : These examinations were held from 5 to 13 September 1960 at Bangalore, Calcutta and New Delhi. In the Junior Certificate Examination, three candidates registered and appeared, while in the Senior Certificate Examination, eight candidates registered and appeared. One candidate passed in the Junior Certificate Examination and two in the Senior Certificate Examination in one or more papers.

The names of successful candidates for the examinations held in April and September 1960 and also a summary of results by each paper for all the examinations held from 1951-52 to 1960-61 are given in Appendix 11.

4. PLANNING DIVISION

A small Central Statistical Unit was established in New Delhi in 1949 and was staffed by the Institute workers. This Unit looked after the statistical work of the Government of India for two years until the establishment of the Central Statistical Organization. A small Institute Office continued to be maintained in New Delhi for active collaboration in the statistical work of the Government. In 1963-64 an Operational Research Unit was established to undertake, on a small scale, technical work on planning.

In September 1964, the Institute was asked by the Planning Commission to study jointly with the Central Statistical Organization and the Finance Ministry the possibility of preparing the Second Five Year Plan in such a way as to ensure a continuing increase in national income and improvement in the level of living and also a solution of the problem of unemployment, if possible, in ten years.

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On 3 November 1954 Prime Minister Jawaharlal Nehru inaugurated a section in the Indian Statistical Institute for studies relating to planning for national development. These studies led to the formulation of the "Draft Plan-frame" of March 1955 which was accepted as the basis for the preparation of the Second Five Year Plan.

In September 1955 it was decided that the technical work on planning in the Institute should be strengthened and greater attention paid to perspective planning. Since then work on planning is being done by the Institute in Delhi and Calcutta.

WORK IN DELHI

The Planning Unit of the Institute in Delhi has been actively collaborating with the two divisions, one for Perspective Planning and the other for Statistics and Surveys in the Planning Commission under Professor Mahalanobis and with the Central Statistical Organization. The Delhi Unit has cooperated in the preparation of a series of studies on scientific and technical man power and technical studies relating to the preparation of the Third Five Year Plan.

The Delhi Unit was engaged in research work of different types during the year under review. Some of the studies were concerned with the change in the structure of the national economy over the period 1955-1957. Estimates of gross national product, national income and contribution of different sectors to the aggregate income for different points of time, past and future, were worked out in this connection. Secondly, the change in the pattern of consumer expenditure was studied and projections were attempted. Also, inter-industrial relations and growth models were studied in the context of long-range development of the economy. Next, the financing aspect of the long-range development plans was also considered and approximate estimates were worked out. Finally, the foreign trade problem was studied from long-range point of view.

In another group of studies, continued attention was paid to the problem of effective utilization of man-power and costs and benefits of educational courses and scholarships were critically examined. Preparation and analysis of various technico-economic coefficients useful for planning and for studying the implication of any given set of production targets in terms of investment, employment and material consumption engaged the attention of yet another research group; effectiveness of investment in certain fields was also studied. Some headway was made in the field of regional planning and the problems connected with locational aspects of development were taken up for detailed consideration. The Regional Survey Unit of the Institute was transferred to Delhi for this purpose. Planning experience of foreign countries relevant in the context of the other work in the Unit continued to be studied as in the past.

During the last two years a number of economists came to New Delhi under the India-M.I.T. Research Project and some of them namely, Dr. I. M. D. Little, Dr. Trevor Swan, Professor W. R. Reddaway and Dr. H. F. Lydall worked in close collaboration with the Planning Unit on some economic problems of planning. Dr. Louis Lefebvre of the Project and Dr. Rosenstein Rodan joined the team in Delhi.

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Dr. M. Kalecki, Vice-Chairman, Planning Commission, Poland, came in the winter of 1959-60 at the invitation of the Institute and the workers of the Unit had the privilege of working with him for a couple of months on some problems of planned development under conditions of financial stability. Mr. I. Chadzev and Mr. A. I. Poluaukhine from the Soviet Union helped the unit in certain studies. Mr. Thomas Balogh of Oxford University came for a brief assignment, under similar arrangement, for the winter months of 1960-61. Mr. Bruce Mefarlane of Sydney University came under a fellowship scheme of the Institute to work in the Unit for three months on a study of planning methods in India. He gave a number of lectures on planning techniques of Yugoslavia based on his on-the-spot study during an earlier year long visit to that country. Similarly, in response to a request received from Mrs. U. Rabe, a research fellow from East Germany, facilities were extended to her to work for about a month on the subject of Indian public finance in the Unit.

Among Indian scholars, Dr. A. K. Sen, worked in association with the Unit for a few months on problems of effectiveness of investment and choice of technology and Dr. I. S. Gulati, Professor of Economics at Baroda University carried out studies on some problems of taxation. Dr. S. J. Patil, on leave from UN Economic Commission for Europe, and Dr. Jagdish Bhagwati, a Fellow of the Oxford University, also worked in the Unit for some time. A scheme of research project, "Rural Manpower Utilization in India," presented by Dr. Chao Kuo-Chun, a visiting scholar from Harvard University, has been approved and he has been offered an assignment of one year to complete the study with necessary assistance from the Institute.

WORK IN CALCUTTA

The work in Calcutta, as usual, included research, teaching, seminars and discussions and other studies.

Research : The main fields of research covered at Calcutta were inter-industry studies, national income and allied subjects, studies on consumer behaviour, econometric studies and miscellaneous studies on planning. Lists of reports and papers prepared by the Division are given in Appendices 5.6-5.8.

A draft report relating to the details of estimation of the 1953-54 inter-industry table has been completed and supplied in parts to the members of the Inter-Industry Study Committee set up by the Planning Commission. An inter-industry table for 1955-56 was prepared at the instance of the Planning Commission. The 1953-54 Table has already been inverted by the Electronic Computer Division and the 1955-56 Table has been sent to the Division for inversion.

The section on national income continued studies on the basis of original NSS records with an aim to ascertain levels of output in certain household enterprises. Work has also been taken up on the growth of the economy during the last century as well as distribution of national income by factor shares and by size.

Studies on consumer behaviour mainly related to the preparation of a paper on the distribution of consumer expenditure in India during the last decade. This study was circulated to the members of the Committee on the Distribution of Income

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and Wealth appointed by the Government of India. At the instance of the Planning Commission projections of consumer demand for various commodities during the period of the Third Five Year Plan were worked out on the basis of NSS data.

Econometric studies were benefited by the presence of Professor Gerhard Tintner in the Institute for a number of months. The econometric studies group continued to work as the secretariat of the annual conference of econometricians.

Other studies include optimization of plant utilization, comparative levels of inventories in India and in the USA, labour's share in manufacturing industries and economy of Indian livestock. Two workers of the Soviet Academy of Sciences, Mr. V. G. Rastryanikov and Mr. G. G. Kotovskii came to the Institute to work on agrarian problems in India on the basis of NSS data.

The workers of the Division contributed a number of papers to the Indian Conference on Research in National Income held in August-September 1960. M. Mukherjee and H. Mazumdar attended the Asian Conference of the International Association for Research in Income and Wealth held in August 1960 and presented papers.

Cottage Industries : Certain studies on cottage industries were taken up in February 1956. A working centre, *Kalyanasri*, was started in the Institute for the purpose and has been running more or less on a self-supporting basis; the workers engaged are being paid out of the sale proceeds from the industry products. A study was also initiated in three selected villages near Calcutta for finding out the improvement in the conditions of cottage-industry workers when certain facilities (of marketing, etc.) were provided to them.

Teaching : The Division organized, as in previous years, several courses in economics under the auspices of the Research and Training School. Lectures and practical classes on economics and economic statistics were also arranged for the International Statistical Education Centre and the Statistical Officers' Training Course, in accordance with the usual practice. Professor Tintner took courses on advanced and elementary econometrics for the benefit of the workers of the Division.

Seminars : A number of lectures and seminars were held in the Unit. Besides a number of prominent foreign scholars, the staff-members themselves conducted seminars and discussions to report the progress of work done by them.

During the period April 1960-March 1961 covered by this report, twentytwo additions were made to the mimeographed working papers published by the Division.

Three volumes of planning papers in the series, *Studies Relating to Planning for National Development*, have been published, namely, (1) *Planning for India: Selected Explorations in Methodology* by Ragnar Frisch; (2) *A Demonstration Planning Model for India* by J. Sandee; (3) *Some Basic Planning Problems* by Charles Bettelheim.

Two more volumes, namely, *'Talks on Planning'* by P. C. Mahalanobis and *'Statistics and Planning in Socialist Countries'* by several foreign experts are in the press.

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5. NATIONAL SAMPLE SURVEY

The National Sample Survey (NSS) was started in 1950 at the instance of Prime Minister Nehru with the object of obtaining comprehensive and continuing information relating to socio-economic and demographic conditions on a countrywide basis. It has been carrying out a continuous survey programme since that time through which a wide variety of essential statistical information has been and is being collected to provide national and regional estimates of demographic characteristics, consumption pattern, employment features, agricultural production, and other subjects.

NSS collects information simultaneously on a number of topics in a specific survey period called a round. The period of survey for one round at present is approximately one year. Different subjects are covered in different rounds, some subjects being repeated over a number of rounds.

Information is collected by the NSS to meet the needs of various users, including the Ministries of the Government of India, the Planning Commission, and the States. As the resources are limited it is not possible to meet the demands of all the users at the same time. It is therefore necessary to decide on the subjects of enquiry and the items of information to be collected in a particular round and to formulate programme of tabulation and draw up a time-schedule for completion of work, keeping in view the available resources. The Central Statistical Organization of the Government of India is the co-ordinating body in regard to the different aspects of the NSS enquiries including drawing up of the survey design and tabulation programme, fixation of priorities for tabulation work and other related matters. A Programme Committee consisting of the representatives of the various Central Ministries and other interested parties advises the Central Statistical Organization on various aspects of the survey.

The NSS organization is broadly divided into three branches—one concerned with the planning of the survey, the second with the field work and the third with the processing and analysis of the data collected and preparation of statistical reports. Since the very inception of the NSS the planning and the processing and analysis branches are located in the Institute. The field work is mainly the charge of the Directorate of National Sample Survey, which is under the control of the Cabinet Secretariat, Government of India. The field work in West Bengal and Bombay city is, however, the responsibility of the Institute.

Participation by States : The NSS was started solely as a central agency for collection of statistics. But it was soon realized that the States also should participate in NSS work. The States collect statistics for their own use. It was considered only natural that the same or similar data collected by both the Central and State agencies should be based on uniform concepts and definitions. Further, the data collected by the Central and State agencies on the same concepts and definitions and according to the same survey plan could be pooled together to obtain estimates for the different regions with increased precision. Moreover, if they collect data according to the NSS programme, they would have to process their own data. This would mean the building up or strengthening of the tabulation units of the States, who come in for participation in NSS work. According to the present arrangement both the Central and State agencies cover different interpenetrating networks of samples according to the same survey plan. State agencies also process their own data but the work relating to the planning of the survey including drawing up of the sample design and preparation of schedules of enquiry is done at the Institute. Participation by States in

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NSS work started from the ninth round with the coming in of Bombay and Uttar Pradesh; Kerala joined in the tenth round, Bihar in the eleventh, Andhra Pradesh, Assam, Orissa and Punjab in the fourteenth and Madhya Pradesh in the fifteenth round. Rajasthan started participation from the sixteenth round.

Use of Interpenetrating Networks of Samples : A unique feature of the statistical operation in NSS is the use of inter-penetrating network of samples (IPNS). This technique in its general form consists in drawing a number of parallel samples each of which is spread over the entire region under consideration. These samples, which have the same sample size, are drawn independently under identical process of selection from the same universe. Different sets of samples are generally surveyed and/or processed independently by different operational units. Each sample is thus capable of providing an equally valid estimate of the population characteristics under study.

The normal practice in NSS is to arrange interpenetration in field-work by allotting different sets of samples to different parties of investigators. Until recently the data obtained from the different samples were largely processed by one operating unit. In the year under review interpenetration was extended to the processing work as well. The data collected in the very recent rounds are being processed by three independent processing units located in Baranagar (Calcutta), Giridih and Delhi.

Machine Tabulation : The NSS data are processed with the help of machine equipment located in the three operating units. During the year under review there were twentyfive sorters, twenty tabulators, six multipliers, five collators and twentyfive reproducers and gang summary punches and two electronic machines of the IBM and ICT. A Russian tabulator and a Russian reproducer and gang summary punch were also used in the tabulation work. In addition to these, seven sorters manufactured by the Institute workshop were used by the different operating units. In this period a feature deserving special mention was the creation of a machine pool out of the above machines with three tabulators, four sorters, one collator, one multiplier, three reproducers and gang summary punches and one electronic machine. The pool was created primarily to meet the demands of research work both theoretical and applied. In addition to this, work relating to mechanized accounts like preparation of salary bills are also done by the pool. Further, this acts as a reserve for NSS work in times of emergency.

Recent Rounds : Fourteen rounds of the NSS were completed by June 1959. During the period under review the fifteenth round (July 1959-June 1960) was completed and the sixteenth round started in July 1960. Immediately before the start of a round, a training conference is held at the Institute where the concepts and definitions adopted in the survey and methods of filling the schedules of enquiry are explained by the Institute (NSS) technicians to the supervisory field staff who in turn explain these to their subordinate officers at their respective headquarters. In the year under reference the training conference was held at the Institute in July 1960.

After the sixteenth round had been in progress for two months the Chief Director, NSS Field Branch, organized another training course for the field staff in a number of centres. Quite a number of technicians from the Institute participated in these refresher training conferences during August to October 1960. The Programme Committee met twice at the Institute under the Chairmanship of the Central Statistical Organization in

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October 1960 and February 1961 to settle the items of work to be covered in the seventeenth and eighteenth rounds of NSS as well as to decide on the tabulation plans and priorities.

Subjects Covered in Different Rounds : The subjects covered in different rounds may be grouped into two categories—continuing and *ad hoc*. Information on consumer expenditure and conditions of household living is being collected from the first round. Other subjects of a broadly continuing nature are employment and unemployment, household enterprise, rates of births and deaths and growth of population, land utilisation and crop production, and retail and wholesale prices. Among the important *ad hoc* surveys conducted in the earlier rounds may be mentioned—newspaper reading (sixth round), distribution of land holdings (eighth round), household indebtedness (eighth round), farming practices (eighth round), employment and unemployment and indebtedness of agricultural labour households (eleventh and twelfth round), production of milk and production and utilization of cowdung (twelfth round), book readers' preference (thirteenth round), livestock products (fourteenth round) capital formation (fourteenth round), disposal of cereals (fifteenth round), land holdings (sixteenth round) and family planning (sixteenth round). In addition, type studies and pilot enquiries were also undertaken from time to time.

Manufacturing Industries : The NSS is carrying out since 1952 (reference year 1951) a survey of manufacturing industries in continuation of the survey which was started in 1951 by the Directorate of Industrial Statistics, Government of India. The Sample Survey of Manufacturing Industries (SSMI) brought within its purview establishments using power and employing ten or more workers, and establishments not using power and employing twenty or more workers. From the fourth round (reference year 1954) the scope of the survey was extended to include industrial undertakings covered by the Industries (Development and Regulation) Act 1951. In this round an exploratory survey of thirty-six out of fifty industrial undertakings registered or licensed under the above Act was undertaken side by side with SSMI. In the fifth round (reference year 1955) all the industrial undertakings except coal mines were covered on the basis of complete enumeration. Coal mining undertakings are being included in the complete enumeration of undertakings since the sixth round (reference year 1956). The work of the eighth round (reference year 1958) was practically completed in July 1960. The size of the sample factories (registered under the Indian Factories Act 1948) was 6,090 and 7,222 undertakings were covered.

Till 1956 the Census of Manufacturing Industries (CMI) was being carried out under the Industrial Statistics Act 1942. In respect of establishments using power and employing twenty or more workers, twenty-nine industry types out of the total of sixty-three industry groups were covered in the Census. The State Statistical Bureaus were responsible for the collection of data. As the integration of CMI and SSMI was considered desirable these two enquiries were merged together and in August 1960 the Annual Survey of Industries was started (reference year 1959). The salient features of the survey are (1) collection of data on statutory basis under the Collection of Statistics Act 1953, (2) complete enumeration of all large establishments having fifty or more employees on an average using power, and one hundred or more employees on an average not using power, (3) coverage of all the remaining smaller establishments by a probability sample, (4) a common questionnaire for both the bigger and the smaller establishments on vital items with additional details for bigger establishments. In all 9,078 factories are covered in the Census and 6,057 factories in the sample. Important item coverages are input, output, labour employed, wages, capital inventory and transactions.

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SPECIAL ENQUIRIES AND TYPE STUDIES

Crop Surveys in West Bengal and Ancillary Enquiries : As in the previous years experimental surveys to develop survey techniques were conducted in West Bengal during *jute-aus*, *aman* and *rabi* seasons of the year 1960-d1. A total of 936 villages were selected in each of the *jute-aus* and *rabi* seasons and 720 villages in the *aman* season. A sample of clusters of plots was taken from each village for area and yield surveys.

During *aman* season three type studies were organized at Desghara in the district of Hooghly. The first type study was conducted to test the reliability of the conventional method to determine the proportion of area under paddy crop in individual plots by eye-estimation. This was done by comparing the results obtained by eye-estimation with the results based on actual measurement of the paddy fields by experienced surveyors.

In the second type study the object was to study the variance functions of the proportion of area under paddy estimated from village clusters of varying sizes in the first stage and plot clusters of varying sizes in the second stage.

The third type study was carried out for testing the reliability of the data relating to the consumption of cereals collected by the interview method by checking these data against the results obtained by direct measurements of the quantity consumed for one day and thirty days preceding the date of enquiry.

Further studies on the prediction of outturn of paddy based on specific yield rates under different crop conditions and plant densities for sowing as observed in the previous season, and acreages obtained by a pre-harvest survey in the current season was continued this year also. Analysis of the data collected so far is proceeding.

During *rabi* season a special enquiry into the incidence and extent of fish cultivation in tanks and ponds was taken up.

Crop-cutting Experiments : A Working Group was set up by the Central Statistical Organization in October 1960 for examining the discrepancies between NSS and official estimates of crop production. As the official estimates are based on the yield rates obtained from the rectangular cut of 33 ft. by 16½ ft. and NSS estimates on the yield rate based on the circular cut of radius of 4 ft., the Working Group recommended that studies should be undertaken to compare the yield rates obtained by the two agencies from their respective sample cuts and that necessary experiments should be conducted under the joint supervision of the different agencies concerned.

As a first step to such a series of joint studies, crop-cutting experiments were carried out on *jowar* grown in mixture in two adjoining villages of district Bundi in the State of Rajasthan in November 1960. This study was conducted under the joint supervision of the Directorate of National Sample Survey, Government of India, Department of Agriculture, Government of Rajasthan and the Indian Statistical Institute. In the second of this series, crop-cutting experiments on *rabi* crop were carried out in Barh in the State of Bihar in March 1961.

Enquiry into Distributive Enterprises of Joint Stock Companies : A pilot enquiry into distributive activities of Joint Stock Companies in Bombay city was started in 1960 with 500 samples drawn from the 1957 list of trading Joint Stock Companies maintained in the Office of the Registrar. Data were collected by the local field branch of the Institute.

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The objectives of this survey were to test the frame and the schedule of enquiry, to assess the rate of response and to get an idea of the field cost involved.

Type Study on Population and Vital Statistics : The report on the first phase of the type study which was continued from December 1958 to January 1960 in Assam, Bihar and Kerala for improving the methodology of collection of NSS data was finalized.

Type Study on Morbidity : A type study on morbidity was started in October 1960 to continue for a year in one village and in one urban block each in the three States of Maharashtra, Kerala and Rajasthan and in two villages in West Bengal and five urban blocks in Bombay city. The object for this study was to examine the effects of different probes and definitions, recall periods and proxy interviews on the morbidity rate.

Post-census Survey : The post-census survey was started in March 1961 with a view to obtaining independent population estimates with provision to study the 'coverage' and 'content' errors in the decennial population census of 1961. About 1,200 villages and 400 urban blocks were scheduled to be surveyed.

Pre-testing of the Questionnaire on Family Planning : A pilot study to test the questionnaire for family planning schedule of the sixteenth round was conducted in twenty blocks of the city of Calcutta during February to May 1960. The purpose of the enquiry was to test the questionnaire as well as to get the reaction of the respondents in giving relevant information on the different aspects of family planning.

Type Study on Errors in Reporting Births and Deaths : A type study was conducted in twentyfour villages in West Bengal during August to October 1960. The object of this study was to find out the extent of error involved in reporting births and deaths by the informant.

Type Study on Consumption of Cereals : A type study on consumption of cereals was started in one village and one urban block in each of the States of Maharashtra, Rajasthan and Madras and in one urban block in Bombay city. The object of the type study was to determine the optimum reference period of collection of data by the interview method. This was done by getting the consumption of cereals by actual weighment as well as by interview method for different reference periods of enquiry.

6. ELECTRONIC COMPUTER DIVISION

The usual activities of this Division were continued as before. An expansion of activity along a new line was decided upon during the year. On the request of the Jadavpur University a joint project for the construction of two general purpose high speed electronic digital computers was undertaken. Development of a fully transistorised electronic computer is contemplated. Apart from common features, one of the machines will have facilities for processing of statistical data. A joint committee consisting of the Dean of the Faculty of Engineering and the Professor-in-charge of Telecommunications Engineering of the Jadavpur University and two senior staff-members of the Institute is being set up for the execution of the project.

With the help of the punched card input equipment for URAL, which was constructed last year, it became possible to undertake a large-scale fractile graphical analysis of the NSS data. Some peripheral equipment for handling of cards, consisting of a collator, a reproducer and two Institute-made sorters were installed. It was found that the URAL

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with the punched card input unit was equal in efficiency to eight conventional tabulating units. In order to cope with such volume of work as well as the growing demand for scientific computation from other institutions round-the-clock operation of URAL was started from 1 November 1960. The machine is being run for 24 hours a day for six days in a week. As expected, the total time taken for repairs and maintenance became appreciably low as compared to the previous one-shift runs. The other computer is being run for two shifts per day.

RESEARCH AND DEVELOPMENT

Apart from the usual computation services to the departments of the Institute and to outside scientific and government institutions two new lines of activity were started. One of these was the study of electrical power flow problems with the help of digital computers. During recent years calculation of such power flow problems has become a necessity due to the formation of zonal national grids in India. At present only one net-work analyser exists in Bangalore where problems are sent for solution from various parts of the country. The setting of such problems on a net-work analyser is a fairly lengthy and arduous process. It is also beyond the capacity of a net-work analyser to handle power flow problems for larger grids. The accuracy is also very limited in net-work analyser and for problems of power loss they are considered to be unsuitable. Since 1956 digital computers are being increasingly used for solution of electrical power problems, such as power flow problems, calculation of power losses during transmission, transient stability problems in power systems etc. in countries like USSR and USA. Preliminary studies show that the URAL computer with its magnetic tape unit will be fully capable of tackling all power flow problems not only in the eastern zone but for the whole of India when all the national grids became connected. The setting up time and computation time would be negligible compared to the time taken on a net-work analyser.

The second new line of work is the application of digital computers to problems of fundamental science. A computer can simulate random walk problems. A programme has been made to simulate the classical Rayleigh's random walk problems. The results are interesting. Problems which are extremely difficult to solve and are practically unsolvable by means of ordinary manual methods, can be simulated by the computer and the distribution functions can be numerically tabulated. Problems computed on the computers HEC2M and the URAL, are listed in Appendix 6.

Computer Components: Investigations on the mechanical details, the logic and the design of electronic circuitry for an optimum magnetic drum store for computers with a view to application in data-processing systems and scientific computers were continued. The results of the investigations were published in two research papers. (Appendix 6.3).

A theoretical study on the physics of magnetic recording was nearly completed. The magneto-static problem for the magnetic head was solved mathematically by conformal transformation and the numerical computation of the problem was done on the computer HEC2M. Attempt is being made to transistorise the associated reading recording circuits. A new type of self-strobing reading circuit was designed and constructed.

Transistorised Arithmetic and Logical Circuits: Design and experiments on the basic building blocks for different logical circuitry for computers using transistors were continued as in last year.

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Analogous Machine for the Statistical Analysis of Telemetered Data from Seismographs :

An analogous co-relation computer using a new type analogous multiplier based on Hall effect is being designed and constructed.

Random Number Generator : Random numbers are often required in statistical work. The random numbers are usually punched on cards from available random number tables, such as Tippett's Table or Rand Corporation Table. This is a time-consuming work. In many problems a large amount of random numbers are to be used. For problems of random walk simulated on high speed computers, it is often found that the cards containing random numbers, which require a fortnight for a puncher to punch, are consumed within a short time. Work was undertaken to generate true random numbers (distinct from pseudo random numbers) and to automatically punch these on standard eighty column Hollerith cards. It is known that the emission of Alpha and Beta particles from a radioactive source is a truly random process which can not be predicted by Causality Principle. Using this principle a card punching mechanism has been actuated to punch random numbers consisting of one to eighty digits on eighty column cards. Attempt has been successfully made to actuate the printing mechanism of a standard tabulator for printing random numbers. The work which has been started recently is in progress. List of papers published and completed during the year is given in Appendices 6.3. and 6.4.

Maintenance Service : The constructive maintenance of punched card machines was continued as before. One 602A calculator, which was purchased from the IBM, was added to the list of punched card machines maintained from this unit, viz., two Russian tabulators, two summary punches, twenty electric key punches, six electric verifiers and one IBM type 416 tabulator.

Training : The following five graduate apprentices, who were sent by the Department of Radio Physics & Electronics, Calcutta University were given practical training. Ranen Biswas, M.Sc. (Tech.), Satyen Deb, M.Sc. (Tech.), Shyamala Sankar Majumdar, M.Sc. (Tech.), Suhas Majumdar, M.Sc. (Tech.), and Ajit Singh, M.Sc. (Tech.).

7. DEVELOPMENT WORKSHOP

High Speed Electronic Sorters : During the period under review the Workshop has produced seven more sorters, thus bringing the total to fourteen including two prototypes. Of these four are working in the Army Statistical Organization, New Delhi, four are being used by the Institute at Baranagar and one at Giridih; three sorters are ready for installation. Another batch of twentyone sorters has been taken up for production and it is expected that twelve of these will be completed by the next year. The Workshop is examining the possibility of using transistorised electronic units for the sorters to be produced in future.

Desk Calculators : The development work on desk calculators has been taken up at a much higher pace for the purpose of finalizing the production of development part at an early date. It has been decided to produce sufficient number of calculators in the next financial year for the purpose of actual trial in the different departments of the Institute. Simultaneously necessary special tools are being designed and constructed so that the workshop can undertake mass-scale production of the calculating machines.

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Other Projects : Besides the two projects, namely, high speed electronic sorter and desk calculating machine, the workshop has undertaken development of other punched card machines, such as, manual key punch, manual verifier and tabulator. A licence for manufacture of desk calculators, key punches, verifiers and tabulators has been received from the Government of India and work has already been started in this direction. UNTAA machines are in the process of being unpacked, run and tested, for the purpose of installation, in a new shed at 202 B.T. Road, Calcutta-35. Engineers and other personnel are being recruited and a scheme for the purpose of giving proper training to the requisite technical personnel for the workshop is under examination. A training programme under National Apprenticeship Training Scheme has been worked out in collaboration with the Directorate of Industries (Vocational Training), Government of West Bengal and is now in progress.

Service : Services to the different departments of the Institute have been rendered by the workshop as usual during the period under review and 150 crop survey instruments have been fabricated for supply to NSS. Calculating Machines Repair and Maintenance Unit attended 167 service calls and executed seventy major repairs of calculators in addition to routine maintenance of 309 calculating machines, both hand-operated and electrical. Valuable technical services rendered to some outside parties, such as, National Instruments Ltd., National Carbon Company Ltd., Indian Airways, School of Printing and Technology and others. The jobs executed for these concerns were very intricate and precise.

The Maintenance Unit for Institute Punched Card Machines has been transferred to the Development Workshop.

An electronic unit headed by H. Raha, M.I.R.E. (USA) has been added to the Development Workshop. This unit is engaged in development of the electronic part of the tabulator under production.

S. C. Maulik joined the Institute as Consulting Engineer and gave his advice in technical matters.

8. STATISTICAL QUALITY CONTROL (SQC)

In 1947-48, Dr. Walter A. Shewhart, who may be described as the "father" of SQC paid a visit to this country and aroused considerable enthusiasm in the idea of SQC both in statistical and industrial circles. Immediately after Dr. Shewhart's visit, the Indian Society for Quality Control was established in Calcutta, but the SQC idea did not really catch on till 1952 when a team of experts deputed by the United Nations Technical Assistance Administration conducted intensive training courses in SQC methods in different parts of the country. The programme in this connexion was organized by the Institute in collaboration with the Central Statistical Organization. SQC has since made fairly steady progress and seven SQC Units are now functioning, one each at Bangalore, Baroda, Coimbatore, Bombay, Calcutta, Delhi and Madras with a coverage between them of fiftyeight factories.

A factor of considerable importance in the progress of SQC has been the three All-India Conferences, held in Calcutta in January 1948, January 1955 and December 1958. Dr. Shewhart who presided over the first conference paid two more visits: in 1954-55 and in 1958-59. An Advisory Committee for the guidance of SQC policy was set up in 1953 with Sri C. D. Deshmukh as Chairman and Sri Pitambar Pant as Secretary.

The SQC work has three aspects: (1) promotion, (2) application to industry and (3) training of specialists. The promotional activities are carried on by organization of conferences, seminars and meetings.

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On the operational side, apart from a few large industrial units which have their own SQC organizations and some of which provide consultants who work on a limited scale, the SQC Units of the ISI are engaged directly in the practice of Quality Control establishments. An idea of the wide scope of the advisory service given by these Units will be apparent from the following list of industries which are covered by SQC work: textiles; metallurgy; foundry & light engineering; electrical; plastics, chemicals & pharmaceuticals; glass & ceramics and process & miscellaneous industries.

During the year under review training courses for factory personnel were held in all the seven units of SQC in addition to the usual apprenticeship courses. Several introductory visits were paid and a number of promotional and special lectures, seminars and discussions were held in the units. Professor Lloyd A. Knowler, Professor and Chairman, State University of Iowa USA came to the Institute as an SQC expert, besides offering expert consultation to the different SQC Units of the Institute all over India, he participated in a series of lectures in Calcutta.

In Bombay an in-plant supervisory course was conducted for the supervisors of a light engineering factory and an advanced course, exclusively for chemists was arranged for a member factory. The Delhi unit consolidated its efforts at developing a SQC system for sugar mills and a draft brochure was prepared.

The SQC staff also participated in the teaching programmes of the Research and Training School.

9. LIBRARY

The Central Library continued to be located at Baranagore with a service centre at the City Office at 9B Esplanade East and branch libraries at Giridih, Delhi, Bombay and Bangalore.

Resources: The library has a book collection of nearly 87,500 volumes distributed by subjects as follows: Statistics—22,450 volumes; Mathematics—4,400 volumes; Physical and Biological Sciences—7,550 volumes; Economics and its subsidiary branches—22,200 volumes; Sociology, Cultural Anthropology and Demography—9,800 volumes; Engineering and Technology (including Agriculture, Medical Sciences and Management Sciences)—9,000 volumes; Humanities—8,200 volumes; and General Reference works—3,900 volumes. There is also a collection of 22,312 reprints, Monographs and specialized technical reports and documents and a large collection of photoprints and microfilms.

Books and Journals: The library acquired 7,484 volumes of which 5,700 volumes were processed, compared to 5,725 volumes in the previous year. Of these 7,434 volumes, 1,591 were gifts, 188 were received on exchange basis and 4,246 volumes were purchased. The remaining volumes were 370 bound volumes of periodicals, 487 official publications, 411 and 141 volumes were acquired for Russian and other exchange.

Periodicals: 1,816 Periodicals and serials were received, compared to 1,717 in the previous year. Of these 501 were subscribed to, 783 were received in exchange of *Sankhyā* and other occasional publications of the Institute and 532 were received on complimentary basis. Twentyfive daily newspapers were subscribed to for the newsclipping files on planning and economic development in India.

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Special Collection : Scientific and technical publications in Russian, Chinese and Japanese languages were received from various agencies as in previous years under the existing exchange commitments. The processing of these publications was taken up : the statistical section of Russian publications was made up-to-date.

The collection of the photo-duplicated material comprises 259 microfilm rolls running to 2,218 feet and containing 22,176 exposures and paper prints of 2376 pages.

Bibliographic Service : The library continued to issue the documentation lists : (1) Weekly List of Selected Periodicals; (2) Monthly Bulletin of Acquisitions and Library News, and (3) Index to Statistical Literature at regular intervals and these were received favourably by the research workers in and outside the Institute. Besides these regular bulletins the following reading lists and bibliographies were prepared : (1) Metropolitan problems and planning in big cities (submitted to East Asia Regional Organization for Planning and Housing, New Delhi (EAROPH) for incorporation in the international bibliography on metropolitan areas in various parts of the world except USA and Canada, to be compiled by the International Union of Local Authorities; (2) Printing and lay out; (3) Public opinion survey methods, and (4) Engineering and technological publications available in the library.

The Union List of Learned Periodicals, Calcutta Region compiled by J. Saha and published in 1959 received a favourable response from librarians and research workers in India and abroad. A scheme for revision of this list and bringing it up to date was undertaken and much progress was made in this direction.

Translations : Altogether fiftythree documents were translated into English. Of these fourteen were from Russian, twentyfour from Chinese, eleven from Japanese, one from German and three from French.

A notable work of the year was the translation of V. N. Krylov's "Sampling methods in statistics." The translation was edited with the assistance of A. K. Sinha of Flood Research Unit. Annotations of sixty articles from current Chinese periodicals were prepared for incorporation in a documentation list. A glossary of Japanese statistical and technical terms was also prepared.

Japanese Translation Unit : The Japanese Translation Unit in Tokyo prepared eighteen English translations of Japanese documents for the use of research workers in the Institute. This unit also supplied twentyone Japanese publications in English on social and economic aspects of the Japanese life.

Service and Circulation : Altogether 1,419 persons used the library during the period as against 1,366 in the previous year. Books, journals and other materials issued during the year numbered 64,406 as against 57,722 last year. Of these 15,734 were issued from the lending section, 28,943 from the reference section and 19,729 from the periodicals counter. Requests received numbered 71,064 of which about nine per cent could not be fulfilled against twelve per cent last year.

146 outsiders were given special permission to use the library against 165 persons last year.

Hindii Library : Altogether 11,82 items were issued from the Hindii Branch Library during the period of which 1,071 were issued from Reference Section and ninetyone items from the Lending Section.

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Inter-Library Loan : Inter-library lending system worked smoothly and the library made inter-library loan transactions with: (1) Bose Institute, Calcutta; (2) Calcutta University Central Library; (3) Calcutta University Department of Anthropology Library; (4) Commercial Library, Calcutta; (5) India Govt. Central Glass and Ceramic Research Institute Library; (6) India Govt. Geological Survey of India Library; (7) India Govt. Department of Anthropology Library; (8) Imperial Chemical Industries Library, Calcutta; (9) Institute of Nuclear Physics Library, Calcutta; (10) India Govt. Zoological Survey of India Library; (11) Jadavpuro University Library, Calcutta; (12) R. G. Kar Medical College Library; (13) West Bengal State Statistical Bureau Library, Calcutta; and (14) UNESCO Research Centre Library, Calcutta.

10. PUBLICATIONS

From 1932 the Institute started holding regular scientific meetings at which statistical papers began to be presented. The need of a journal became pressing and the Council set up a special committee to report on this matter. After a careful review, the committee recommended that a new journal should be started as the official organ of the Institute but its management and business arrangements should be made independent so that no financial liabilities should fall on the Institute. This recommendation was accepted by the Council; and it was decided to start a new journal *Sankhyā* : *The Indian Journal of Statistics* with P. C. Mahalanobis as Editor. The late Narendranath Mukherjee, the proprietor of the Art Press, very kindly shouldered the management responsibilities while the Editor made himself personally responsible for all financial liabilities. In this way the first number was issued in June 1933.

A little later, on the initiative and the approval of the Council of the Institute, a separate, non-profit distributing association called the Statistical Publishing Society was registered under Act XXI of 1860 in September 1935 with Dhirendra Nath Mitra, Girindra Sekhar Bose and P. C. Mahalanobis as Trustees to take over the financial and business responsibility for *Sankhyā*. After the death of G. S. Bose, Satyendranath Bose was appointed the third Trustee. This Society gradually built up the Ekka Press which has modern typesetting and monotype equipment and now prints a large variety of scientific publications.

Sankhyā, the official journal of the Institute, soon gained an international reputation and became self-supporting. Publication was partly interrupted during the war but twentythree volumes had been published by 1961. To cope with the increasing volume of matter, the Council decided that *Sankhyā* should be published from 1960 in two separate series, one mainly for papers and notes on new methods and techniques and the other mainly for original data, records and applications of new methods.

During the year under review, parts 3 & 4 of volume 22, all the four parts of volume 23, series B and part I of volume 23, series A containing thirtyeight papers and three reports were published. There were papers on sampling distributions, probability, estimation, tests of significance, multivariate analysis, design and analysis of experiments, stochastic processes, biometry, economic studies, demography and National Sample Survey Reports.

Indian Statistical Series : Over fifteen years ago the Institute had considered the possibility of bringing out a series of statistical monographs. The first book was 'Some Aspects of Multivariate Analysis' by S. N. Roy (who had undertaken this assignment when he was in the Institute) which was published jointly by the Indian Statistical Institute and John

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Wiley & Sons, Inc. New York in 1957 for distribution outside India, and an Indian edition was published jointly with the Asia Publishing House, Bombay. Since then arrangements have been made for the publication of the monographs in this series jointly by the Statistical Publishing Society and the Asia Publishing House under the auspices of the Indian Statistical Institute.

During the year, the following six books were published: (1) *A Demonstration Planning Model for India* by Jan Sandee. (2) *Planning for India: Selected Explorations in Methodology* by Ragnar Frisch. (3) *The Environs of Tagore* by Hashim Amir Ali. (4) *Then and Now* by Hashim Amir Ali. (5) *Experiments in Statistical Sampling in the Indian Statistical Institute* by P. C. Mahalanobis.

Samvadhanam: The *Samvadhanam* was first published in July 1956 as a house journal of the Institute during a period of its rapid growth with the object of opening channels of communication, fostering the growth of team spirit and to help the workers appreciate the purpose of the Institute. The journal has succeeded in attracting contributions from prominent guests and scientists and rank and file workers. Each issue has different sections in English, Bengali and Hindi. During the year, the first issue of the fourth volume was published in October 1960 and the second and third issues were combined and published in March 1961.

Publication Unit: The Unit which was established in April 1960 looked after the entire publication work of the Institute. Its primary responsibilities were to sub-edit, to determine typography and lay-out, to see through the proofs and to co-ordinate and expedite the publication work.

11. GENERAL ADMINISTRATION

The Indian Statistical Institute continued to function as a non-profit distributing organization registered on 28 April 1932 under the Societies Registration Act XXI of 1860. The Institute was recognized "as an institution of national importance" by the Indian Statistical Institute Act, 1939 which was sponsored by the Prime Minister in the Parliament in December 1959. The Act came into operation in April 1960.

Membership: During the year under review 88 new members of different categories were enrolled bringing the total membership of the Institute to 448 allowing for reduction due to death resignation etc. The number includes 65 life, 209 ordinary, 4 institutional, 79 student and 24 sessional members. The remaining 7 are honorary members.

Annual General Meeting: The Annual General Meeting was held on 29 October 1960 to transact the usual constitutional business, namely, election of office-bearers and members of the Council, adoption of the general report and statement of accounts for 1959-60 audited by Messrs. Lovelock & Lewis, Chartered Accountants. List of office-bearers and members of the Council is given in Appendix 2.

Meetings of the Council: The Council of the Institute met 9 times during the year on 21 May, 18 July, 12 August, 20 October, 3 December, 27 December in 1960 and 25 January, 22 February and 15 March in 1961. Fixing of pay structure for the employees under different categories was considered by the Council during the year.

Governing Body of the Research and Training School: The Governing Body met on 29 October 1960 under the Chairmanship of Sir D. N. Mitra, Chairman of the Institute

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and on 24 March 1961 under the Chairmanship of Dr. C. D. Deshmukh, President of the Institute.

Finance Committee: The Finance Committee of the Council and the Finance Committee of the Governing Body met on 28 October 1960 to consider the audited statement of accounts, the report of the *ad hoc* Committee on the allocation of expenditure, the budget proposals and other matters.

The *ad hoc* Joint Committee of the Governing Body of the Research and Training School and the Council of the Institute examined the allocation of expenditure to different projects on 28 October 1960 and submitted its report to the Finance Committees of the Governing Body and the Council. A list of members of the Committees is given in Appendix 2.

Changes in Senior Staff: The staff of the Institute was strengthened during the year by the addition of the following persons. The date of joining is shown against each name: Shri S. Basu, M.Sc., F. X. I., Former Director General, Observatories, 1 August 1960 (*Administration*) as Joint Director; Chao-Ku-Chun, 1 December 1960 (*Planning Unit, Delhi*); P. K. Dey, M.Sc., A.I.I.Sc., Ph.D. (London), 2 July 1960 (*Research and Training*); A. B. Gupta, M.Sc., 18 July 1960 (*Research and Training*); S. C. Maulik, Former Director and Chief Engineer, Raynas Corporation, 1 July 1960 (*Consulting Engineer*); E. M. Paul, M.Sc., Ph.D. (Illinois), 1 January 1961 (*Research and Training*); J. R. Pal, Ph.D., 20 March 1960 (*Research and Training*); Miss A. Sen, M.A., B.T., Ph.D. (London), 12 August 1960 (*Appraisal Division*); Miss A. Sen Gupta, M.A., B.T., Ph.D., Academic Diploma in Education (London), 24 October 1960 (*Family Planning*).

The following members of the staff left the Institute on the dates mentioned: Morton Nadler (*Electronics Division*), 1 October 1960; Miss A. Sen (*Appraisal Division*), 9 March 1961.

Estates and Transport Sections: The Estate Office designs and supervises all construction work in the Institute and looks after the repair and maintenance of its buildings, roads, grounds, furniture and other equipment. The electric installation and internal telephone system are maintained by a trained group of workers who also look after the refrigeration plants used for air-conditioning some of the laboratories and machine-rooms.

All buildings and hutments of the Institute at Baranagar and Giridih have been designed and constructed so far and are being maintained by the Institute's own staff. The Institute was occupying in 1961 about 1,25,000 sq. ft. of *pucca* buildings and nearly 1,00,000 sq. ft. of hutments in its different premises at Baranagar. The Institute was also occupying over 9,000 sq. ft. in rented premises in the city of Calcutta, and about 42,000 sq. ft. of buildings and 2,000 sq. ft. of hutments at Giridih.

Subodh Chandra Das D Gupta was in general charge of the Estate Office. The Institute had started a transport section in 1945-46, and since then a number of light cars are being maintained for official work and the use of Institute guests. The Institute has 17 vehicles of various types in its fleet. 4,294 out of 4,150 requests for transport were complied with during the year.

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WELFARE AND GENERAL SERVICES

Visitors : Over 500 visitors from India and abroad (from 24 countries) came to see the Institute in the year under review. (See Appendix 3).

The Public Relations Unit was responsible for showing the visitors round the Institute and also for the house-organ *Samvadathanam*.

International Guest Houses : Since 1938 distinguished foreign scientists began to come to the Institute as visiting professors and experts; and upto 1952 or 1953 most of them used to stay with Professor and Shrimati Mahalanobis. The numbers of guests increased very considerably with the inauguration of the work on economic planning in 1954 and it became necessary to make some regular arrangements for guests. A portion of the main building at 203, Barrackpore Trunk Road, Calcutta-35, was converted into a guest house, and several suites of rooms at *Amarapali* were set apart for Institute guests.

In 1953 a House Committee was constituted with Shrimati N. K. Mahalanobis as Honorary Chairman to look after the arrangements for the Institute guests, and the workers who reside at headquarters and in five rented houses in the neighbourhood, the grounds and gardens and sanitation.

In 1955 and 1956 new hutments (East Cottage and North Cottage) were constructed to provide additional accommodation for the trainees of the International Statistical Education Centre and some of the many foreign visitors who came to attend the Twenty-fifth Anniversary Celebrations of the Institute. In this way, by the end of 1956, thirty-two single and double rooms, many of them with attached baths, became available for guests in these hutments.

The Institute maintains these Guest Houses mainly for foreign visitors, many of whom stay at the Institute for fairly long periods for lectures, research work and technical consultations. The number of such guests during 1960-61 was 163. There is a guest house at *Mahua*, Giridih.

Medical Welfare Unit : The Medical Welfare Unit which is now in the seventeenth year was set up on a modest scale in February 1945. Since the shifting of the Institute's headquarters from Calcutta to Baranagar, the Unit has been making steady progress. The benefits of the Unit which are available to the workers, members of their families as well as students and guests include free consultation and services, visits to residences at subsidized rates and the supply of medicines on a cost basis. The number of workers seeking medical aid has been increasing steadily. About 26,000 patients were treated in the Unit and above 1,100 home visits were paid. The cost of medicine supplied to workers has also increased from Rs. 36,382 in the previous year to Rs. 38,162 in the year under review. The present staff of the Unit is as follows : Dr. B. Goswami as consultant, and Dr. R. Mitra, Dr. S. C. Sen (resident medical officer) and Dr. A. Bauerjee.

Cultural and other Activities : The ISI Workers Club at Baranagar, the ISI Field Workers Club in Calcutta and the Salboni Club at Giridih organized annual sports, meetings, recreations and varied cultural activities. In addition, a music club *Suradhuni* at Baranagar was given certain facilities for its activities.

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The ISI Club participated in the Inter-office Table Tennis League under B.T.T.A. in Calcutta. Two teams of ISI met in the final. ISI B became champion and ISI A was runners up. In valley ball, the ISI secured third position in the league under Valley Ball Federation and lost to P & T in the knockout tournament in the quarter final. The club also participated in football and cricket tournaments under West Bengal Sports Federation, Calcutta. Inter-sections games and other indoor and outdoor competitions were conducted by the Club. The yearly issue of *Lekha* was published as usual.

OPERATING CENTERS

For the first ten years (1932-1941) the work of the Institute used to be done in the Presidency College, Calcutta, and in some rented rooms in the city. At the time of evacuation during the war in 1942, one part of the Institute was removed to *Amarjali* (Professor Mahalanobis' house) at 87, now 204 Barrackpore Trunk Road, Calcutta-35 in Baranagar, a suburb of Calcutta) and another part to *Mahua* (Mrs. Mahalanobis house) at Giridih, Bihar, about 200 miles from Calcutta, both of which were placed at the disposal of the Institute by the owners, free of rent, for the duration of the war and one year thereafter.

Headquarters at Baranagar (Calcutta-35): From 1946 the Institute has also occupied rented premises at 206 B. T. Road, Calcutta-35 (near *Amarjali*) comprising about 8 acres of land. In 1960 the Institute acquired about 3 acres of land at 203 B. T. Road, Calcutta-35, and started constructing buildings on it. Since 1954 the Institute was using about 8 acres of land and buildings at 202 B. T. Road, Calcutta-35 and the premises known as *Gopalanias* in the same neighbourhood which were placed at its disposal by the Government of India. The Institute subsequently purchased some other pieces of land at Baranagar measuring about three and a half acres.

In this way Baranagar (Calcutta-35) gradually became the headquarters of the Institute. The Institute has constructed about 65,000 sq. feet of buildings and 25,000 sq. feet of hutments on its own land at 203 B. T. Road, Calcutta; and also occupies about 56,000 sq. feet of buildings and 75,000 sq. feet of hutments in other premises. Over 121,000 sq. feet of buildings and 100,000 sq. feet of hutments are thus in the occupation of the Institute in Baranagar.

The Research and Training School with its different laboratories, the International Statistical Education Centre, hostels for students, the bigger part of the National Sample Survey, the Calcutta wing of the Planning Division, the Library, the Electronic Computer Laboratory and Development Workshop, the Guest Houses, and Central Office and services are located at Baranagar. The associated non-profit organizations, the Statistical Publishing Society and the Eka Press, occupy adjoining premises at 204/1 Barrackpore Trunk Road and the non-profit organization, India Calculating Machine and Scientific Instrument Research Society (ICMSIRS) is associated with the Development Workshop.

Calcutta City Office: The Institute occupies about 9,000 sq. ft. in rented premises in the city. The SQC Unit has its office at 9B Esplanade East which is also used for evening training courses and for meetings and lectures of the Institute. The Field Branch of the Institute has its offices at 204/2/1 Upper Circular Road, Calcutta-9 and 210 Cornwallis Street, Calcutta-6; and rooms in the Albert Hall near Presidency College.

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Giridih : Since 1941 an operating centre has continued to be located at Giridih. In 1940, the Institute acquired 35 acres of open land adjoining *Mahua* and standing on the river *Uari* where an agricultural farm has been established. The Institute has put up some hutments on its own land and has also constructed a Health Home for convalescent workers on a piece of land at *Pachamba* which was received as a gift. The total space in the occupation of the Institute at Giridih in 1960 was about 45,000 sq. ft. of buildings and 2,000 sq. ft. of hutments.

The agricultural farm is used for various field experiments and biological studies by the Biometric Unit and two field units are maintained at Giridih one for the *ad hoc* crop and socio-economic, and the other for sociological surveys. The National Sample Survey also has a branch at Giridih with a machine tabulation unit of four tabulators, seven sorters, one collator, two multipliers, one reproducer and three gang and summary punches. During the year Giridih Centre was assigned 20 per cent of the operation work of NSS.

The students of the RFS and the ISEC trainees go in batches every year to Giridih for practical training in crop-cutting experiments and in socio-economic surveys.

There are guest houses for visitors, canteen with subsidized tiffin, circulating library, club for sports and social functions and a medical welfare unit for the workers.

Delhi : In 1949 when Professor Mahalanobis started working as Honorary Statistical Adviser to the Cabinet, the Institute opened a small office in New Delhi which functioned for two years as the Central Statistical Unit for the coordination of the statistical work for the Government of India until the Central Statistical Organization was established in 1951.

The Institute staff was increased from 1954 to work on studies relating to planning and scientific and technical man-power in collaboration with the Planning Commission under the guidance of Sri Pitambar Pant who is the Chief of the Division of Perspective Planning and also helps the Institute as its Honorary Joint Secretary.

During the year under review, 30 per cent of the total work of the National Sample Survey was processed in the NSS Operations, Delhi. Due to increase in work and in staff new accommodation was arranged at 6 Link Road, Jangpur Extension for housing Punching, Pre-Punching and Post-Machine Processing sections.

Bombay : In addition to a society branch, the Institute maintains one operating centre in Bombay working under the guidance of Sri M. A. Telang, with an office for the field work of the National Sample Survey in Bombay city and one SQC Unit. Various special surveys and studies were undertaken from time to time in cooperation with the society branch.

Bangalore : One SQC Unit which is maintained at Bangalore under the guidance of Sri Srinagabhushana.

Field Branch : The Institute has a field branch which is in charge of the field work of the National Sample Survey in West Bengal, and office for similar field work in Bombay city, and two small field units at Giridih for pilot studies.

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12. VISITING SCIENTISTS

Since 1938 the Indian Statistical Institute has been inviting distinguished scientists from abroad to come to the Institute as visiting professors. Such visits have not only been of considerable benefit to the Institute and its workers but have also contributed to a wider knowledge and an appreciation of the work of the Institute and of Indian conditions and problems in other countries.

Foreign Scientists : During the year, a number of distinguished foreign scientists participated in the research, training and other activities of the Institute. Some of them stayed for fairly long periods and assisted in the regular work of the Institute, while others came for short periods and participated in lectures and seminars. A list of the visiting scientists is given below. The dates in parenthesis indicate the period of their work in the Institute.

BETTELEKIM, CHARLES, Directeur d'Etudes, Ecole Pratique Des Hautes Etudes, France. *Lecture* : Economic Problems of West Africa (February 1961).

BRATES, B. V., Head of Russian Language Department, Leningrad University, USSR. *Lecture* : The Methods of Learning the Russian Language (February 1961).

CHADAEV, I., Deputy Chairman, Gosplan, USSR, participated in the work of the Delhi Unit of the Planning Division in certain studies in collaboration with the Perspective Planning Division of the Planning Commission, Government of India (January-March 1961).

COPELAND, ARTHUR H., Michigan State University, USA. *Lecture* : Foundations of Probability and Induction (November 1960).

FRIET, KAMPE DE, Professor of Mathematics, University of Lille, France. Two *Lectures* : (i) Asymptotically Stationary Random Functions, and (ii) Wiener Levy Random Functions (February 1961).

FISHER, SIR RONALD, A., F.R.S., came for the eighth time as a guest scientist for an extended stay in the Institute. He gave two courses of three lectures each on Sampling the Reference Set in Behren's Problem and Polyomic Inheritance and was available for consultation by the teaching staff and research workers, (December 1960-February 1961).

KNOWLER, LLOYD A., Professor and Chairman, State University of Iowa, came to the Institute as an SQC expert in July 1960 on a one-year assignment. He participated in lectures on SQC problems besides offering expert consultation to the different SQC Units of the Institute all over India. (July 1960-June 1961).

LECOMTE, J., Department of Physics, University of Paris. *Lecture* : Infra-red Spectrum—Some Results and the Equipment in the University of Paris. (January 1961).

MACURA, MILOŠ, Joint Director, Federal Statistical Institute, Yugoslavia. *Lecture* : Savings Survey—Method and Experience. (January 1961).

MCCARTHY, M. D., Director, Central Statistical Organization, Ireland. *Lecture* : The Working of the Central Statistical Office in Ireland. (November 1960).

MONOD, J., Professor, Institut Pasteur, Paris. *Lecture* : Genetic Regulatory Mechanisms in Enzyme Synthesis (January 1961).

POLOSUKHINE, A. I., expert on planning for machine building, Gosplan, USSR, participated in the work of the Delhi Unit of the Planning Division in certain studies in

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collaboration with the Perspective Planning Division of the Planning Commission, Government of India. (*January-March 1961*).

ROBINSON, PAMELA L., came for the third time as a guest scientist on deputation from the University College, London with a grant for equipment from the Royal Society of London. She led an expedition to the Pranhita-Godavari Valley where dinosaur fossils of great importance were discovered. She gave some introductory lectures to the students of the B.Stat. course; and helped in drawing up plans for the expansion of the Geological Unit for research and teaching requirements of the integrated B.Stat. Course. (*November 1960-April 1961*).

SHIYU, M., Institute of Mathematical Statistics, Tokyo, worked as a teacher for six months in the International Statistical Education Centre (ISEC), and gave some lectures on mathematical statistics. He will also participate in the teaching programme of the new Summer School for statisticians scheduled to start in May 1961.

SMITH, ALAN J., Lecturer in Sedimentology, Department of Geology, University College, London, on deputation with the support of the Royal Society of London, came to India mainly to initiate studies in sedimentary petrology at the Geological Unit. He was also a member of the team which went to the Pranhita-Godavari valley for a geological expedition and gave considerable help in equipping the Unit for this work. (*December 1960-March 1961*).

SOLMONS MORRIS J., Mathematical Statistician, Sampling, Atlas Powder Company, USA, worked in the Institute as a TCM expert from October 1959 to March 1961. He completed an experimental project in the machine tabulation section of the Institute, and gave lectures on operations research to the trainees at the ISEC and in Two-year Advanced Statistician's Training Course (*October 1959-March 1961*).

SOULIER, J. P., Director-General, National Blood Transfusion Centre, Paris; member, Faculty of Medicine, University of Paris. (*October 1960*).

TINTNER, GERHARD, Iowa State College of Agriculture and Mechanical Arts, Department of Economics and Sociology, USA, worked in the Planning Unit in Calcutta and conducted a number of seminars on econometric problems, and gave some seminar lectures on econometric subjects. He also participated in the teaching programme of the International Statistical Education Centre. (*June-August 1960*).

TUMURA, YOSIRO, Director, Planning Section, Division of Statistics and Research, Ministry of Agriculture and Forestry of Japan. *Lecture: A Problem in Measuring Income Elasticities.* (*March 1961*).

VIRATA, ENRIQUE T., Executive Vice-President, University of the Philippines. *Lectures: Population Growth in the Philippines and its Impact on the Public Educational System.* (*December 1960-March 1961*).

M. J. T. and Ford Foundation Project: The Indian Statistical Institute collaborated with other research institutes in a research project sponsored by the Massachusetts Institute of Technology and the Ford Foundation. The following economists of the Massachusetts Institute of Technology Centre for International Studies in India participated in the work of the Planning Unit in Delhi in collaboration with the Perspective Planning Division of the Planning Commission, Government of India, during the last two years in the subjects mentioned against each name.

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LITTLE, I. M. D. : Studies relating to public finance and tax policy in the Third Five Year Plan.

LYDALL, H. F. : A study of consumption, and the incidence of taxation.

SWAN, TREVOR : Inter-relationship between investment, output and employment for organized manufacturing.

Dr. L. Löfber and Dr. Rosenstein Rodan joined the team in Delhi.

Indian Economists : The following Indian economists were associated with the research work of the Planning Unit in Delhi during the period :

BHAUWATI, JAGADISH, Nuffield College, Oxford University.

GULATI, I. S., Professor of Economics, Baroda University.

PATIL, S. J., U.N. Economic Commission for Europe.

SEN, A. K., Fellow, Trinity College, Cambridge University.

Lectures by Indian Guest Scientists : A list of lectures from other Indian Institutions and Government departments is given below :

BAGAI, OM PRAKASH, Lecturer, Government College, Ludhiana. *Lecture* : Multiple Comparison Methods and Certain Distributions Arising in Multivariate Statistical Analysis. (September 1960).

BANERJEE, K. S., Deputy Director, State Statistical Bureau, West Bengal. A series of six lectures on the Construction of Cost of Living Index Numbers (December 1960).

MUKHERJEE, RADHAKAMAL, Director, J. K. Institute of Sociology and Human Relations, Lucknow University. Four *Lectures* : (i) Value Considerations in Social Science, (ii) Institutional Planning and the Third Plan, (iii) Population and Human Values, (iv) The Dimensions of Human Evolution (September-October 1960).

13. VISITORS

Among other visitors may be mentioned :

M. S. BARTLETT, Head, Department of Statistics, Manchester University (23-29 May 1960).

YVES BIRAUD, Director of Health Statistics, World Health Organization (17-19 December 1960).

ARTHUR F. BURNS, President, National Bureau of Economic Research, New York (10 January 1961).

S. DUTT, Foreign Secretary, Government of India (24 February 1961).

P. D. ERZIN, Vice-Rector, Friendship University, Moscow (20 October 1960).

FAIZE EL-KHURI, Director International Statistical Education Centre, Beirut (25-26 May 1960).

FRANK FENNER, F.R.S., Professor of Microbiology, School of Medical Research, Australian National University, Canberra (27-31 December 1960).

LEO KATZ, Director, Statistical Laboratory, Michigan State University (13-15 June 1960).

A. N. KOBYGIN, First Deputy Chairman, Council of Ministers, USSR (24 February 1961).

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F. J. LOFTUS, Deputy Director, U.N. Statistical Office (15-17 June 1960).

H. R. MILLS, Director, Colombo Plan, (7 January 1961).

A. E. MOURANT, Director, Blood Group Reference Laboratory, Lister Institute, London (20-22 September 1960).

K. N. PLOTNIKOV, Director, Institute of Economics, USSR Academy of Sciences (24 February 1961).

G. M. PUSHKIN, Deputy Minister of Foreign Affairs, USNR (24 February 1961).

DIETRICH H. SCHWENCKE, Director, Research Institute for International Technical Co-operation, Aachen (17 March 1961).

A. M. N. SHAFIEI, Under Secretary of State, Ministry of Social Affairs and Labour, Cairo (12-16 May 1960).

D. N. WADIA, F.R.S., Geological Advisor, Department of Atomic Energy, Government of India (11-16 December 1960).

14. VISITS ABROAD

Sri A. Biswas, Planning Division, worked out a paper on the experience of inter-industry analysis in India, with special reference to the evaluation of cost data, for the Second Expert Group on Programming Techniques held in the ECAFE at Bangkok in December 1960. He joined the Second Expert Group on Programming Techniques in the ECAFE at Bangkok in February 1961.

Sri A. K. Chakravarty, Planning Division, went to Europe for a study tour at the end of 1960.

Sri D. N. Ghosh, National Sample Survey, left for the Catholic University of America, Washington in June 1960 for further studies.

Sri N. C. Ghosh, National Sample Survey, went to Bangkok and Tokyo in April 1960 on a study tour for a period of six weeks. He visited the Statistics Development Section of the ECAFE at Bangkok and studied materials relating to the statistical systems in the South East Asian countries. At Bangkok, he attended, as a member of the Indian delegation, the Third Asian Statistician's Conference from 5 to 15 April 1960. From there he went to Tokyo to gather firsthand knowledge of the statistical system in Japan with particular reference to industrial statistics. In Tokyo he visited the offices of the Bureau of Standards in the Prime Minister's Office, the Statistics Bureau, the Economic Planning Agency, the Ministry of Trade and Industry and the Ministry of Agriculture.

Professor J. B. S. Haldane, Dr. H. Spurway, K. R. Dronamraju, and T. A. Davis, visited Ceylon as guests of the Ceylon Association for the Advancement of Science from 23 November to 31 December 1960. They attended the annual session of the Association held from 2 to 28 November, and read papers. Professor Haldane gave an inaugural address at the opening session on biological research with simple apparatus.

Professor Haldane and party visited the Fisheries Department at Colombo on 28 November, the Rubber Research Institute at Agalawata on 29 November, the Coconut Research Institute at Lunuwilla on 1 and 2 December, the Tea Research Institute at Talawakelle on 5 December, the Dry Farming Research Station at Maha Illuppalam on 6 December, and the Rice Breeding Station and the Live-stock Farm at Battalagoda on 8 December.

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Professor Haldane was consulted on genetical and biometrical topics by the staff of the research institutes visited by him and his party. He gave a lecture on the scope for work on genetics at the Coconut Research Station.

Professor Haldane and party visited some archaeological sites at Anuradhapura, Polanaruwa, Sirgiri, some Buddhist temples and the Gotama Vihar Art Gallery. Professor Haldane and T. A. Davis gave radio talks at Colombo.

Professor P. C. Mahalanobis accompanied by Mrs. Mahalanobis made two exclusive tours, one in USSR, UK, USA and Japan (7 April to 11 June) and another in Australia and New Zealand (25 October—11 December 1960). Details are given in Appendix 4.

Dr. H. Mazumdar, Planning Division, attended the First Asian Regional Conference of the International Association for Research in Income and Wealth at Hongkong in August 1960 and presented a paper. He made a study trip to the ECAFE Headquarters, Bangkok in September 1960.

Sri M. N. Murthy went on a study tour abroad in February 1960 and returned in October 1960. He visited the USA, Canada, the UK and some other countries in Europe and the Middle East. He spent most of his time in the US Bureau of Census studying its organization and functions, and the methodology used in the various censuses and surveys. He visited a number of statistical organizations in various countries during his tour, including the Dominion Bureau of Statistics, Canada; the Central Statistical Office, Social Survey Organisation and Agricultural Experimental Centre (Rothamstead) in the UK.

Dr. A. Matthai at the invitation by the ECAFE, and representing the International Statistical Education Centre, Calcutta, attended the meeting of the Working Group on Training of Statisticians at Bangkok from 8 to 18 November 1960, and contributed to the formulation of a training programme and syllabus for national training centres for primary and intermediate personnel in the ECAFE countries.

Dr. C. R. Rao, Head, Research and Training School, went to Japan in June 1960 to attend the 32nd session of the International Statistical Institute held in Tokyo, where he was invited to read papers and participate in the discussions. A full session was devoted to his paper on maximum likelihood estimation, followed by a discussion in which Sir Ronald A. Fisher, Professor J. Neyman, Dr. J. Berkson, Professor G. A. Barnard, Professor A. Birnbaum and Professor Kitagawa participated. He read another paper on statistical methods in anthropology in the special session on multivariate analysis. He also acted as the chairman at one of the sessions for the contributed papers.

During his stay in Japan, he gave, on invitation by the Japanese Union of Scientists and Engineers (JUSE), a five-day (extended over 20 hours) intensive course on advanced statistical methods in industry. This was attended by statisticians and engineers working in industrial establishments in Japan. He also gave an address on some aspects of least square estimation at the Operations Research Society of Japan, and a lecture on some recent researches in multivariate analysis in the seminar series organized during the Statistical Conference at Tokyo.

On his way to Japan, Dr. C. R. Rao visited Manila and Bangkok. At Manila, he met Dr. E. Virata, Executive Vice-President of the University of Philippines, Dr. H. Fairfield Smith, Dr. P. B. Patnaik of the Statistics Centre, and a number of statisticians and economists of the statistical organization of the Government of Philippines. He had informal discussions with them about the facilities available for the training of professional statisticians.

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and the new degree courses started at the Institute. At Bangkok, he met some of the statisticians and economists working at the ECAFE, and the staff of the Mathematics Department at the Chulalongkorn University. There was a keen desire, both at Manila and Bangkok, to depute some students for the degree courses and the advanced professional training at the Institute. On the basis of these discussions, the Institute made some decisions regarding the admission of foreign students, which was incorporated in the 1961-62 edition of the Prospectus of Courses at the Indian Statistical Institute.

Sri S. K. Roy, Biometry Unit, was on a study and lecture tour in Europe during 27 February to 25 December 1960. He attended an advanced course in genetics and plant breeding arranged by the FAO in Sweden during March to September 1960, for delegates from ten different Asiatic, European, Middle East and African countries. During this period of training he undertook investigations on the problems of genotype interaction in barley and interaction between red clover and timothy, the results of which were highly appreciated. He visited many agricultural and plant breeding institutes and biological laboratories in Sweden.

He also visited many Institutes and Universities in Denmark, West Germany, Holland, the United Kingdom, France, Switzerland and the USSR on his way back to India during 11 September to 12 December 1960.

He was invited to give lectures at the following Institutes: Forest Research Institute, Stockholm; Sir William Dunn School of Pathology, Oxford University; Department of Genetics, Glasgow University; Department of Botany, University of Edinburgh; Department of Botany, the University College, London; Department of Botany, University of Geneva; Main Botanical Garden of the Soviet Academy of Sciences, Moscow; Botanical Society, Leningrad; Botanical Institute of the Soviet Academy of Sciences, Leningrad.

Sri T. K. Roy Choudhury, Geological Studies Unit, spent a year (September 1959 to September 1960) in the United Kingdom, mainly at the University College, London, and took an advanced course in vertebrate palaeontology. He visited some European museums as part of his research training. He attended the Symposium of Vertebrate Palaeontology and Comparative Anatomy held in September 1960 at Oxford. A small explanatory demonstration of some interesting fossil reptiles and amphibians, collected by the geological party of the Institute was arranged.

15. EXTERNAL ACTIVITIES

As in previous years the workers of the Institute participated in various conferences, served on committees and gave lectures at many places in India. An account of these activities is given in Appendix 12. Mention may be made here of some of the more important of these activities.

Besides lectures and discussions abroad of which an account has been given elsewhere Professor Mahalanobis delivered an address on Scientific Research and National Institute of Sciences of India in Delhi on 31 December 1960. On 2 March 1961, he presided over a meeting of the Advisory Committee on National Income in New Delhi.

Sri M. Mukherjee, Head, Planning Division, attended the ninth Conference of Central and State Statisticians held in December 1960 at Jaipur, as a delegate of the Institute.

Sri J. Saha Chief Librarian, attended the Regional Seminar of Scientific Documentation for South East Asia held in New Delhi during 7-16 March 1961.

PART 2: RESEARCH SUMMARY

A brief account is given in this section of the progress of research in the different divisions and sections of the Institute. Lists of scientific and technical papers published and read at conferences or submitted for publication and working papers and notes are given in Appendix 5. References are also given in this section to relevant papers.

RESEARCH AND TRAINING SCHOOL

A. THEORETICAL STATISTICS

Limit Theorems (R. Ranga Rao, S18): Let X_1, \dots, X_n, \dots be a sequence of independent and identically distributed K -dimensional random vectors with mean zero and the unit matrix as the variance-covariance matrix. Let F_n be the probability distribution of the normal sum $Z_n = (X_1 + \dots + X_n)n^{-1}$ and let ϕ be the standard normal distribution whose first two moments coincide with those of Z_n . Then the following questions have been investigated.

- (1) An upper bound for the error $F_n(A) - \phi(A)$, where A is any convex subset of R_k .
- (2) An asymptotic expansion of the error $F_n(A) - \phi(A)$ for the class of all convex subsets of R_k .

Results parallel to those of Cramér, Berry-Esseen for the case of real valued random variables are obtained in this case.

Stochastic Processes (R. Ranga Rao, S19): Let $X_1(t), X_2(t), \dots$ be a strictly stationary sequence of random functions taking values in the space $D[0,1]$ —of all functions on $[0,1]$, with discontinuities, if any, only of the first kind. Even though the space $D[0,1]$ is non-separable under the uniform norm, by using a new method, it is shown that the strong law of large numbers (both in the sense of almost everywhere convergence, as well as mean of order α) is valid under suitable assumptions. These results generalize the earlier results of Fortet and Mourier for the case of random functions taking values in a separable Banach space.

Distributions on Groups (K. R. Parthasarathy, R. Ranga Rao and S. R. S. Varadhan, S14): Let G be a locally compact separable metric group and m the semi-group of distributions (countably additive probability measures) on G . This study concerns the arithmetic of distributions on G . Firstly, we establish in its complete generality a general decomposition theorem which decomposes any element $\mu \in m$ as $\mu_1 * \mu_2 * \mu_3$ where μ_1 is the maximal Haar component, μ_2 is an infinitely divisible law without any indecomposable factors, and μ_3 is the product of a finite or countable number of indecomposable factors. This generalizes a result due to Khinchin who proved it in the case of the real line.

In the case when G is any complete separable metric group, a study is made of the topological size of various collections of indecomposable distributions such as (1) all indecomposable distributions, (2) all continuous indecomposable distributions and (3) all absolutely continuous indecomposable distributions. It is shown that under appropriate conditions on the basic group G , they form a dense G_δ . An important tool in the above study is the concept of shift compactness and a theorem asserting that if a sequence λ_n of distributions is compact, and μ_n is any factor of λ_n , the sequence μ_n is shift compact. All the results described above are new even in the case of the real line.

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Ergodic Theory (K. R. Parthasarathy, S12): If X is a separable metric space, T is a homomorphism of X into itself, m is the set of all probability measures invariant under T and is assigned the weak topology, it has been shown that the set of all ergodic measures is a G_δ in m . In case X is a countable bilateral product of a complete metric space and T is the shift transformation of X then the set of ergodic measures is actually a dense G_δ . In the same case the first category nature of the set of strongly mixing measures has also been demonstrated.

Characteristic Functions (R. G. Laha, S7, S8): Using the result that $(1 + |t|^\alpha)^{-1}$, where $0 < \alpha \leq 2$, is the characteristic function of a unimodal distribution, it has been proved that every symmetric stable law is unimodal. It has also been shown that every distribution belonging to the symmetric L -class (as defined by P. Levy) is unimodal.

The following result on the analytical decomposition of the Poisson law is obtained.

Theorem: If the n characteristic function $f_j(t)$, $(j = 1, 2, \dots, n)$ are connected by the relation

$$[f_1(t)]^{\alpha_1} [f_2(t)]^{\alpha_2} \dots [f_n(t)]^{\alpha_n} = e^{\lambda(e^{it} - 1)}$$

for all t such that $|t| < \delta$, where δ, λ , and the α_j 's are positive numbers then for each j

$$f_j(t) = e^{i\mu_j t - \lambda_j(e^{it} - 1)}$$

where μ_j is real and $\lambda_j \geq 0$.

Large Sample Theory (C. R. Rao, P15): Research on properties of maximum likelihood (m. l.) estimates in large samples was continued. The new concept of efficiency introduced earlier was used in the study of large sample test criteria like the chi-square tests of goodness of fit, independence in contingency tables etc. An important result in estimation, is the demonstration of asymptotic efficiency and normality of m. l. estimates in the case of a multinomial distribution, assuming only the continuity of the first order derivatives. Earlier work by others demanded the existence of second order derivatives.

A new chi-square test for a composite hypothesis, which seems to have important practical applications has been given. The new test is applied in examining the homogeneity of A-B-O blood group gene frequencies of several populations. In some situations the new test has some advantages over a previous test given by the author in 1948, now called the Lagrangian multiplier test.

Sample Surveys: P. K. Pathak (S9, S10) obtained the moments of distinct units that appear in a sample, are derived under any sampling scheme. If d denotes the number of distinct units, it is proved that

$$E \left[\frac{1}{d} \right] = \frac{1}{N} \left[1 + \frac{1}{(N-1)} \sum_1 q_{11} + \frac{1.2}{(N-1)(N-2)} \sum_1 q_{12} \right. \\ \left. \dots + \frac{1.2 \dots (N-1)}{(N-1)(N-2) \dots 2.1} \sum_1 q_{12} \dots (N-1) \right]$$

where $q_{12} \dots m$ represents the probability of exclusion of units 1, 2, ... and m from the sample and the summation \sum_1 is taken over all possible combinations. This expression was required while deriving the variance of average of distinct units observed in a simple random sample (with replacement). Exact expressions for $E(d^2)$ ($E \neq 0$) and $E\{f(d)\}$ (where $f(d)$ is a function of d satisfying some regularity conditions) are also derived.

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D. Basu investigated sampling without replacement from a finite population, and showed that the order in which the units are selected, is immaterial for the purpose of estimation. He proved that the 'order statistic' (sample units arranged in an ascending order of their unit indices) forms a sufficient statistic, and therefore, any estimator which is not a function of the 'order-statistic', can be uniformly improved by the use of Rao-Blackwell theorem. In this paper, certain results obtained by M. N. Murthy are shown to be immediate consequences of this observation. It is shown that sampling with different probabilities with replacement, until we get a specified number of distinct units, is equivalent in some sense to sampling with different probabilities without replacement. Some other related problems are also considered in this paper.

Design of Experiments, Combinatorial Problems (C. R. Rao, S16, S17): At the suggestion of Sir Ronald A. Fisher, a study has been undertaken of the balanced incomplete block designs with replications 11 to 15. Solutions have been obtained in many cases by utilizing methods developed at the Institute several years ago by R. C. Bose and C. R. Rao. In several other cases, solutions based on complicated types of difference sets have been obtained by trial and error. An interesting combinatorial assignment problem has emerged out of this study: In an establishment, there are $v = nk$ officers, r departments and k types of jobs in each department. Each officer has to be assigned a job in each department in such a way that there are exactly n officers for each job in a department and any two officers have common jobs in exactly λ departments. This is a generalization of the problem of mutually orthogonal latin squares. It is easy to show that when $n = k$ is a prime or prime power a solution exists with $\lambda = 1$ and no such solution is possible for $n = 6$. An interesting solution has been, however, found for $n = 6$ with the next number $\lambda = 2$. Thus 6 has the characteristic 2. All numbers n can then be characterised with the minimum λ for which the assignment problem admits a solution.

Design of Experiments, Analysis of Data (J. Roy and K. R. Shah, S20): The problem of analysis of two-way designs with recovery of information both from row and columns is investigated, making use only of additivity of treatment and plot effects and the physical fact of randomisation. Three mutually orthogonal sets of contrasts are introduced namely, row-contrasts, column-contrasts and interaction-contrasts. It is shown that equation for estimation of treatment effects from interaction contrasts are the same as those obtained under the so-called Normal fixed effects model. The equations for combined estimation after recovery of information from row and column contrasts are derived next. Methods are given for estimating the different weights that are required in this problem. Three separate analysis of variance are necessary.

Though the analysis requires rather heavy computations in the general case, it has been found that if the columns (or the rows) of the design form a BIB, the analysis is much simpler. The case where the columns are balanced and the rows partially balanced is discussed in full.

(K. R. Shah, S23, S24): An estimate of inter-block variance in incomplete block designs alternative to that given by Yates, Rao, was obtained in (S20) and the variances of those estimates were compared. A simple computational procedure for the new estimate was derived. Corresponding estimates of inter-row and inter-column variances in general two-way designs were also obtained. These estimates were used in the analysis of quasi-latin squares with recovery of information from row and column totals (S24).

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(J. Roy and K. R. Shah, 821) : In estimating treatment effects from the results of an experiment with an incomplete block design, the ratio ρ of the inter block variance to the intra-block variance plays an important role. When ρ is unknown C. R. Rao, following an earlier work of F. Yates, suggested the use of an estimate $\hat{\rho}$ which depends on the adjusted block sum of squares in the analysis of variance. In (P4) two alternative estimators of ρ are put forth. One is the maximum likelihood estimate, which has to be evaluated by an iterative procedure. The other is an unbiased estimator, based on two quadratic forms which are respectively the estimators of the inter and intra-block variances, optimum in a certain sense. It is shown that the use of certain estimators $\hat{\rho}$ instead of ρ in the estimation of treatment effect from both intra and inter-block contrasts does not affect the unbiasedness of the estimators. There is, however, some increase in the variance of the estimates of the treatment effects and an approximate expression is obtained for this increase.

B. APPLIED RESEARCH

Biometric Unit

S. K. Roy continued statistical investigation of factors influencing the yield of rice. The favourable interaction of two varieties (38 BK BR7 and 298-2A BR8) was not so marked as in the previous year, but still positive and significant. Other favourable interactions have been found, but are as yet less significant. The second crop from *aus* (autumn) varieties harvested by cutting halfway up the stem varied greatly in different varieties. In some it reached 30% of the first crop obtained six weeks earlier. He investigated the interaction between two barley varieties in water culture and in the field, and established the existence of an active substance in the root exudates. He also showed that these two varieties differ in their root systems. He discovered the existence of a water soluble substance in clover seeds stimulating growth of a grass in small concentrations and inhibiting it in large ones, also a water-soluble substance in 18 month old rice which inhibits the germination of new seed. This work opens up a new field of plant physiology.

K. R. Dronamraju continued his work at the Institute on floral dimorphism and (with H. Spurway) on choice of flowers by insects. With Meera Khan in Andhra Pradesh, he collected data on the frequencies of the blood groups and of colour-blindness. The B gene is significantly more common among Muslims than among others. At the suggestion of H. Matis, he collected three pedigrees of hairy ear margins, proving the holandric inheritance of this character, which had been disputed for fifty years. He compared the frequency of this character in different populations, including Indian tribal peoples. The highest frequency of 37% occurs in Ceylon. With Meera Khan he collected data on 2,217 marriages in Andhra Pradesh. 7% were of uncles and nieces, 16% of first cousins. This is the highest intensity of inbreeding recorded except in small islands. The coefficient of inbreeding of patients with pulmonary tuberculosis is twice that in all other hospital patients, and the excess is highly significant.

S. D. Jayakar and J. B. S. Haldane began a statistical analysis of these results. They made the first exhaustive classification of simple human relationships. Thus there are 48 distinguishable relationships between a man and a woman who is his first cousin. The test of significance developed for use in the case of pulmonary tuberculosis involves a new theory of sampling from a finite population.

T. A. Davis, who joined the Institute in May 1960 studied the asymmetry (right or left-handed leaf spiral) of 3,028 coconut palms. The frequency of left-handed spirals is $52.05 \pm 0.45\%$, and different populations do not differ significantly. The character is not inherited, a unique fact so far. He has now conclusive evidence that the roots of many species of palms produce very high pressures, upto 12.5 metres of water, while the suction of the trunk is less than 1 metre. In this respect palms differ completely from dicotyledons and gymnosperms. Davis' research on the splitting of palm seedlings with a view to clonal reproduction is going forward. Unfortunately two shoots induced from an arecanut seedling died during the winter. Davis has been responsible for founding a "Crop museum" in which over 80 species of plants economically important in India have been grown. This is regularly demonstrated to the students, but it is also useful to foreign visitors who wish to acquire some knowledge of Indian agriculture and horticulture.

In November 1960, Davis served on a Technical Sub-committee of the Indian Central Arecanut Committee. After studying the condition of these palms in Kerala, Maharashtra, and Mysore, the committee made recommendations on the "micro-nutrient aspects of the coconut and areca palms."

H. Spurway collected data on the spot pattern of 704 caterpillars (tassar silk-worms) of *Atheraea mylitta*. There are 4040 possible patterns, but only 80 were realized. S. D. Jayakar found that two orthogonal factors accounted for 80% of the variance. She has successfully reared several families of *Atheraea mylitta* and continued her statistical studies of the times of emergence of moths. The Societa' Italiana di Genetica Agraria asked her for a paper on the biometry of the two types of cocoon in this species, which differ both biologically and in their economic value, which is now in press (with Dronamraju as joint author). The life tables of *Lebistes reticulatus* are now almost completed. She also continued her work on sexual cycles in this fish, with the aid of M. M. Mukherjee, adding very substantially to the work done in London, which was the first demonstration of a monthly cycle in female fish. With help from Dronamraju, Spurway made the first nearly complete study of the building of a solitary wasp's nest. 948 visits were timed and classified according to the work performed (e.g., building a tube for the larva, giving it food, making a lid). Statistical analysis is showing large differences between the mean times needed for skilled and unskilled operations.

M. M. Mukherjee studied variation in segment number in eight millipede species. If the number is 19-21 it does not vary. If it is about 50, it is variable, but the coefficient of variation may be as small as 1%, which is very low for biological material.

J. B. S. Haldane carried out an analysis of J. S. Haldane's biometrical data on human physiology, and with S. D. Jayakar, those of Lord Avebury on ant and wasp behaviour. He produced an accurate estimate of the "cost" of natural selection, and a preliminary theory of evolution under selection of slowly changing intensity.

Psychometric Unit

Occupational and Educational Selection. The Medical College Selection Programme (for Vellore and Ludhiana Christian Medical College) was continued and a revised version of this test battery was completed for use in 1961. The unit assisted RTS in the selection of trainees for the M. Stat., B. Stat., LARS (First and Second Year), Short-term (Senior and Junior), Computers courses and also in the selection of the research scholars. The revision of these selection batteries were completed on the basis of extensive analysis of

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the past data. The selection of students for Librarian training course of the Bengal Library Association was continued and the selection battery was modified with the inclusion of several new tests. College Entrance Examinations, Graduate Record Examination, Law College and Medical College Admission tests, etc. were conducted on behalf of the Educational Testing Service, Princeton, USA. Tests were also developed, administered and scored for the selection of apprentice for the Development Workshop. Interview rating forms were developed, used and analysed in connection with the selection of technical persons for the Geological Survey Unit.

Educational Selection Assessment : Studies were reported on the relation between inventorial interest and later achievement of college students. Several personality inventories were developed and revised to make them suitable for future use. Work is also being done towards the development of a Differential Aptitude Test Battery for helping the allocation of students to the Science and Arts courses.

Psychometric Tests and Analysis : The construction and validation of Chatterji's Preference Record—a Non-verbal instrument for measuring the interests in eight broad fields was completed.

A table was constructed for estimation of Daw's Discrimination index when the group is split at the median for purposes of item analysis.

Sociological Research Unit

Changes in Family Structures—Urban/Rural—in West Bengal : This scheme of research, sponsored by the Research Programmes Committee of the Planning Commission, Government of India, was the main task of the Unit during the period of reference. The field work has been completed. Data were collected by the Union Research Assistants of the Unit (two cultural anthropologists, two social psychologists, and one historian) from the cities of Calcutta and Howrah, from 4 sampled towns, and from 21 sampled villages of West Bengal. The scheme of analysis of the data is under preparation at the Headquarters while a few preliminary tabulations have been started.

Attitude to Caste Hierarchy in West Bengal : As a by-product to the study of family structure in West Bengal, data were collected to indicate variations in the attitude to the caste hierarchy among the people of West Bengal classified by domicile and socio-economic stratification.

Exploratory Studies in Motivational and Communications Aspects of Family Planning : Two areas were selected for this study; one within a distance of 20 miles from Giridih township in the District of Hazaribagh, Bihar and the other in the northern part of West Bengal comprising the districts of Darjeeling (Siliguri area), Malda, West Dinajpur and partly also of Birbhum and Jalpaiguri. The existing Family Planning Centres were visited as well as the situation in some villages and towns was observed in this context. The investigations elicited some information regarding the usefulness of introducing Action Programme Centres for family planning in urban/rural/tribal sectors of society. Two working papers have been prepared in this context.

Levels of Integrations in Rural Societies : The objective of this study is to obtain some preliminary information relating to the relative importance of family/household/kinship/caste/religion/village/neighbourhood/region in the life and living of the rural people;

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so that eventually the facets of social organization which need primary attention for planning rural societies may be brought to light. Eighteen villages from all those falling within a radial distance of 10 miles from Giridih township were selected at random on relevant sociological and statistical considerations; and in these villages all the households as well as a number of sampled individuals from different social strata were intensively surveyed in order to obtain data in this context with respect to the individual life-cycle of the people and their daily life. Field work has already been completed in 9 villages, and is in progress in the remaining ones. This scheme of research is still in progress.

Urbanization of Villages around Giridih Township : This study, reported last year, is in progress; the investigators visiting the villages at the radial distance of 10-20 miles from Giridih town.

Structural Analysis of the Growth of Township at Durgapur : Further analysis on the sociological implications of the survey data is in progress, and is likely to be completed before the end of the calendar year. A draft report has been prepared.

Pilot studies on the different aspects of social life in the areas under operation, have also been taken up.

Demography Unit

Follow-up Study of In-patients in Maternity Wards : About 500 women who were delivered at the maternity wards were followed up for a study of the post-natal maternal health and the development and survival of infants. The field work and primary tabulations have been completed—final analysis is in progress.

A Study of Mortality Pattern in Calcutta City : This is a pilot survey, the object of which is to obtain age-specific death rates of the residential population of Calcutta City. The frame of reference is the death register and appropriate exposures were obtained through a control sample. The field work and primary tabulation have been completed. A paper on validity of cause of death statistics has been prepared and submitted for publication.

Regional Survey Unit

The Regional Survey Unit was engaged in the study of macro-regional survey of South India with a view to study the distributional patterns and problems of resource use which will provide a basis for the formulation of regional development plan for South India. Studies of natural regions, crop regions, patterns of industrial development and population distribution and growth were conducted. Improved cartographic techniques were designed to prepare synthetic maps and applied to different area levels of mapping. Application of statistical methods to geographical analysis and regional breakdown of national targets and estimates is being tried. All-India studies relating to power, coal and heavy industries are in progress.

Delimitation of planning regions, metropolitan regions, and future spatial pattern of urban development are some of the aspects on which the unit is trying to develop a method of approach.

V. L. S. Prakasa Rao prepared a report on regional planning and a note on regional concept based on his study tour of the UK, Continent and USSR during October 1959 to March 1960. The report has been circulated.

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In view of the magnitude and scope of work at all-India level in the context of regional/area planning, the Unit was transferred to Delhi in December 1960 to work with the Perspective Planning Division of the Planning Commission.

Geological Studies Unit

The Unit continued its programme of investigations in the Godavari-Pranhita Valley, the scope of which has been considerably widened. It has been proved impossible to divorce the study of fossil vertebrate faunas from the study of the Gondwana group of rocks in which they are found, for these rocks provide a history of the climate, topography and earth-movements, etc. of the time at which the animals lived. The Gondwana group of rocks cannot themselves be understood without broadening the field of investigations to include the more ancient pre-cambrian rocks surrounding and underlying them.

The discovery of numerous surface fragments of a large dinosaur in 1958-59 required the mounting of a special expedition for its excavation. The expedition was mainly financed and organized by the Indian Statistical Institute. The Royal Society of London sanctioned a grant of £1200 to purchase certain equipment for the expedition which are not available in India.

Excavations by Dr. Pamela Robinson of the University College, London, and S. L. Jain, Tapan Roy Choudhury, T. S. Kally and D. K. Rudra of Indian Statistical Institute, have revealed a very rich fossil bone deposit. The importance of the discovery is partly national and partly international. It provides India with the first really good remains of four large dinosaurs and the world with a "missing link" in the knowledge of dinosaur evolution. About ten tons of large bones have been excavated and the Unit has now begun to clean and study them. The fossil-bearing site has been leased by the Institute for future programme of field excavation. A small museum is being organized by S. L. Jain, curator-in-charge, for the display of a small selection of the Unit's fossil discoveries and geological work.

A planned programme using several geological approaches to the study of the Godavari-Pranhita region has been initiated with the help of Dr. Alec Smith of the University College, London. An attempt is being made to interpret from the rock record the history of conditions of sedimentation, past topography, climate and earth-movements in the region.

A second geological approach is being initiated by Binulendu Roy-Chaudhuri, now in charge of the Geological Studies Unit. He is studying the more ancient pre-cambrian rocks which frame and underlie the fossil-bearing Gondwana sediments and will contribute a study of their structure tectonics and petrogenesis. He is also planning to obtain some geochronological data on these pre-cambrian rocks.

Data needing elementary statistical evaluation are already being collected in relation to the direction of movement of an ancient ice sheet, in demonstrating an unconformity within the Gondwana group of rocks, in measuring the direction of flow of the ancient rivers of Gondwana times and in differentiating species within a genus of ancient fossil fishes.

S. L. Jain continued work on the Kota fishes. He spent a fortnight in the field early in 1960 collecting fossil fishes.

Tapau Roy Chowdhury completed reconstruction of a new amphibian skull and is continuing work on the other remains of the same animal.

Sudhir Basumallick is studying the nature and genesis of concretion in three major suites of sandstone, i.e., arkose, orthoquartzite and graywacke with a view to find out the essential differences in cementation mechanism between the various suites and their significance in relation to the sedimentary environment.

Tharavath Sankaran Kutty a trainee in the I.T.S., took part in the Unit's 1960-61 field expedition and showed a keen interest and aptitude for paleontological and geological work. He will help in extending the statistical side of the Unit's work and the Unit is particularly happy to record this example of the breakdown of barriers between scientific subjects which is so much a part of the Institute's aims.

Flood Research Unit

During the year 1960-61, the Flood Research Unit carried on its activities under the guidance of Dr. N. K. Bose, Head of the Unit, with the staff consisting of A. K. Sinha, Statistician, and four computers. The number of computers in the Unit was increased from 2 in 1959-60 to 4 in 1960-61, because of the large volume of data the Unit had to collect from various sources. However, from January 16, 1961, the Institute placed the whole unit at the disposal of Metropolitan Water Supply and Drainage Board, Government of West Bengal, for the determination of surface water potential with adequate hydrology and quality data in connection with the preparation of a Master Plan for Water Supply, sewerage and drainage of Greater Calcutta area. G. M. Naidu joined the unit as Statistical Assistant to help in this work.

During the current year, the Unit took up a number of important studies and problems relating to the various river-systems in Bengal. In the selection of these problems, priority was, however, given to those of the river Ajoy because of the importance of this river in determining the conditions of navigability of the river Hooghly, and also because very little is known about the hydrological condition of the river. A summary is given of these studies:

(i) *Stage-Discharge Relationship of the River Ajoy at Natunhat*: The present analysis reveals that the 'river level and discharge of the 'Ajoy' at Natunhat are, perhaps related to each other in the following manner:

$$\log Q = a + b \log (H - 50.7) \text{ for } 59 \geq H \geq 50.7$$

$$Q = A + BH + C'H^2 + DH^3 \text{ for } H \geq 59$$

where *a*, *b*, *A*, *B*, *C* and *D* are constants

Q, river discharge in cusecs
and *H*, river level in feet.

(ii) *Regeneration of the Discharge of a River between Two sites "X" and "Y" during the Dry Months*: This study based on the analysis of only low water discharge records for January 1960 to May 15, 1960, was made with a view to study the correlation between the said 'regeneration of the river and the river level at the upstream point "X"'

(iii) *Trend in the Low-water Level of the River Ganga*: This study is confined to the period 1873-1904 and is based on the daily river gauges during the dry months at seven sites, i.e.: Mirzapore, Banaras, Buxar, Dimpore, Monghyr, Sukhigung, and Rampur Boalia. The work is in progress.

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(iv) *Synchronisation of Storms over the 'Damodar' and the 'Ajay' Catchments*: This study, as mentioned in the 1959-60 report, is based on only those years which witnessed severe floods and is being continued.

(v) *Estimation of Daily run-off in the Ajay of Natunhat*: The data used are the daily rainfall in the catchment area and the daily run-off during such periods (July 8 to July 16; July 27 to August 1; August 2 to August 8; October 22 to October 27) in 1959 when the run-off attained certain peak values.

Besides the above studies, a statistical note on the method of "observation and estimation of river discharge by current meter" was prepared by A. K. Sinha.

Anthropometric Studies: Mahalanobis study of scrutiny of Risley's data relating to Tribes and Castes of Bengal and of Chittagong Hills was extended by Arun Kanti Bhattacharyya to Risley's data for Darjeeling Hill tribes; it is concluded that the data can be used with safety after using the corrections given in the paper.

PLANNING DIVISION*

Inter-Industry Studies: The draft report on the Inter-Industry Table (1953-54) has been completed and is now being revised in the light of the comments received from the Inter-Industry Committee. On the basis of the Inter-Industry table for 1953-54, the structure of the Indian economy was analysed in some detail, using the inversion of a 30 x 30 matrix which was done by the Electronic Computer Division of the Institute. A critical examination of the Inter-Industry table relating to the year 1953-54 was undertaken for the use of the Second Expert Group on Programming Techniques under the auspices of the ECAFE. An Inter-Industry table for the year 1955-56 was prepared and submitted to the Planning Commission. This table relates to the concluding year of the First Five Year Plan and provides a useful base with which the future performance of the economy can be analysed (16). The work in progress in the Inter-Industry unit consists in the finalisation of an Inter-Industry table for 1954-55 and a partial Inter-Industry table relating to industries (inclusive of minerals) for the years 1953 and 1954.

The cost structure of rural transport was analysed in a paper on the basis of data available from the NSS enterprise schedules.

Studies on Consumer Behaviour: Using available data on quantity and value of consumption, some special forms of demand functions were developed explaining quantity of consumption in terms of total household expenditure and average price paid for the commodity. Some interesting aspects of rural and urban consumer behaviour derived from the demand relationships.

Detailed investigations were made into the changes in the pattern of distribution of persons by monthly per capita total consumer expenditure over the NSS rounds using various measures of inequality including the well-known Lorenz ratio, covering approximately a period of eight years which roughly corresponds to the first eight years of the two five-year plans taken together; the results were reported to the Committee on Distribution of Income and Wealth, recently set up by the Government of India.

Certain detailed tabulation of consumer expenditure data were taken up by the Division at the instance of Professor H. Lydall of the MIT Centre, New Delhi. Some tabulation was also started on important items of the NSS consumption schedule based on a

* A list of papers is given in Appendix 5, ii to 5, 8

TWENTYNINTH ANNUAL REPORT : 1960-61

part of thirteenth round (rural) material. Work was also started on the possibility of constructing cost of living indices of all-India coverage, for various economic levels, from NSS data, and on the level of consumption of cereals in rural areas of West Bengal and Bihar.

A technical study of the effect of differentials in cost of living index on the Lorenz measure of inequality was recently concluded, and three papers of N. S. Tyengar were published in important scientific journals.

Other Econometric Studies: A study was made of the effect of prices of selected crops on the demand for wheat in India (2). A sector model has been used to derive forecasts of demand for coal by the end of the Third Five-Year Plan period, but the results are still extremely tentative.

A macro-economic model for India with explicit consideration of production and consumption was used to study the effects of wages, population, investment, taxation, etc. upon the economy.

National Income and Allied Topics: At the International Conference on Income and Wealth held at Hongkong during August 1960, M. Mukherjee read a paper on a preliminary study of the growth of national income in India during the period 1957-1957 and H. Mazumdar presented a paper on the financing of Indian capital formation.

The Second Indian Conference on Research in National Income was held in New Delhi during September 1960. Of the twenty papers discussed at this conference six were contributed by the workers of the Planning Division. A. K. Chakravarti contributed a paper on analysis of demand for wheat in British India during the period 1924-25 to 1941-42; and A. K. Biswas and D. K. Bose presented a paper on consumption projections of selected items over the period of Third Five Year Plan. M. Mukherjee reviewed series estimates of national income in India for the period 1900 to 1958; and in another paper G. N. Chatterjee and Mira Sinha made a review of the national estimates of India for the years 1944-45 to 1947-48. M. Mukherjee discussed in another paper the available estimates of the breakdown of national income by distributive shares in India. The sixth paper dealt with certain sectors of national income, namely, financial intermediaries by T. Piplai, road transport by A. K. Chakravarti and S. B. Pande, mining by B. Dey and A. Sanyal, and cotton industry by R. K. Lahiri and N. Chattopadhyaya (12). Some work was also done on per capita contribution to national income from professions and liberal arts, domestic service, the trading sector, and small-scale industries on the basis of NSS and other data.

Compilation of a bibliography on national income was started during the year under review and some progress was made in this direction.

Types Studies: A survey of blacksmiths in Calcutta, Howrah, 24-Parganas, Malda, West Dinajpur, Siliguri, Darjeeling, Jalpaiguri and Midnapore was undertaken with the help of the field unit attached to the Planning Division, and tabulation of data has started. A survey, in collaboration with the NSS, was also taken up on factors affecting generation and movement of the market surplus of foodgrains and the field work is in progress. A survey on the income and some other aspects of employment of domestic servants in Calcutta was completed during the year under review. A study was made of the economic progress

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taking place in the community block areas on the basis of a small-scale field survey. Two surveys were conducted as part of a study on alternative techniques in the production of agricultural implements and mustard oil.

Miscellaneous Studies: A paper was produced on inventory holding by manufacturers in India and the United States and another on the pattern for optimum plant utilization in India.

The economy of the Indian livestock in relation to raw and milk yield was discussed in two working papers (8, 9) while two others were devoted to the production, availability and requirement of milk in India including the factors affecting the same. The efficiency of plough animals was investigated in another paper.

A note on labour share in manufacturing industries (1947-48) and another preliminary note on concentration of income on the basis of Income Tax Revenue statistics for the years 1950-51, 1953-54 and 1957-58 were prepared during the year under review.

An analysis has been undertaken in collaboration with the NSS on the dietary levels of households in India based on NSS data and covering all the principal nutrients present in the different items of food under Indian conditions.

Estimates of population for the period 1800 to 1870, agricultural growth for the period 1830 to 1900, growth of Indian cotton textile industry for the period 1850-1900 and growth of coal mining in India for the period 1850 to 1960 were the subjects under investigation by a group on economic history. A study of the changes in the regional patterns of agriculture and industry during the last ten years is in progress.

NATIONAL SAMPLE SURVEY

RESEARCH AND OTHER STUDIES

Sampling Studies: In a large-scale survey, where a non-self-weighting design is used, the work at the tabulation stage becomes time-consuming and costly due to a large number of multipliers (inflation factors) involved in obtaining the estimates. M. N. Murthy and V. K. Sethi developed a technique to substitute the multipliers by a very small number of multipliers called "randomized rounded-off multipliers" by a suitable randomizing process, thereby reducing the work at the tabulation stage. A suitable procedure has been suggested for determining the values of the randomized rounded-off multipliers which would minimize the increase in the variance of the estimates.

In a monograph entitled "The work of the United States Bureau of the Census with emphasis on sample designs and control of errors in censuses and surveys," M. N. Murthy has presented the work of the United States Bureau of the Census with emphasis on the methodological aspects of the sample designs and techniques of assessing and controlling of errors in their censuses and surveys. It consists of 14 chapters ranging from the organization and functions of the Bureau of the Census to the techniques of controlling errors and the use of data processing electronic equipment in census and survey work. The sampling design of the current population survey, which is an important monthly survey conducted by the Bureau, is described in detail. The procedure adopted in the 1960 United States Census of Population and Housing has been discussed with emphasis on the various

techniques being used in evaluating and controlling the quality of the census data. In the chapter on non-sampling errors the results of some of the evaluation studies conducted by the Bureau of the Census are given to illustrate the methodology used.

M. N. Murthy has studied the efficiencies of short-cut methods of estimating variance and confidence interval. It is shown that the loss of efficiency in estimating the variance and confidence interval on the basis of independent interpenetrating sub-samples decreases more rapidly for initial increases in the number of sub-samples than for further increases. The estimator of variance built up from strata sub-sample estimates is formally shown to be more efficient than that based on the sub-sample estimates pooled over strata without any assumptions.

Population Studies : Studies on sampling and non-sampling errors and biases (including recall lapse) in estimating vital rates, continued on the basis of NSS data by R. K. Som, A. K. De, N. C. Das, H. L. Mukherjee and S. M. U. Sarma. A paper on analysis of variance of demographic variables from NSS ninth round data was prepared by R. K. Som and H. L. Mukherjee which showed that the survey was generally under statistical control. R. K. Som investigated the use of IPNS in demographic studies on the basis of NSN and other materials in (a) examining the investigator bias and finding the sampling error by the analysis of variance; (b) supplying margins of uncertainty, not only of the principal variates (aggregates, means, etc.) but also of the derived functions (rates, ratios, percentages, population projections, parameters of the "recall curve", etc.); (c) giving an "error area" for a curve and the "separation" of the curves for two sectors or time periods by the method of fractile graphical analysis; and (d) providing control in collection, processing and statistical analysis; (e) supplying advanced estimates on the basis of part-samples.

The population trends and problems in India were studied by R. K. Som. With an almost stationary birth rate and steadily declining death rate, the rate of natural increase of population in India was seen to be very rapid in the recent decade. The general under-utilization of manpower, with shortage at peak periods of agricultural activities, was also revealed.

R. K. Som and S. Sengupta prepared a paper dealing with the data on the survey on opinion of optimum number of children and attitude towards family planning in West Bengal conducted by the Institute in 1954. The responses were studied by religion, occupation, per capita monthly expenditure and education differentials.

The relationship of household size with household expenditure was studied by S. S. Bose and R. K. Som on the basis of NSS twelfth round data.

A. Ganguly and N. C. Das studied the progress of literacy in West Bengal from the data of the West Bengal Household Comparative Study conducted by the Institute in 1955; the rate of increase in rural literacy in West Bengal was seen to be about 1 per cent per year.

R. K. Som studied the response errors in the economic classification of population from NSN sixth to thirteenth rounds and the characteristics of the agricultural labour as revealed by the NSS.

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A methodological study was initiated in three urban areas and five villages by N. C. Das and R. K. Som to test the effects of different probes and definitions, recall periods, and proxy interviews on morbidity rates.

Consumer Expenditure and Income Studies: J. K. Aikat conducted a methodological study on consumption of cereals in three urban areas and three villages to determine the optimum reference period for collection of data by personal interviews. The consumptions of cereals by the sample households were recorded by actual weighing, also by the interview method, the latter for different reference periods.

The study on reference period in family budget enquiries was undertaken by D. K. Dutta Majumdar as a follow up of Mahalanobis and Sen (1954) based on the data of NSS fourth and fifth rounds and those of a Special Survey in West Bengal. The results show that the estimates with month reference period are more precise (in respect of sample errors) and less subject to bias than the estimates with week reference period; the latter were significantly different from the former.

The extent of real income differences between rural and urban areas of India was estimated by G. D. Rao on the basis of NSS price and consumer expenditure data of fifth-ninth rounds. Two types of price differential indices were obtained as a ratio of weighted average of urban prices to weighted average of rural prices, the weights being the rural consumption expenditure figures for the first type and urban consumption expenditure figures for the second type. Then as an approximation to the real price differential index geometric mean of these two types of indices was obtained. These price differential indices were then used as deflators to derive the indices of real income differences, real consumption expenditure differences and finally the real wage-earning difference between rural and urban areas.

Fractile Graphical Analysis: Mahalanobis' technique of fractile graphical analysis was continued to be applied on NSS household consumer expenditure data, where the consumer expenditure per person per month was the classificatory item.

Crop-Cutting Experiments: A methodological study was conducted jointly by the NSS, States and ISI under the auspices of the CSO, in a group of villages in Rajasthan and Bihar to test the differences in the estimates of yield rates of jowar and wheat respectively with rectangular cuts of size $33' \times 16\frac{1}{2}'$ and circular cuts of radius $4'$; the results (confirmed by the complete harvesting of a number of sample fields in Bihar) indicated that under adequate supervision, the rates from the two types of cuts were not significantly different.

Growth Models: The different approaches to, and models of, economic growth were studied by P. Maitra in the context of problems of growth of the under-developed economies.

Miscellaneous Studies: The problems of marketable surplus in Indian agriculture were studied by P. Maitra on the basis of the NSS data and the findings of the Agro-Economic Research Centre, Santiniketan. The possible amount of marketable surplus and the actual marketed supply were estimated, the latter being found less than the former.

The problems of growth, rate of production, trends of the amount of capital and labour invested in different industries, trends of wages and profits, problems of excess capacity and the problems of capitalist concentration in some of the industries, (both basic and consumer goods) were studied by P. Maitra on the basis of CMI, SMMI and other materials.

REPORT BY MESSRS. LOVELOCK & LEWES
CHARTERED ACCOUNTANTS

LOVELOCK & LEWES
Chartered Accountants

Post Box No. 900
4, Lyons Range, Calcutta-1.

In your reply please
refer to No. AKM/PN/948

AUDITORS' REPORT TO THE CHAIRMAN
AND THE MEMBERS OF THE INDIAN STATISTICAL INSTITUTE

We have examined the Receipts and Payments Accounts in respect of Current Expenditure, Capital Accounts and the Subsidiary Fund Accounts of the Indian Statistical Institute for the year ended 31st March, 1961, with the books and records maintained by the Institute and subject to the following remark, have found them to be in accordance therewith :—

"The sanction from the Central Government was not available in respect of the sale of Station Wagon in terms of condition 2(i) laid down in their letter No. 17/1/59-Estt. III dated 29-4-1961".

Calcutta,
20th October 1961

Sd/. LOVELOCK & LEWES
Chartered Accountants

INDIAN STATISTICAL INSTITUTE

Indian Statistical Institute : Receipts and Payments Accounts

<i>To Receipts</i>		Rs.	nP.	Rs.	nP.
1. Opening Balances :					
i) Cash in hand and at Banks with Central Office	...	30,002.39			
ii) With branches and sub-offices	... ..	36,422.45			
iii) Unadjusted suspense of 1958-60	... ..	78,387.13			
iv) Loans unrecovered from staff for educational and house building purposes, etc. as per last account	... ..	40,236.61			
v) Security deposits	... ..	3,938.04		1,86,877.52	
<hr/>					
2. Membership subscriptions	... ..			5,902.08	
3. Fees for training courses and sale proceeds of syllabus, etc.	... ..			30,861.46	
4. Amount received for Scoring and tabulation work done by the Psychometry Unit for Christian Medical College, Vellore	... ..			3,926.32	
5. Tuition fees for language classes	... ..			320.00	
6. Examination fees and other receipts	... ..			15,543.50	
7. Receipts from produce at Giridih Experimental Farm	... ..			2,703.24	
8. S.Q.C. Receipts from non-Government sources :					
i) Membership fees	... ..	72,300.00			
ii) Training fees, etc.	... ..	35,884.60			
iii) Service charges	... ..	1,06,807.50		2,14,092.10	
<hr/>					
9. Receipts for work done by Electronics, Workshop Division	... ..			80,823.01	
10. Fees for symposium on Operational Research	... ..			4,400.00	
11. Block grant from Government of India for non-project sectors	... ..			24,50,000.00	
12. Contract payment by Government of India for					
A. National Sample Surveys & Integrated activities sector :					
i) Paid directly to the Institute	... ..	48,00,000.00			
ii) Paid through Army Statistical Organisation	... ..	73,600.00		48,73,500.00	
<hr/>					
B. Urban Frame Collection Survey : On account payment received from Government of India	... ..			65,800.00	
<hr/>					
13. Amount received as sale proceeds of Institute's own publications	... ..			2,431.25	
14. Amount received from Delhi School of Social work for some tabulation work	... ..			600.00	
<hr/>					
15. Sub-total of items 2-14 (for current projects and sectors)	... ..			Rs. 77,31,603.95	

TWENTYNINTH ANNUAL REPORT : 1960-61

(current expenditure) for the year ending 31st March 1961

		<i>By Payments</i>			
		Rs.	nP.	Rs.	nP.
1.	i) Salary, dearness allowances, honoraria	49,04,296.54			
	ii) Employer's contribution for workers Provident Fund (outstanding liability as per contra)	2,88,899.82			
	iii) Overtime Allowances	1,89,732.70		63,82,928.18	
2.	Contribution to Leave Salary Fund			74,160.97	
3.	Contribution to Gratuity Fund			1,73,339.95	
4.	Travelling expenses			2,28,532.30	
5.	i) Visiting Professors & Scientists for RTS Sector	50,000.00			
	ii) Visiting Professors, fellows, foreign experts and scientists, etc. for other sectors	65,362.80		1,15,362.80	
6.	i) Scholarships, stipends, etc. to trainees of the Research and Training School	2,00,000.00			
	ii) Fellowship allowances and other assistance to INREC non-Colombo Plan trainees	8,169.96		2,08,169.96	
7.	Prizes to workers for initiatives, etc.			10,075.00	
8.	Ex-gratia payment			1,20,886.47	
9.	Machine Tabulation expenses :				
	a) Hire and maintenance of tabulating equipment, Key punches and verifiers including freight, transport and other charges	8,09,809.04			
	b) Cost of cards and cabinets etc.	1,99,489.82			
	c) Payments to Army Statistical Organisation direct by Government of India as per contra	73,500.00		10,82,798.86	
10.	Printing and publication (including paper for printing)			1,48,097.58	
11.	Society type activities			28,253.80	
12.	Examination expenses			21,876.23	
13.	Books and Journals (including cost of binding, etc.)			1,64,100.24	
14.	Remittance to translation unit set up in Japan			60,041.00	
15.	Microfilm and photo expenses			13,018.52	
16.	Laboratory & Workshop stores, tools & minor accessories			1,05,381.40	
17.	Repairs, maintenance and replacement of machinery, equipment, accessories, furniture and fittings etc.			87,608.05	
18.	Stationeries and consumable stores			1,36,075.84	
19.	Audit fee and expenses :				
	i) Lovelock & Lorne	13,319.52			
	ii) P. C. Nandi & Co.	4,000.00		17,319.52	
20.	Electricity, telephons, postage including M.O. commission, postal freight etc.			1,91,482.83	
21.	Other miscellaneous expenses, viz., advertisement, law, bank charges and interest, conveyance, hot weather contingencies, etc.			1,11,521.28	
22.	Rent, rates and taxes (including those of field, camp and out-station premises and Rs. 54,067/- transferred to capital expenditure account being the rent of Institute's own premises)			2,19,627.41	
23.	Repairs and Maintenance of land and buildings including petty construction			1,04,038.05	
24.	Transport			87,394.07	
25.	Workers' welfare and amenities			1,23,252.16	
26.	Development at Director's discretion			18,890.43	
27.	Materials and other charges for experimental farming at Girdih			3,668.55	
28.	Sub-total of items 1-27 (for current projects and sectors)			Rs. 90,18,952.30	

INDIAN STATISTICAL INSTITUTE

Indian Statistical Institute : Receipts and Payments Accounts

		<i>To Receipts</i>			
		Rs.	nP.	Rs.	nP.
16.	Balance of the Ford Foundation grant held in deposit account with American Express Co., Inc. as per last account ...			1,05,802.32	
17.	Arrear dues received from the Government of India, Ministry of Finance in reimbursement of disbursements to the trainees of the ISEC under the Technical Co-operation Scheme, Colombo Plan for the 13th Session ...			65,417.47	
18.	Arrear dues received from Government of India :				
	i) Director of Health Services for Demographic Studies ...	43,587.00			
	ii) Research Programme Committee of the Planning Commission for sociological studies ...		6,200.00		
	iii) For NSS & allied activities of 1959-60 ...		3,43,000.00		
	iv) For additional NSS Tabulation work (under slab) ...	78,000.00		4,70,787.00	
19.	Miscellaneous receipts : viz., sale proceeds of waste paper, cards, etc. ...			5,402.20	
20.	Sundry deposits payable (at close of the year) ...			44,518.02	
21.	Outstanding liabilities for payment :				
	i) of Employer's share of contribution to ISI General Provident Fund for 1960-61 ...	2,88,899.02			
	ii) to Leave salary fund—				
	as per last account ...	21,400.00			
	add during the year ...	74,150.97		95,550.97	
	iii) to Gratuity fund—				
	as per last account ...	1,48,104.00			
	add during the year ...	1,73,330.95		3,21,503.95	7,05,954.84
22.	Outstanding liabilities for goods and services ...			58,689.20	
23.	Overdraft from State Bank of India, Shambazar (against transfer of proportionate amount of securities from Safe-custody Account of overdraft account) ...			8,62,883.96	
24.	Sub-total of items 16-23... ..			Rs. 23,10,455.70	
25.	Grand Total of items 1, 16 & 24			Rs. 1,02,38,047.17	

TWENTYNINTH ANNUAL REPORT : 1960-61

(current expenditure) for the year ending 31st March 1961

		<i>By Payments</i>			
		Rs.	nP.	Rs.	nP.
20.	Expenditure incurred against Ford Foundation grant for staff training abroad, etc.			48,740.48	
30.	Disbursement of fellowship allowances to IBEC trainees under Colombo Plan			1,03,071.86	
31.	Repayment of loan to :				
	i) Provident Fund	1,75,000.00			
	ii) Supervision Fee Fund	7,000.00		1,82,000.00	
32.	Outstanding liabilities for payment of employer's contribution (incorporation of balances as per last account) :				
	i) ISI General Provident Fund	2,46,840.16			
	ii) Leave Salary Fund	21,400.00			
	iii) Gratuity Fund	1,48,104.00		4,16,604.16	
33.	Outstanding liabilities for goods and services (incorporation of balance as per last account)			57,791.00	
34.	Deposit (incorporation of balance as per last account)			39,412.61	
35.	Loan to staff for educational and house building purposes and relief loan, etc. (at the close of the year)			32,073.43	
36.	Purchases of books for RTS and Night School students (pending adjustment)			13,815.05	
37.	Security deposits receivable (at the close of the year)			16,158.94	
38.	Unadjusted advances (at the close of the year) :				
	i) Advance against T.A. and other dues against which bills are awaited for adjustment	1,10,790.26			
	ii) Advances to suppliers, contractors, etc. against goods and services	19,628.71			
	iii) Advances against special projects and experiments	28,767.67			
	iv) Imprest Cash and/or working capital with different departments, sections, units, etc.	29,848.60			
	v) Advances to Visiting Professors	3,641.72			
	vi) Festival and other recoverable advances	7,666.38		2,00,290.24	
39.	Closing Balances :				
	i) Cash in hand and at Banks	59,499.84			
	ii) With Branches and Sub-offices	40,837.10		1,00,336.94	
40.	Sub-total of items 29-39			Rs. 12,10,094.78	
41.	Grand Total of items 28 & 40			Rs. 1,02,38,047.17	

(a) Out of temporary loans amounting to Rs. 8,63,000/- taken from funded accounts for current expenditure remaining unpaid upto 31.3.60, an amount of Rs. 1,82,000/- (item No. 31 of expenditure side) having been repaid during the year under report, the position of outstanding loans as at the close of the year 1960-61 comes as under :

i)	Leave Salary Fund	Rs.	2,45,000.00
ii)	Gratuity Fund		3,18,000.00
iii)	Scholarships, stipends, Visiting Professors & Fellows Fund		31,000.00
iv)	Supervision fee Fund		60,000.00
v)	Development Fund I (created out of savings from Director's salaries, etc.)		27,000.00
		Rs.	8,81,000.00

In terms of our report of even date.

Delimita,
20th October 1961

Sd/- LOVELOCK & LAWES
Chartered Accountants

INDIAN STATISTICAL INSTITUTE

Indian Statistical Institute : Receipts & Payments Account for the year ending 31 March 1961

SCHOLARSHIPS, STIPENDS, VISITING PROFESSORS AND FELLOWS FUND

<i>To Receipts</i>		Rs.	n.P.	Rs.	n.P.
1. Opening balance :					
i) Cash in hand and at Banks	...	718.26			
ii) Advances recoverable from Current Expenditure Account as per last account	...	31,000.00		31,718.26	
2. Amount provided for award of scholarships, stipends, etc. transferred from Current Expenditure Account					
	...			2,00,000.00	
3. Amount provided for Visiting Professors and for Fellows of the Research & Training School and Society Type Activities Sector transferred from Current Expenditure Account					
	...			50,000.00	
				Rs. 2,81,718.26	

<i>By Payments</i>		Rs.	n.P.	Rs.	n.P.
1. Scholarships and stipends awarded during the year :					
i) Scholarship, etc. for research workers	...	47,231.12			
ii) Stipends to students and trainees	...	88,068.37		1,36,189.49	
2. Expenses for Visiting Professors and Fellows from U.S.A., U.K., U.S.S.R., France and several other countries					
	...			70,068.06	
3. Closing balance :					
i) Cash in hand and at Banks	...			34,580.71	
ii) Temporary advances made to Current Expenditure Account as per last account	...			31,000.00	
				Rs. 2,81,718.26	

In token of our report of even date.

Calcutta,
20th October 1961

Sd/- LAURELLOK & LAYTON
Chartered Accountants

TWENTYNINTH ANNUAL REPORT : 1960-61

Indian Statistical Institute : Receipts & Payments Account for the year ending 31 March 1961

LEAVE SALARY FUND						
<i>To Accounts</i>						
			Rs.	nP.	Rs.	nP.
1. Opening balance :						
i)	Cash in hand and at Banks	...	...	...	977.22	
ii) Advances recoverable as per last account from :						
a)	Capital Expenditure Account	...	...	...	5,93,000.00	
b)	Current Expenditure Account	...	...	...	2,45,000.00	8,38,977.22
					Rs.	8,38,977.22

<i>By Payments</i>						
			Rs.	nP.	Rs.	nP.
1. Leave salary paid including payments in lieu of leave ...						
					Rs.	42,805.96
2. Closing balance :						
i)	Cash in hand and at Banks	...	...	...	3,081.26	
ii) Temporary advances made to :						
a) Capital Expenditure Account						
	as per last account	...	...	...	5,93,000.00	
	Less : Amount realised during the year	...	...	...	45,000.00	5,48,000.00
b) Current Expenditure Account						
	as per last account	...	...	...	3,46,000.00	7,96,081.26
					Rs.	8,38,977.22

No transfer to this fund has actually been made though the contributions have been provided as liability in the Current Expenditure Account to be transferred in due course.

As per last account	...	...	Rs.	21,400.00
Add during the year	...	...	...	74,150.07
			Rs.	95,550.07

In terms of our report of even date.

Calcutta,
30th October 1961

Sd/- LOVELOCK & LEWIS
Chartered Accountants

INDIAN STATISTICAL INSTITUTE

Indian Statistical Institute : Receipts & Payments Account for the year ending 31 March 1961

GRATUITY FUND

To Receipts

	Rs.	nP.	Rs.	nP.	Rs.	nP.
1. Opening balance :						
i) Cash in hand and at Banks ... ..	...	...			767.94	
ii) Advances recoverable as per last account from :						
a) Capital Expenditure Account	4,80,000.00					
b) Current Expenditure Account	3,18,000.00		7,98,000.00		7,98,767.94	
					7,98,767.94	

By Payments

	Rs.	nP.	Rs.	nP.	Rs.	nP.
1. Gratuity payments ... ..	...	...			7,274.67	
2. Closing balance :						
i) Cash in hand and at Banks ... ..	...	...			1,493.27	
ii) Temporary advances made to :						
a) Capital Expenditure Account as per last account	4,80,000.00					
Less : Amount realised during the year	8,000.00		4,72,000.00			
b) Current Expenditure Account as per last account ... ..	...	...	3,18,000.00		7,01,493.27	
					7,08,767.94	

No transfer to this fund has actually been made though the contributions have been provided as liability in the Current Expenditure Account to be transferred in due course.

As per last account ... ..	...	...	Rs.	1,48,164.00
Add during the year ... ..	...	...		1,73,330.05
			Rs.	3,21,503.05

In terms of our report of even date.

Calcutta,
20th October 1961

Sd/. LOVELOCK & LEWIS
Chartered Accountants

TWENTYNINTH ANNUAL REPORT : 1960-61

Indian Statistical Institute : Receipts & Payments Account for the year ending 31 March 1961

SUPERVISION FEE FUND

		<i>To Receipts</i>			
		Rs.	nP.	Rs.	nP.
1. Opening balance :					
	i) Cash in hand and at Banks		977.19		
	ii) Advances recoverable from Current Expenditure Account as per last account	67,000.00		67,077.10	
2. Advances recoverable as per last account from :					
	i) Small industries experimental unit run by the Institute	32,916.67			
	ii) Small industries experimental units in villages	3,192.90		36,109.57	
3. Cost of land at Baranagar and Giridih as per last account ...				1,12,218.11	
				Rs.	2,16,304.87
<hr/>					
		<i>By Payments</i>			
		Rs.	nP.	Rs.	nP.
1. Temporary advances to Small industries experimental unit run by the Institute as per last account					
	<i>Add :</i> During the year	32,916.67			
		3,321.60			
		36,238.27			
	<i>Add :</i> Advances as per last account to carry out experiments in village units	3,192.90		39,431.53	
2. Land at Baranagar & Giridih as per last account ...				1,12,218.11	
3. Closing balance :					
	i) Cash in hand and at Banks			4,855.53	
	ii) Temporary advances to Current Expenditure Accounts as per last account	67,000.00			
	<i>Less</i> amount realised during the year	7,000.00		60,000.00	
				Rs.	2,16,304.87

In terms of our report of even date.

Calcutta,
26th October 1961

Sd/- LOYLOCK & LEWIS
Chartered Accountants

INDIAN STATISTICAL INSTITUTE

Indian Statistical Institute : Receipts & Payments Account for the year ending 31 March 1961

Development Fund No. 1

(created out of savings from Director's salary, etc.)

		<i>To Receipts</i>					
		Rs.	n.P.	Rs.	n.P.	Rs.	n.P.
1. Opening balance :							
i)	Cash in hand and at Banks	...	...	731.10			
ii) Advances receivable as per last account from :							
a)	Capital Expenditure Account	81,307.78					
b)	Current Expenditure Account	27,000.00		1,08,307.78		1,00,128.84	
2. Advances outstanding with Statistical Publishing Society as per last account							
						10,303.00	
						Rs. 1,19,521.04	

		<i>By Payments</i>					
		Rs.	n.P.	Rs.	n.P.	Rs.	n.P.
1. Temporary advances made to Statistical Publishing Society as per last account							
		...	...	10,303.00			
<i>Less</i> amount realised during the year				10,303.00		Nil	
2. Closing balance :							
i)	Cash in hand and at Banks	...	...	11,124.16			
ii) Temporary advances made to :							
a)	Capital Expenditure Account as per last account	81,307.78					
b)	Current Expenditure Account as per last account	27,000.00		1,08,307.78		1,19,521.04	
						Rs. 1,19,521.04	

In terms of our report of even date.

Calcutta,
20th October 1961

Sd/- LOVELL & LEWIS
Chartered Accountants

TWENTYNINTH ANNUAL REPORT: 1960-61

Indian Statistical Institute : Receipts & Payments Account for the year ending 31 March 1961

DEVELOPMENT FUND No. II

(created out of Development grant received from Government of India)

<i>To Receipts</i>					
		Rs.	nP.	Rs.	nP.
1. Opening balance :					
i)	Cash in hand and at Banks	...	...	2,702	83
ii)	Advances recoverable from Capital Expenditure Account as per last account	...	...	7,07,000	00
iii)	G.P. Notes at cost (face value Rs. 50,000/-)	...	...	45,533	73
				<u>7,55,235</u>	<u>83</u>
2. Interest received on investment in G.P. Notes					
				1,496	00
				<u>Rs. 7,56,732</u>	<u>83</u>

<i>By Payments</i>					
		Rs.	nP.	Rs.	nP.
1. Expenditure on capital outlays during the year					
<i>(Basis:—)</i>					
i)	Earnest money & law expenses for purchase of				
a)	Romo Villa at Giridih	...	...	1,323	07
b)	Biraja Kutir at Giridih	...	...	937	40
				<u>2,261</u>	<u>46</u>
ii)	Motor Vehicles—2 Ambassador Cars	...	...	27,170	68
				<u>29,441</u>	<u>14</u>
2. Expenditure on capital outlays originally met from Capital Expenditure Account upto 1959-60 and not being intended to be claimed from Government of India now transferred from the Capital Expenditure Account :					
<i>i) Cost of premises and/or constructions at—</i>					
a)	36 Bidyayatan Sarani	...	...	50,000	00
b)	160 Gopal Lal Tagore Road	...	...	1,20,855	00
c)	Health/Homes at Giridih	...	...	12,001	97
d)	181 Students' Hostel	...	...	1,06,548	16
e)	208 B.T. Hostel	...	...	1,383	00
f)	Potty Constructions at Giridih	...	...	12,777	50
				<u>8,12,826</u>	<u>50</u>
ii)	Capitalised rental of 5 (five) telephones on O.Y.T. Scheme	...	...	12,100	00
iii)	Equipment for Internal Telephone	...	...	7,014	23
				<u>3,32,640</u>	<u>82</u>
3. Closing balance :					
i)	Cash in hand and at Banks	...	...	1,80,504	91
ii)	Temporary advances made to Capital Expenditure Account as per last account	...	...	7,07,000	00
	Less: amount realised during the year	...	...	4,97,358	24
				<u>2,00,811</u>	<u>76</u>
iii)	G.P. Notes at cost (face value Rs. 50,000/-)	...	...	45,533	76
				<u>3,04,650</u>	<u>42</u>
				<u>Rs. 7,60,732</u>	<u>83</u>

In terms of our report of even date.

Calcutta,
20th October 1961

Sd/- LOVELL & LAWES
Chartered Accountants

INDIAN STATISTICAL INSTITUTE

Indian Statistical Institute : Receipts & Payments

I.S.I. GENERAL

<i>To Receipts</i>		Rs.	nP.	Rs.	nP.
1. Opening balance :					
i) Cash in hand and at Banks	... ..			5,89,197.08	
ii) G.P. Notes at Cost (Face value Rs. 10,70,000/)	... ..			14,29,359.29	
iii) National Savings Certificate at cost	... ..			1,00,000.00	
iv) Loans outstanding with workers as per last account	... ..			2,78,171.00	
2. Advances outstanding with Institute's Current Expenditure Account as per last account					
	... ..			1,75,000.00	
3. Employer's contribution due to the Fund on account of 1958-60 received from the Institute during the year					
	... ..			2,46,940.16	
4. Workers' Own Subscription to the Fund during the year					
	... ..			2,88,899.92	
5. Employer's contribution to P.F. for the year					
			—	
6. Workers' Voluntary Subscription to the Fund during the year					
	... ..			22,775.90	
7. Interest received during the year against loan given to members					
	... ..			8,168.10	
8. Interest on Investments :					
i) G. P. Notes	... ..	37,291.42			
ii) For loans to the Institute	... ..	1,760.00			
iii) For Institute's liabilities on account of Employer's contribution for 1958-60 repaid during the year	... ..	14,816.40		53,867.82	
				Rs. 31,92,367.27	

In terms of our report of even date.

Calcutta,
20th October 1961

Bd'. LOYLOCK & LEWIS
Chartered Accountants

An amount equivalent to workers' own subscription (item 4 on receipt side) was due to the fund as employer's contribution which however could not be paid due to shortage of funds.

TWENTYNINTH ANNUAL REPORT : 1960-61

Accounts for the year ending 31 March 1964

PROVIDENT FUND

	<i>By Payments</i>			
	Rs.	nP.	Rs.	nP.
1. Payment to workers : their P.F. dues (on leaving service)			34,272.94	
2. Payment of Interest to workers on closing of accounts as in item No. (1) above				5,173.47
3. Repayment of workers' voluntary subscription				34,701.17
4. Payment of Interest to workers against their voluntary subscription				2,734.33
5. Loans to Members :				
Outstanding from previous year		2,78,171.00		
Since added during the year		6,01,285.00		
		8,79,456.00		
Less : amount realised during the year		5,44,928.00	3,34,528.00	
6. Temporary advances to meet Institute's current expenditure as per last account		1,75,000.00		
Less : amount realised during the year		1,75,000.00		nil
7. Closing Balances :				
i) Cash in hand and at Banks			7,85,172.87	
ii) G.P. Notes at cost as per last account		14,29,359.29		
Since added during the year (Face value of G.P. Notes Rs. 22,70,000 -)		4,48,425.00	18,74,784.29	
iii) National Savings Certificate as per last account (present value Rs. 1,12,000/-)			1,00,000.00	
				Rs. 31,92,967.27

INDIAN STATISTICAL INSTITUTE

Indian Statistical Institute : Receipts & Expenditure on Capital

		<i>To Receipts</i>		
		Rs.	nP.	Rs. nP.
1.	Opening balance :			
	i) Stock of building and other materials for work under progress and other constructions, etc.			4,64,910.30
2.	On account payment, from Government of India in reimbursement of capital expenditure incurred by the Institute in connection with the acquisition of premises No. 205 B.T. Road			3,72,375.00
3.	On account payment, from Government of India in reimbursement of expenditure incurred by the Institute on repairs, renovations and constructions in premises No. 202 B.T. Road			2,50,000.00
4.	Sale proceeds of DuSoto Station Wagon			2,500.00
5.	Recovery of rent in respect of Institute's main buildings and structures in 203 B.T. Road and 153 Gopal Lal Tagore Road			54,057.00
6.	Recovery against Capital outlay from different sources			50,383.77
7.	Transfer of expenditure on capital outlays originally met from Capital Expenditure Account upto 1959-60 now transferred to Development fund a/c. II as per contra :			
	i) Cost of premises and or constructions at			
	a) 36 Vidyayatan Sarani	50,000.00		
	b) 160 Gopal Lal Tagore Road	1,29,855.00		
	c) Health House at Giridih	12,061.97		
	d) I.S.I. Students Hostel at 206 B.T. Road	1,08,548.16		
	e) I.S.I. Post Office : 204 B.T. Road	1,383.90		
	f) Petty constructions at Giridih	12,777.60	3,12,026.59	
	ii) Capitalised rental of 5 (five) telephones on O.Y.T. scheme			12,100.00
	iii) Equipment for Internal telephone systems			7,914.23
				Rs. 15,25,975.89