

# INDIAN STATISTICAL INSTITUTE

## FORTIETH ANNUAL REPORT

April 1971—March 1972



203, BARRACKPORE TRUNK ROAD  
CALCUTTA 36

## INDIAN STATISTICAL INSTITUTE

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### INTRODUCTION

*Genesis* : The idea of starting the Indian Statistical Institute was conceived by Professor P. C. Mahalanobis and a group of young men who had gathered round him in the nineteen-twenties, being interested in applying statistical methods to the solution of practical problems. There was already a workshop, so to say, for this purpose in what came to be known as the Calcutta Statistical Laboratory which was located in the room of Professor Mahalanobis, then professor of physics in the Presidency College, Calcutta. A public meeting, called over the signatures of Pramatha Nath Banerjee (Minto Professor of Economics), Nikhil Ranjan Sen (Khaira Professor of Applied Mathematics) and P. C. Mahalanobis, was held on 17 December 1931, with the late Sir R. N. Mookerjee in the chair. This meeting adopted a resolution which led to the establishment of the Indian Statistical Institute which was registered on 28 April 1932 as a non-profit distributing learned society under the Societies Registration Act XXI of 1860. A part-time computing clerk was the only worker the Institute had in the first year of its existence, the total expenditure being below Ra. 250.

The Indian Statistical Institute Act of 1959 recognised the Institute as an institution of national importance and empowered it to confer degrees in statistics, thus giving the Institute the status of a university. From 1 July 1960 the Institute, through its Research and Training School, has been conducting courses leading to the degrees of Bachelor of Statistics (B.Stat.), and Master of Statistics (M.Stat.), and a doctorate degree (Ph.D.) is also being awarded with provision for a higher doctorate (D.Sc.) degree. In 1961, the idea of the Institute having "Unity in Diversity" as its motto and the banyan tree as its crest, emerged as a result of discussions between Sir Ronald A. Fisher, and Professor P. C. Mahalanobis and was immediately supported by Shri C. D. Deshmukh, the President of the Institute from 1945 to 1964, who translated the English words into the Sanskrit version incorporated in the crest.

*History of Activities* : Since its inception, the Indian Statistical Institute has been trying to carry out an integrated programme of theoretical studies combined with practical applications of statistical methods through project work. Some of these projects raised theoretical problems whose solution led to original contributions to statistical theory. The Institute's work involved close collaboration with the Government, and it used to be done for a long time on business-like lines for both private enterprises and the Government, with contract grants for specified purposes. The Institute was built up in fact by the untiring efforts of Professor P. C. Mahalanobis and the sincere devotion of a handful of young trained scientific workers including H. C. Sinha, S. S. Bose, R. C. Bose, S. N. Roy and others. These young men helped to lay the foundation of the Institute. They worked

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for an ideal on a modest allowance which the Institute could pay from 'business earnings'. Individual training had started in 1932 under the inspiring guidance of S. S. Bose who joined the laboratory as a senior assistant in 1931. Through him the Institute gained a wide circle of friends and sympathisers. The lack of trained statisticians and computers led to the establishment of training courses in 1939, and the award of certificates of competence from 1938. The Institute's educational activities expanded with passing time, and included cooperation with international agencies for training programmes in South East Asia. H. C. Sinha took a leading part in the foundation of the Indian Statistical Institute in 1931-32 and took up the work of the Institute with vigour as its Honorary Joint Secretary. He rendered invaluable services in making the work of the Institute known abroad. Sudhir Kumar Banerjee was associated with the Institute since its inception. He used to look after the business and financial management with ability until his death in 1952. The actual management of the Statistical Publishing Society was in his able hands.

Earlier publications by Professor P. C. Mahalanobis were on physical anthropology (1922) and two meteorological memoirs (1932) in which errors of observation were separated from physical deviation in correlational analysis. The work in meteorology led to large-scale project studies in the early days of the Statistical Laboratory which were mainly concerned with two problems. The first was the control of floods, in Bengal and Orissa, on which reports were submitted in 1927, 1931 and 1940. The results of this work were partly immediate, in the adoption of adequate measures for flood control in North Bengal and partly long-term, coming to fruition in such schemes as the Damodar Valley Corporation and the Hirakud Dam Project. In the second set of problems, Professor Mahalanobis published a paper on errors of agricultural field trials in 1925, which established contact with Ronald A. Fisher almost immediately and resulted in the introduction in India of the Fisherian "design of experiments", before these methods were adopted in any other country outside Britain. Professor P. C. Mahalanobis and S. S. Bose published a series of statistical notes for agricultural workers in the *Indian Journal of Agricultural Science* (1932-36). Theoretical work on the design of experiments was started in the nineteen thirties and received a great impetus with R. A. Fisher's first visit to the Institute in 1938 which led to the Institute workers making important contributions to this subject field; among them mention may be made of R. C. Bose now in the USA, and Quazi Motalhar Hosain (Pakistan). On the applied side, S. S. Bose helped in a significant way until his untimely death in 1938.

The earlier work on anthropometry had also provided the basis for contributions in multivariate analysis with the formulation of the  $D^4$  Statistics ("Mahalanobis generalised distance") in the mid-, and late nineteen twenties. R. C. Bose who joined the Institute in 1933 obtained the exact distribution of the generalised distance ( $D^4$  Statistics) and developed the general problems of classification and discrimination with S. N. Roy who joined the staff in 1935. Important work in multivariate analysis was done by the late S. N. Roy in the Institute. Work on these problems still continues in the Institute, having been followed up by Professor P. C. Mahalanobis's formulation of Fractile Graphical Analysis in 1958.

Another development is worth recording. On the basis of a note submitted by Professor P. C. Mahalanobis, the University of Calcutta with the active support of the late Dr. Syama Prasad Mookerjee, then President, Councils of Post-Graduate Teaching in Arts

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and Science, decided to establish a post-graduate Department of Statistics, the first of its kind in India, from July 1941, with Professor P. C. Mahalanobis as Honorary Head of the Statistics Department. During this period, the University department was located in the Institute which provided some members of the teaching staff, accommodation and other facilities. It is of interest to mention that seven students including C. R. Rao and H. K. Nandi joined the course for the master degree in Statistics in July 1941. The whole of the Calcutta University Department of Statistics was evacuated with the Institute to Giridih in early 1942 during the Second World War.

In 1936, theoretical and field studies were started, at the desire of the Government of India, to develop sample surveys for the improvement of estimates of production of agricultural crops. These studies led to continuing annual crop surveys in Bengal from 1941, and also to important theoretical developments in the design of sample surveys which secured for the Institute a leading position in the world in this subject.

During the Second World War, the Institute became involved in the study of demographic problems. A detailed tabulation of the 1941 population census was abandoned by the Government owing to the exigencies of war. Professor Mahalanobis, however, succeeded in persuading the Government to retain a small sample of the original census slips. On the basis of this sample, the Institute prepared the detailed tables of demographic statistics for the 1941 census. Since then, studies in demography have been continuing in the Institute.

Research on estimation and distribution theories continued during the war and gradually led to the Institute becoming an internationally known centre for research in mathematical and theoretical statistics.

During the nineteen fifties, the Institute developed important types of project work. The National Sample Survey initiated by the Government of India in 1950, with the help of the Institute, is a continuing and the most comprehensive socio-econometric survey in the world today. Statistical Quality Control was started in 1953 and gradually developed into a training and consultancy service to industry on an India-wide basis, and is fulfilling a basic need in promoting the industrial progress of the country. D. B. Lahiri has made important contributions to the design of sample surveys and J. M. Sengupta to experimental studies.

The most important development of the Institute's work during the nineteen fifties was its significant contribution to economic planning. The studies on planning were inaugurated at the Institute in Calcutta in November 1954 by the late Prime Minister Jawaharlal Nehru, and the Draft Plan Frame for the Second Five Year Plan was prepared on the basis of these studies, and submitted to the Prime Minister in March 1955. The Institute's Planning Unit has since then worked in close collaboration with the Perspective Planning Division of the Planning Commission, and the National Sample Survey data have been found to be of great help in this work.

*Educational Programmes* : All over the world, during the last thirty years or so, statistical methods are being increasingly used in new fields of work. This is clearly seen in the number of books which have been published during this period, surveying the applications of statistics in many separate individual fields of natural science, such as geology, which would once have been thought quite remote from the statistical field.

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The Institute was given powers to award degrees by an Act of Parliament, sponsored by the late Prime Minister Nehru, and passed in 1959. This, together with the recognition of statistics as a key technology, has resulted in a new approach to the teaching of statistics in the Institute, which is also expressed in its research programme.

In universities, it was for a long time the practice to provide courses at the post-graduate level in a single subject like mathematics, physics, biology, economics etc. During the later part of the nineteenth century, it became necessary to develop new educational programmes in two important fields, namely, medicine and engineering, because it was essential for the professional students to have some knowledge of and skills in a number of scientific disciplines.

Sir Ronald Fisher summed up the position of statistics as "the key technology of the present century" in 1962, pointing out that a technologist must talk the language of both theoreticians and practitioners. The education of a technologist must, therefore, have a broad base. A technologist has to see both sides of the fence, and is the channel through which alone the knowledge and skills of others can be made effective. Fisher said, "It is, I believe, in recognizing statistics as the key technology of our century, that we can appreciate the special features of the Indian Statistical Institute. . . . What the scientists have to do with statistics lies in the part they must play in the education of any competent statistician."

Statistics, as a new technology, is concerned with the use of the most economic and efficient methods of observation, measurement, survey and experimentation, and of the processing of data for the drawing of valid inferences. The scope of statistics thus extends over the whole range of both the natural and the social sciences.

C. R. Rao who had joined the Institute as a student in January 1941 and who became Director, Research and Training School, in 1964, has been pursuing the policy of developing statistics as a key technology and extending applications of statistical methods in many new fields. His interest has thus been focussed not only on theoretical-mathematical studies but also on practical applications including Statistical Quality Control in recent years.

The courses leading to the B.Stat. or M.Stat. degrees have been formulated to cover a wide range of subjects, somewhat analogous to courses in medicine and engineering. Pure mathematics and the theory of probability are of basic importance. Theoretical and different branches of applied statistics, naturally, form a large part of the teaching programme. Because of the special needs of India, a great deal of attention is given to the economics of planning. In these three groups of subjects, mathematics, statistics, and economics of planning, the course includes a good deal of knowledge of basic results and facts, besides theory and methodology.

In addition, facilities are provided for the students to become familiar with the methods of observation, measurement, survey and experimentation in a number of scientific subjects. Here the emphasis is not so much on the content of knowledge of facts, or of theories, but on methods, and the stress is, therefore, on practical courses and statistical analysis and the interpretation of data.



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*Research Policy* : Ronald Fisher had pointed out "that the science with which the student is to become acquainted must be genuine research in its own right, not what is eloquently called a 'mook-up' for the use of students only." It is, therefore, the policy of the Institute to establish small, high level, research units in the both natural and social sciences, to offer facilities for research and training in the use of statistical methods in practice.

The Government of India approved this policy in a communication from the Cabinet Secretariat dated 15 June 1962 in the following terms :

"Government accept the view that statistics being a new technology, it should be open to the Indian Statistical Institute to establish and maintain research and study units in subjects other than theoretical and applied statistics to offer facilities for research and application of statistical methods and for the provision of training in such methods. The number of such units would depend on the availability of really able research scientists and also on the funds available to the Institute. Similarly, in furtherance of the purposes as set out in Section 5 of the Indian Statistical Institute Act, the Institute may establish and maintain units for the study of different languages (including translation units, library science, documentation, etc.) and for auxiliary studies and teaching in different subjects including humanities."

In this plan, each research unit would be concerned with a particular theme. Where there are more than one professional scientist in the same unit, they may either work jointly on the same topic or on different topics, which would, however, be related to a central problem. Each research paper may be independent, but the result would be capable of being added together to supply a more comprehensive picture of different aspects of the central theme.

This thematic programme of research is particularly useful in developing countries. In a large department or the faculty of a University, scientists often work on unrelated topics with practically no possibility of communication, or the exchange of views and criticisms among them. Scientists in a small research unit working on related group. of subjects can easily communicate with one another, a miniature scientific community can thus be established with the possibility of a free exchange of views and criticisms. Such scientific cells can then gradually build up a scientific community in the country as a whole.

The concept of a thematic programme for each research unit is also useful in promoting the growth of large units with a big staff dealing with a multitude of subjects. The Institute's policy is to have small units of pioneering research arranged in a horizontal or parallel pattern of organization. The Institute's policy is also to encourage joint projects of research units within the Institute and also with other universities, institutions and organizations.

The Institute's small research units are thus intended to play a quadruple role.

(i) Each unit will contribute to the teaching of degree courses in statistics, familiarizing students with types of problems, and methods of observations, measurements and experiment, in its own field of natural science.

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(ii) Each unit will actually engage in a programme of pioneering research, which will throw up problems of a statistical nature from time to time, some of which may well stimulate the evaluating of new statistical methods.

(iii) It is also hoped that the research units will be able to act as a liaison between workers in similar fields of science in universities and Government organizations, on the one hand, and the research statisticians of the Institute, on the other, to promote the spread of knowledge of statistical methods in scientific research in India.

(iv) Some of these research units have also been functioning in a very encouraging way as the meeting place for active collaboration between the scientists in India and guest scientists from abroad. Such collaboration is an important role of the Institute.

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### PART I : A GENERAL REVIEW OF THE WORK DURING THE YEAR

#### 1. GENERAL ADMINISTRATION

1.1 *Membership* : During the year 1971-72, 44 ordinary members were enrolled, 2 ordinary members became life members, 13 ordinary members resigned and according to information available in the Institute, 1 life and 1 ordinary members died. The membership as on 31 March 1972 was : 222 ordinary members, 96 life members (including 5 honorary life) and 9 institutional members.

It may be stated in this connexion that with the permission of the Council (meeting dated 12 August 1971), the names of certain persons who ceased to be members of the Institute for all practical purposes and who were still on the list were struck off. Membership of certain persons were, with the permission of the Council, also terminated in terms of rule 3.1 of the Rules of the Institute. After necessary revision had been carried out in the light of these decisions, the membership position as on 31 March 1972 was worked out as stated above.

During the year 1971-72, 117 sessional members, and 185 student members were enrolled. Sessional and student members are enrolled for one year at a time.

#### 1.2 *General Meetings* :

1.2.1 *Adjourned Annual General Meeting* : 7 August 1971 : In this meeting, the auditors' report audited statement of accounts for 1969-70 and balance sheets as at 31st March 1970 was adopted, subject to observations made in the report of the Special Committee dated 24 July 1971.

1.2.2 *Annual General Meeting* : 30 October 1971 : This meeting (1) mourned the death of (a) Professor D. R. Gadgil, and (b) Shri B. B. Ghosh, who passed away on 3 May and 27 October 1971 respectively; (2) considered the Annual Report for 1970-71; (3) appointed a sub-committee to examine reasons for delay in preparing the final accounts for 1970-71 and suggested remedial measures; (4) elected (a) President and Vice-Presidents for a term of two years, (b) Honorary Vice-President (Shri K. P. S. Menon) for the period 1971-72 to 1975-76, (c) office-bearers and members of Council for one year; (5) appointed auditors for 1971-72; (6) considered recommendations of the Council regarding report of the Special Committee and Government request for a Hindi version of the Annual Report of the Institute; (7) adopted a resolution regarding implementation of certain earlier decisions of the Council regarding the restructuring of the Institute; (8) decided to nominate a representative of the General Body in the Works Committee for Baranagar; (9) recorded deep appreciation of the services of Shri K. P. S. Menon, and Shri S. C. Law, the outgoing Chairman and Treasurer respectively.

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1.2.3 *Adjourned Annual General Meeting : 22 January 1972 :* This meeting (1) considered the auditors' report and audited statement of accounts for 1970-71 and adopted the same, subject to certain resolutions of this meeting regarding the introduction of a system of physical verification of stock of assets, internal audit of accounts, proper budgetary control and expenditure etc.; the Committee set up on 30 October 1971 in connexion with accounts was empowered by this meeting for taking steps regarding budgetary control also; (2) resolved that the members appointed by the Council for negotiations regarding NSS take-over should continue to take part in the discussions till the take-over was actually completed; (3) decided that a general meeting should be held before the end of May 1971 for considering the question of the reorganisation of the Institute; (4) decided that a member of the Institute should be included in the Works Committee for Delhi.

The list of names of President, Vice-Presidents and office-bearers and members of Council are given in Annexure 1.

1.3 *Meetings of the Council :* The Council of the Institute met 12 times during the year on (1) 29 April (2) 29 May (3) 19 June (4) 12 August (5) 11 September (6) 7 October (7) 14 October (adjourned meeting) (8) 29 October (9) 13 November 1971 and (10) 6 January (11) 22 January and (12) 17 March 1972 (jointly with the Governing Body).

1.4 *Meetings of the Governing Body :* The Governing Body of the Research and Training School met 7 times during the year on (1) 29 April (2) 19 June (3) 10 September, and (4) 28 October 1971 and (5) 8 January (6) 22 January, and (7) 71 March 1972 (jointly with the Council).

1.5 *Meetings of the Finance Committees :* The Finance Committee of the Council and the Finance Committee of the Governing Body jointly met four times during the year on (1) 28 October 1971, and (2) 5 January, (3) 22 January and (4) 17 March 1972.

1.6 *Meetings of the Special Committee :* The Special Committee which was constituted in a general meeting held on 16 January 1971 with all members of the Finance Committees of the Governing Body and of the Council and two members of the Institute (Dr. P. K. Bose and Dr. D. Basu) to go into the details of the auditors' report for 1969-70 met four times during the year on (1) 20 June, (2) 9 July, (3) 10 July (adjourned meeting), and (4) 24 July 1971.

1.7 *Membership of the Governing Body and Finance Committees :* The names of members of the Governing Body of the RTS and of the Finance Committees are given in Annexure 1.

1.8 *Institute Staff :* Professor P. C. Mahalanobis held the office of the Honorary Secretary and Honorary Director of the Institute throughout the period. Dr. C. R. Rao continued as the Director of the Research and Training School. Dr. R. Mukherjee held the office of the Additional Director from 1 April 1971 to 31 January 1972.

Shri P. Ray continued to work as Joint Secretary and Administrative Officer up to the middle of July 1971 and was released from the Institute on 17 July 1971 to return to the Government of West Bengal which had lent his services.

Shri Debabrata Das, W.B.C.S., joined the Institute as Administrative Officer on deputation from the Government of West Bengal on 1 July 1971.

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Shri S. R. Mukherjee, Indian Audit and Accounts Service, joined the Institute on 9 December 1971 as Financial Adviser on deputation from the Government of India.

Shri A. C. Ray, Officer on Special Duty in the Delhi Office, was empowered in July 1971 to function as Administrative Officer of the Institute at Delhi.

1.9 *New Appointments* : 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 :

1. Dr. Amitabha Bose, M.Sc. (Anthrop.), D.So. (Anthrop., Cal.), (RTS) : 4 June 1971; 2. Shri Pradip Maity, M.A. (Econ.), (RTS) : 26 October 1971; 3. Dr. Ranjit Chakraborty, M.Stat., Ph.D. (ISI), (RTS) : 27 October 1971; 4. Dr. A. Ram Chandra Rao, M.Stat., Ph.D. (ISI), (RTS) : 28 October 1971; 5. Dr. P. Bhimasankaran, M.Stat., Dip.C.S., Ph.D. (ISI), (RTS) : 1 November 1971; 6. Sm. Tandra Das, M.Sc. (App.Math.), Dip.C.S., (RTS) : 1 November 1971; 7. Shri Subhas Chandra Kundu, M.Sc. (App.Math.), Dip.C.S. (Computer Science Unit) : 1 November 1971; 8. Sm. Kanti Rewat, B.Sc. (Math.Stat.), Dip.C.S., (RTS) : 1 November 1971; 9. Shri Bimal Kumar Sinha, M.Sc. (Stat.), (RTS) : 1 November 1971; 10. Shri I. K. Ravichandra Rao, M.Stat., Dip.C.S., (Computer Science Unit) : 2 November 1971.

1.10 *Resignations and Retirements* : The following members of the staff left the Institute on the dates mentioned :

1. Shri J. C. Guria, M.Stat., Dip.SQC & OR (S.Q.C., Baroda) : 2 April 1971; 2. Shri M. S. V. Rao, B.Sc., M.Stat. (Computer Science Unit) : 31 May 1971; 3. Dr. (Mrs.) Rhea S. Das, M.A. (Psych.), Ph.D. (Psych., Illinois), (RTS) : 1 July 1971; 4. Shri D. S. Bhat, M.Stat. (SQC) : 31 July 1971; 5. Shri Pijush Dasgupta, M.Sc. (Stat.), (Computer Science Unit) : 2 August 1971; 6. Shri Bibekananda Soth, M.Stat. (SQC, Baroda) : 7 August 1971; 7. Shri B. Banerjee, M.Sc. (Puro Math.), Two-year training, ISI (SQC) : 31 August 1971; 8. Shri K. Vejoy Chandran, B.Sc., M.Stat. (RTS) : 18 October 1971; 9. Shri P. N. Mathur, M.Stat. Dip. C.S. (Computer Science Unit) : 31 October 1971; 10. Shri A. K. Mauchanda, M.Stat., Dip.S.Q.C. & O.R. (S.Q.C. Project Centre, Rishikesh) : 24 January 1972.

The following workers retired on the dates mentioned :

1. Shri Suresh Chandra Sarkhel (NSS) : 1 February 1972; 2. Shri H. B. Choudhury (NSS) : 1 September 1971.

1.11 *Obituary* : The Institute regrets to place on record that Shri S. L. Pillay, M.A., LL.B., in charge of the NSS Field Office, Indian Statistical Institute, Bombay, died prematurely at the age of 43 on 22 April 1971. He had joined the Institute on 1 August 1951.

1.12 *Review Committee* : NSS Take-over and Reorganisation : In the Annual Report of 1970-71, it had been reported that tripartite meetings with representatives of the Government of India, ISI Workers' Organisation and the Administration were held on different dates for working out details regarding the transfer of the NSS work and the workers.

During this year, tripartite meetings were held on 26 October 1971 and 20 March 1972 and final resolutions were adopted by the Government.

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The report of the Reorganisation Committee (with Mr. Justice A. K. Mukherjee as Chairman) was placed before the Council on 8 January 1972 and again on 17 March 1972, along with certain comments received thereon. The consideration of the report was, however, postponed. Discussions about the restructuring of the Institute took place in the Annual General Meeting dated 30 October 1971 and the adjourned Annual General Meeting dated 22 January 1972.

Further developments regarding the take-over of the NSS and the restructuring of the Institute will be reported in due course.

### 2. RESEARCH AND TRAINING SCHOOL

The Research and Training School carried out its training and research activities under the guidance of the Director, Dr. C. R. Rao.

The statisticians at Calcutta carry out research, conduct teaching programmes and provide consultation service to other scientists.

The bulk of the teaching responsibility is borne by about sixteen mathematicians and statisticians who form the statistics unit of the Research and Training School at Calcutta. The team of statisticians also conducts a considerable volume of research.

#### 2.1 Training Programmes

2.1.1 *Admission to Courses*: No new courses were started during the year. A full list of courses is given in the Prospectus of Degrees, Diplomas and Certificates, 1971-72.

The following is a list of over 600 candidates admitted to the courses during 1971-72.

						<i>Number of admissions</i>
1.	<i>Courses leading to a Degree in Statistics</i>					
1.1	Bachelor of Statistics with Honours (B.Stat.) (Hons.)					
	1st year	..	..	..	..	35
	2nd year	..	..	..	..	29
	3rd year	..	..	..	..	22
	4th year	..	..	..	..	21
1.2	Master of Statistics (M.Stat.)					
	1st year	..	..	..	..	28
	2nd year					
	Subjects of Specialisation :					
	Econometrics and Planning	..	..	..	..	11
	Computer Science	..	..	..	..	6
	Statistical Quality Control and Operations Research	..	..	..	..	15
	Mathematical Statistics and Advanced Probability	..	..	..	..	4

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1.3	Doctor of Philosophy (Ph.D.) .. .. .	12
	(Research Course preparatory to Ph.D.)	
1.4	Research Scholar/Project Assistant etc. .. .. .	44
2.	<i>Specialised Courses in Applied Statistics leading to Diplomas :</i>	
2.1	Statistical Quality Control and Operations Research .. .. .	23
3.	<i>Courses in Statistics for Persons in Employment :</i>	
3.1	Statistical Officers' Training Course (jointly with the CSO) .. .. .	10
3.2	Specialisation Course for Statistical Officers (jointly with the CSO) .. .. .	10
4.	<i>Evening Courses :</i>	
4.1	Statistical Methods and Applications :	
	(i) Bangalore .. .. .	18
	(ii) Bombay .. .. .	16
	(iii) Calcutta .. .. .	29
	(iv) Delhi (in collaboration with the CSO) .. .. .	9
	(v) Hyderabad (in collaboration with the Indian Institute of Economics) .. .. .	5
	(vi) Madras .. .. .	23
4.2	Elementary Techniques of Computations .. .. .	22
4.3	Statistical Computations .. .. .	8
4.4	Diploma in Statistical Quality Control and Operations Research (Bombay and Madras) .. .. .	
4.4.1	Bombay—1st year .. .. .	36
	Bombay—2nd year .. .. .	19
4.4.2	Madras—1st year .. .. .	23
	Madras—2nd year .. .. .	30
4.4.3	Six-month course on SQC and OR (Bangalore) .. .. .	22
5.	<i>Electronic Computer Courses :</i>	
5.1	Diploma in Computer Science .. .. .	10
5.2	Intensive Course on Programming and Applications .. .. .	24
5.3	Course on Operation of Punch Card Machine .. .. .	6
6.	<i>Courses at the International Statistical Education Centre, Calcutta :</i>	
6.1	Regular Course in Statistics .. .. .	20
7.	<i>Documentation Training Course at Bangalore</i> .. .. .	7
8.	<i>French Language Course</i> .. .. .	9
9.	<i>Indian Statistical Service Officers Course :</i>	
	(i) Probationers .. .. .	7

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### 2.2 Research Activities :

The units for applied research and science laboratories attached to the Research and Training School, together with the names of the heads of units, are as follows :

Sudhir Ranjan Das (*Anthropometry and Human Genetics*), Prabhat Ranjan Pal (*Biochemistry*), Bhupendra Chandra Das (*Biometry*), Subodh Kumar Roy (*Botany*), Jogabrata Roy (*Computer Science*), Trupapur Antony Davis (*Crop Science*), Manapadam Venkateswarier Raman (*Demography*), Deb Kumar Bose (*Economic Research*), Samarandra Kumar Mitra (*Electronics*), Ratan Lal Brahmachary (*Embryology*), Sohan Lal Jain (*Geology*), S. Matai (*Leaf Protein*), Alokananda Mitter (*Linguistic Research*), Monimohan Mukherjee (*National Income Research*), Durgaprosad Bhattacharyya (*Pre-Census Population Studies*), Sibabrata Chatterjee (*Psychometric Research and Service*), Ramkrishna Mukherjee (*Sociology*), and T. N. Srinivasan (*Planning and Regional Survey, Delhi*).

Jogabrata Roy was the Dean of Studies from December 1970 to January 1972. Sujit Kumar Mitra was in charge of the Summer School and Jogabrata Roy in charge of the evening courses at Calcutta and the branches of the Institute.

From 15 February 1972, the following arrangements were made :

1. Professor T. Antony Davis was placed in charge of research units in social and natural sciences including the Computer Science Unit in Calcutta.
2. Professor Deb Kumar Bose was placed in charge of the library in Calcutta and the Documentation Research and Training Centre in Bangalore.
3. Professor Jayanta Kumar Ghosh was placed in charge of research groups in statistics, teaching, training and related activities to be assisted by Dr. Asok Maitra in respect of the International Statistical Education Centre (ISEC), Calcutta, and by Dr. T. V. Hanurav as acting Dean of Studies.

2.2.1 *Important Topics of Research* : The research work of the Institute during the current year is embodied in about 127 research papers sent for publication, besides mimeographed technical reports. The fields of research covers, besides statistics and mathematics, various subjects for which the Institute has specialised research units—anthropometry and human genetics, biochemistry, biometry, chemistry, computer science, crop science, demography, documentation and library science, embryology, economics and econometrics, geology, leaf protein, linguistics, psychometry, sociology, theoretical physics and electronics. A selected list of topics, on which research was carried out during the year, is given below :

#### A. *Statistics and Mathematics (Theoretical Statistics)*

Following is a brief report of C. R. Rao's research during the year :

(i) *g-inverse of matrices* : The work on generalized inverse of rectangular and singular matrices was continued. New applications were found in electrical network analysis, treatment of singular normal distribution and linear estimation. A full length volume on the subject by C. R. Rao and S. K. Mitra was published by John Wiley and Sons in October 1971. The concept of *g-inverse* is generalized to constrained inverse which has applications in a number of problems.



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(ii) *Unified theory of linear estimation* : Let  $Y$  be a vector variable such that  $E(Y) = X\beta$  and  $D(Y) = \sigma^2 V$ , where  $V$  and  $X$  are known matrices and  $\sigma^2, \beta$  are unknown parameters. The problem is to obtain estimators of  $\beta$  and  $\sigma^2$  and draw inferences on them on the basis of observed vector  $Y$ . The theory and methods when  $V$  is non-singular are well known, but no satisfactory approach is available when  $V$  is singular. Further, there is no unified computational procedure to cover all the situations.

Two unified approaches are suggested in a recent paper. In one, the solution depends on computing an inverse or a  $g$ -inverse of the symmetric partitioned matrix

$$\begin{pmatrix} V & X \\ X' & 0 \end{pmatrix}$$

The other is analogous to the least square theory but differs in the expression to be minimised, which is

$$(Y - X\beta)' (V + k^2 XX') (Y - X\beta),$$

where  $k^2$  is an arbitrary constant  $\neq 0$  in all situations, where  $V$  is non-singular or not. The estimators are independent of  $Lk$ .

Methods are also proposed for obtaining best linear estimators when the condition of unbiasedness is not imposed.

Methods are also proposed for obtaining best linear estimators when the condition of unbiasedness is not imposed.

(iii) *MINQUE Theory* : A new theory is proposed to estimate variance and covariance components in linear models. The method is completely general, applicable in all experimental situations and is not based on analysis of variance techniques. Estimators are unbiased and quadratic functions of observations with a minimum norm defined in a certain sense to ensure optimum statistical properties.

(iv) *Combinatorial arrangements based on arrays* : Twenty-five years ago, combinatorial arrangements called orthogonal arrays were introduced, which found applications in many problems including the disproof of Enter's conjecture on the non-existence of orthogonal Latin squares. A variety of new combinatorial arrangements, called semiorthogonal partially balanced etc., arrays have been introduced and applied to problems of design of experiments.

(v) *Characterization of probability distributions* : How much information is contained in a few linear functions of a number of independent variables about the individual variables themselves ? A complete answer is provided to this question, both for scalar and vector variables. A surprising result is that given the joint distribution of only  $p$  suitably chosen linear functions of  $p(p+1)/2$  independent variables, one can determine the individual distributions of each of the  $p(p+1)/2$  variables apart from change of location.

Some of the fields in which significant progress in statistics has been made by others are (i) mathematical logic and descriptive set theory, (ii) topology and measure theory, (iii) graph theory, (iv) game theory, (v) probabilistic number theory, (vi) statistical

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inference and sample survey, and (vii) mathematical genetics. The following is a brief summary of the stimulating research conducted during the year.

(i) *Mathematical logic and descriptive set theory* : E. M. Paul is writing a book on this topic. A. Maitra is making a thorough study of the consequences of certain axioms of set theory, e.g., the axiom of constructibility, the axiom of measurable cardinals, the axiom of determinateness, in the descriptive theory of sets. H. Sarbadhikari is working in this area with Maitra. She has constructed a projective Blackwell space which is not analytic. M. G. Nadkarni has obtained a decomposition of the domain of a Boreal function using a deep theorem of Lusin and the Hellinger-Hahn method for spectral measures on separable Hilbert space.

(ii) *Topology and measure theory* : A. B. Raha has submitted a thesis on "Maximal and minimal topologies" which contains many elegant characterisations of such topologies. For example, he has shown that every minimal real compact space is compact.

D. Ramachandran has resolved a question on finitely additive measures raised by Hewitt and Yoshida. This problem had been open for quite sometime.

K. P. S. Bhaskara Rao and M. Bhaskara Rao have proved a number of interesting results on Boolean algebras, finitely additive set functions etc. They have completely characterised Boolean algebras which support a non-atomic charge. M. Bhaskara Rao has submitted a thesis on "Contributions to measure theory."

(iii) *Graph theory* : A. R. Rao has made a number of interesting contributions to this area. Another young mathematician working in this area was S. B. Rao.

(iv) *Game Theory* : T. Parthasarathy has written a book (with T. E. S. Raghavan of the University of Illinois at Chicago Circle). Mitra and his joint work on stochastic games has been published recently. He is currently working on selection theorems and differential games. His monograph on selection theorems published by Springer Verlag has just been published.

(v) *Probabilistic number theory* : Jogesh Babu has been working in this field under the guidance of J. K. Ghosh and E. M. Paul. Using probabilistic techniques, he has obtained striking extensions and new proofs of some results on additive arithmetic functions of integral polynomials which were proved by Kátain by deep number theoretic methods.

(vi) *Statistical inference and sample survey* : Some new phenomena that occur in large sample estimation of discrete parameters were studied in detail by J. K. Ghosh and K. Subramaniam. J. K. Ghosh and K. K. Roy have proved Dynkin-type theorems on finite dimensional sufficient statistics when the carriers depend on the parameter; their results solve partially a problem raised by Academician Linnik in his book *Statistical Problems with Nuisance Parameters*.

M. Ghosh has written interesting papers on various aspects of non-parametric inference. Y. R. Sarma and B. K. Sinha worked on Bayesian inference.

N. D. Prabhsakar has achieved many interesting results on dynamic programming. He is now writing his thesis on this topic.

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T. V. Hanurav is preparing a monograph on sample survey. Many interesting results were obtained in this field by T. J. Rao and M. K. Ramakrishnan who submitted his thesis on "Optimum estimators and strategies in survey sampling."

(vii) *Mathematical genetics* : In an interesting paper, B. P. Adhikari, Y. R. Sarma and R. Chakraborty have shown how gene frequencies can be obtained from blood-group data without using the random mating hypothesis in its usual unrealistic form. R. Chakraborty has studied various aspects of mathematical genetics and the statistical problems that arise therefrom.

(viii) *Generalized inverses of matrices and applications* : A unified theory of linear estimation is developed by C. R. Rao, which can be applied to all cases of linear models (whether the design matrix is singular or non-singular and the dispersion matrix of the error vector is singular or non-singular). It is shown by Rao, Mitra and Bhimasankaram that if  $A^+e\{B^-\}$  and  $B^+e\{A^-\}$  then  $A = B$ . Some other interesting results along these lines are also obtained by the same authors. Prasad Rao and Bhimasankaram have developed a method of computing a  $g$ -inverse of a matrix. Computer programmes have also been written for this method and based on the examples worked out it is (empirically) found that this method is quite stable. It is shown by Prasad Rao that a doubly stochastic matrix has a doubly stochastic  $g$ -inverse if and only if it is a partial isometry.

Not covered in the above summaries are the important work of S. Bagchi in harmonic analysis and R. Subramanian on Markov processes and martingales.

### B. Natural Sciences

#### (i) Anthropometry and Human Genetics

(a) Indo-Soviet collaborative study : Variations in a number of anthropometric, somatoscopic and physiological characters, and in the gene frequencies for five blood group systems, serum proteins, haemoglobin, and red-cell enzyme systems among five categories of population in Delhi.

(b) Genetic variations in respect of placental enzymes, Erythrocyte enzymes, serum proteins, etc. among different Indian populations in collaboration with Professor R. L. Kirk and Professor H. Walter, Australian National University.

(c) Anthropometric and genetic investigation of the sub-caste variations among the Dhargar caste of Maharashtra in collaboration with the Deccan College, Poona.

(d) Infant growth and its probable association with the placental alkaline phosphatase in a group of Bengali infants.

(e) Investigations on the bio-social problems of the mentally disordered in collaboration with the Calcutta University.

(f) Study of polygyny and its effects on fertility in India under the guidance of Sir Alan Parkes, F.R.S.

(g) Distribution of 'marriage propensity' by distance among the Pahira, a tribal community of eastern India.

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(h) Study on parity-specific fertility achievements of women in collaboration with the Calcutta University and the Ramakrishna Mission Seva Pratisthan.

(ii) *Biochemistry* :

(a) Extraction and purification of plant leaf AT Pase.

(b) Synthesis of amino acid hydroxamates of naturally occurring amino acids for studies on their possible oncolytic activities.

(iii) *Botany* :

(a) Inter-varietal and inter-species interactions in crop plants.

(b) Mechanism of interaction.

(c) Behaviour of field rodents.

(iv) *Crop Science* :

(a) Investigations on the mechanical laws operating in the arrangement of leaves on palm crowns as well as the seeds on the sunflower head.

(b) Exploring the possibilities of inducing clonal propagation in palms.

(c) Study on the external morphology and anatomical structure of young palms.

(d) Floral biology of a number of species of palms; also investigations on floral and foliar asymmetry in some crop plants.

(e) To investigate quantitatively the norm of epidermal patterns of palm species.

(v) *Embryology* :

(a) Nucleic acid and protein synthesis in *Limnaea* during development.

(b) The analysis of the nature of inorganic and organic sulfur metabolism during early embryonic development of *Limnaea*.

(c) Pattern of nucleic acid biosynthesis in the antigen sensitised animal.

(vi) *Geology* :

A. In the Pranhita-Godavari valley :

(a) Sedimentology and tectonics of the Pre-Cambrian rocks.

(b) Sedimentology of the Gondwana rocks.

(c) Palaeontology and stratigraphy of the Gondwana deposits.

B. In other areas :

(a) Present-day fluvial sedimentation process.

(vii) *Leaf Protein* :

(a) Systematic agronomic studies to set the optimum levels of fertilisers, seeds and plant age (first phase completed).

(b) The screening of local vegetation including wild plants and water weeds.

(c) A pilot plant was set up to produce leaf protein on a small scale.

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(viii) *Immunochemistry* :

- (a) Survey of Immunoglobulins, IgG, IgA, and IgM in normal subjects of West Bengal.
- (b) Immunochemical aspects of blood coagulation factors.
- (c) Blood genetic profiles.
- (d) Immunochemical quantitation of transferrin in serum in normal population of West Bengal.
- (e) Immunochemical quantitation of total protein, albumins and globulins.

C. *Computer Science* :

- (a) Model sampling studies on Fractile Graphical Analysis.
- (b) The project 'Statistical Analysis of Psychometric Tests' (final stage).
- (c) A research project on the development of soft-ware package for Analysis Linked Cross-Sectional Surveys.

D. *Demography* :

- (a) State growth rates during 1961-71.
- (b) Population projections for India, 1951-1991.
- (c) Construction of life tables for West Bengal, 1941-50.
- (d) Distribution of fertility and its correlates in West Bengal.
- (e) Nuptiality patterns of bachelors, India, rural and urban, 1961.
- (f) Effects of female marriage patterns on demographic measures.
- (g) Population projects of India, 1951-71.
- (h) Estimation of counting error in 1961 census.

E. *Linguistic Research* :

- (a) Study of the phonetic structure of Indian languages.
- (b) Investigation of the problems relating to the structure of moaning.
- (c) A statistical approach to linguistic and psycholinguistic problems.

F. *Psychometry* :

- (a) Test development and related psychometric problems; several new tests were constructed for the selection of students and personnel.
- (b) The follow-up study was continued in connection with tests which had been developed and administered earlier.
- (c) Selection of students and staff for the Institute and also for public and private sector organisations in India and the U.S.A.

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### G. *Sociology* :

- (a) Project on Data Inventory on Social Sciences, India (second phase completed).
- (b) Bibliographical and documentary research on materials connected with social change and development in India.
- (c) Study of variation in family structures in India.
- (d) Field research on the growth of urban locations in India.
- (e) Exploratory studies on the problems of (i) socio-economic polarisation, and (ii) social communication and development in several selected backward/non-backward regions of India.
- (f) Transcription of the primary socio-economic data of 1,876 villages, consisting of 86,813 households surrounding Giridih town, Hazaribagh district, Bihar.
- (g) Exploratory study in Calcutta on the reactions of intellectuals regarding socio-economic problems and current topics (first phase completed).

### H. *Planning* :

The research activities of the Planning and Regional Survey Unit, New Delhi, covered a wide spectrum, from research oriented to immediate economic policy issues to theoretical research on optimising models.

The research work on planning conducted during the year may be classified briefly as follows :

(i) *Studies in the structure of the Indian economy* : Work on a capital coefficients matrix to correspond to the 144 sector input-output matrix for 1964-65 is continuing. This is a long-term project which involves careful compilation, collation and comparison of data on capital structure from diverse sources. The project is likely to continue for some time to come. The results of a regression analysis relating output (or capacity) with capital in a number of industries were reported in a discussion paper.

Data collection relating to a study of production and investment relations in the engineering industry has been completed.

A study of the efficiency of the Indian Capital Market in the allocation of risk capital between different industries and between large and small firms within an industry has been in progress.

A study was undertaken to estimate the net profitability of the different elements of bank portfolios. A discussion paper reporting the results of the study was prepared.

A theoretical investigation of alternative ways of extending the Constant Elasticity of Substitution Production Function to the case where there are more than two inputs was continued.

The following studies were completed :

- (a) Real National Product in India and Japan, 1965-66.
- (b) Efficiency of resource allocation in the transport industry.
- (c) A survey of consumption, investment and savings in India.
- (d) Three chapters of a book on planning models.

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(ii) *Studies on Indian agriculture* : Performance of the agricultural sector, particularly with respect to the production of food crops and selected commercial crops has been critically evaluated. It has been shown that the hypothesis that there has been a revolution only in wheat output since 1964-65 and not in other crops cannot be rejected. A discussion paper incorporating the results of this study was prepared.

The project on fertilizer requirements of different States, undertaken under a contract with the Fertiliser Association of India, was initiated at the end of 1970. The project is expected to be completed by the end of June 1972. The objective of the project is to estimate the demand for fertiliser for the year 1975-76 for each State of India. An essential part of the study is to estimate the relationship between fertiliser inputs and crop yields for each major crop in each agro-climatic zone. For this purpose, India has been divided into 40 agro-climatic zones. Experimental data relating to crop yields, fertiliser inputs and sources, etc., were collected for the period 1965-66 to 1970-71. Data on monthly rainfall at various agricultural meteorological stations were also collected. The estimation of response function for each crop for each zone is in progress.

A study to examine the time series data on agricultural output for a number of districts (whose geographical area did not change much over time) in relation to changes in input use and soil-cum-climatic factors has been in progress. Preliminary analysis relating to wheat in 11 districts of Punjab, rice in 8 districts of Madras and jowar in 6 districts of Bombay was completed.

(iii) *Research on International trade theory and problems relating to foreign trade in India* : The work on the effects of exchange control liberalisation since the devaluation of the rupee initiated during the second half of 1970-71 was continued. Data relating to exports, imports, import entitlements, cash subsidy rates, import premia etc., for a large number of commodities were compiled. A first draft of some chapters of a monograph containing the results was presented at a conference in New York in February 1972.

(iv) *Econometric methodology and applications* : Papers prepared on estimation of heteroscedastic variances and on identifiability of parameters in simultaneous equation system were revised for publication.

A paper on the international comparison of changes in Money Wage Rates and unemployed levels was completed and submitted to the Eleventh Indian Econometric Conference.

(v) *Economic theory* : A new proof of the Non-Substitution Theorem was presented in a discussion paper.

(vi) *Regional development* : A short paper on the relative position of Kerala State in the Indian economy was prepared. Research on inter-state comparison of changes in employment and earnings in the manufacturing industries during the period 1958-65 is in progress. A study on attempts at Regional Planning in France is in progress.

(vii) *Miscellaneous research project* : The work on translating selected materials from Russian, French and other European languages dealing with planning techniques, institutions and practices was continued.

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*Teaching* : The two-year course leading to registration for the Ph.D. degree, started in 1969 for training specialists in different fields of economics, was conducted during the year. The third batch of nine students was admitted in August 1971.

### I. *Regional Survey* :

(i) *Studies in regional survey and planning* : A project was started to study the Karnal area of Haryana as a part of its area development studies. A reconnaissance field tour was conducted in which data and information on the available services and amenities, and consumer travel patterns in selected villages were compiled. In all, 31 villages were covered in the course of this study. With the data on services and amenities compiled earlier for all the 100 villages in Karnal block, a hierarchic association functions has been attempted.

A study on the intra-regional and inter-regional pattern of commodity flows in India has been completed. This is an empirical study in analysing the organisation of macro-economic regions of India.

The study of space relations by mapping the bus frequency along all the transport routes of Karnal area has been completed. The identification of nodal hierarchy is in progress.

The processing of data cropping pattern for all the 418 villages in Karnal area has been completed. The preliminary mapping is in progress. A working paper on Rural Area Development, Karnal Area—a case study, has been prepared for discussion at the forthcoming Seminar organised by the Regional Science Association (India) in Calcutta during 14-15 April 1972.

(ii) *Quantitative techniques for regional planning* : The main results of a theoretical study on this topic have been reported in two papers, one already published and another forthcoming in the *Indian Journal of Regional Science*.

(iii) *Regional information, regional statistics and regional planning* : As one of the basic obstacles of regional plan formulation and development is the inadequacy of regional statistics and other types of regional information in a developing country like India, a detailed report was prepared on this topic with case studies in India.

### J. *Economic Research* :

The activities of the Economic Research Unit (ERU) during the year covered mainly studies on various problems of economics, econometrics, teaching and holding seminars and lectures.

The research work done at the Economic Research Unit during the year 1971-72 may be classified as follows :

(i) *Mathematical economics* : One of the studies related to the differentiability of ordinal utility function. The ordinalist position regarding the quantification of utility function was analyzed. The set of utility indices was shown to be a subset of a Banach space. As such, the gap between the ordinalist and the cardinalist positions could be seen to be much narrower than usually understood. In another study a formalization of Keynesian view of inflation is worked out. Dividing the consumers into three classes, workers,



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profiteers and the fixed income group, the model leads to a higher level of national income in money terms if the consumption propensities of profiteers are larger than those of both workers and fixed income class and if the share of workers in income declines in the course of inflation.

(ii) *Short-term forecasting* : Trends of important economic characteristics have been analysed with a view to prepare short-term forecasts for the overall functioning of the economy. Time series data were used to analyse the nature of short-term deviations of various characteristics from their long-term trends. Forecasts for 1971-72 were released to the press in July 1971. The E.R.U. has undertaken a systematic classification of news items relating to economic activities in the country published in two of the specialised dailies, and their documentation for reference of the researchers.

(iii) *Demand analysis* : The current methods of determining Engel elasticities and comparison of the consumer expenditure pattern of middle class and working class households in India have been examined. Expenditure pattern of the two social classes on the basis of the information obtained from the Family Living Survey—1958-59, jointly conducted by the Bureau of Labour Statistics and the CSO, has been studied. The application of the Tobit model to consumer behaviour in rural India has also been studied. A simple modification of the Tobit model provided good fit to data on proportions of persons reporting consumption in NSS data for rural India.

(iv) *Agricultural economics* : A study on the nature of land reform in India since independence has been completed. The study examines the claims that through considerable progress in land reform the agrarian structure in India has today become more rational and equitable. Acreage response of jute to relative price shift between jute and paddy has been examined in another study. Initially, the study is being undertaken at the West Bengal level.

(v) *Industrial economics* : The construction of a new series of productivity indices for 25 manufacturing industries with 1960 as the base year has been completed in a study. In another paper, a survey on characteristics of industrial labour in greater Calcutta has been examined. A technical note on the background of the unstable character of jute mill labour has been prepared.

(vi) *Development economics* : An analysis of the features of foreign trade as well as inter-wing trade of Bangladesh (East Bengal), and the future prospects and problems of Bangladesh's foreign trade, both from short-term and long-term viewpoints, with special reference to Indo-Bangladesh trade relations has been examined in a study. Another study examines the possibilities of employment generations in Haldia and its scope as counter magnet to the city of Calcutta.

The teaching courses on economics and econometrics in the B.Stat., M.Stat., and specialisation courses in the Research and Training School and the International Statistical Education Centre was organised by the ERU as in previous years, with the help of the National Income Research Unit. The ERU also organised a research course in advanced theory in econometrics and economics leading to the Ph.D. degree of the I.S.I. The course for the year was initiated in September 1971.

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Ten students were enrolled during the year for the specialisation course in econometrics and planning under the M.Stat. syllabi and four students for the Ph.D. course.

### K. National Income Research :

The National Income Research Unit (NIRU), Calcutta, is concerned with analytical studies on national income and its several distributions. The studies entail, among other things, obtaining estimates that are not available in official statistics, working out interrelations among relevant variables and furnishing thereby explanations of the growth of the Indian economy.

(i) *Trends and structure of national income* : Two short texts were prepared on national income and its distribution in India incorporating an examination of the United Nations system of national accounts, 1968, for the Summer School courses in the Gokhale Institute of Politics and Economics and the Indian Statistical Institute. An attempt was made to explain the growth of Indian unduplicated output in terms of labour and capital inputs using Abramovitz-Denison approach. Another study obtained the share of agricultural income accruing to agricultural workers for the post-independence period. A comprehensive survey of researches on national income in India since independence was completed under the auspices of the Indian Council of Social Science Research.

(ii) *Regional disparity* : Inter-state variations in consumer prices was studied in considerable details, isolating prices governing different segments of the budget. Rural-urban differentials of consumer prices were obtained by several ordinal groups of relevant populations and were examined. An attempt was also made to cluster the districts of a State (Madhya Pradesh) using a distance concept, the measure of which was estimated on the basis of district-wise information on several variables.

(iii) *Size distributions* : A study was initiated on measurement and control of disparity of the distribution of real level of living in India based, by and large, on NSS data. The study is expected to continue, going into methodological details.

(iv) *Consistent system of index number* : A considerable amount of work was done on the unique and base-independent consistent systems of price index numbers and a methodological advance was made by adding a new system to the handful of available system like Geary-Khamis, Eltoto-Koves, etc., and elegant demonstrations were obtained for some of the results in the Geary-Khamis system. An attempt was made to face the problem of choice between several consistent systems, and a procedure was suggested. For comparison of dissimilar groups where the items of consumption only partially intersect between pairs of groups, a procedure was suggested which uses the same set of transformed variables for all the groups connected with the original variables by some transformation matrices. The method involves solution of the dual of a primal linear programming problem yielding the "shadow prices" of the transformed variables.

(v) *National accounts* : Work continued on national accounts, and the available Indian national accounts was considered in one study. Some ideas on the problem of national budgeting in India was discussed in another brief essay.

(vi) *Historical series on capital formation* : The study on the series of capital formation in India since 1900 is nearing completion. Apart from providing annual estimates of gross and net capital formation and their various breakdowns, the study will also examine

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the interrelations between other available indicators of growth of the Indian economy on the one hand and real capital formation on the other. An attempt will also be made to obtain a series of savings in India by adjusting the estimates of capital formation for international transactions.

(vii) *Education and economic growth* : The study on services as components of national product continued with special emphasis on education. It was found, in a study on intercountry comparison, that technological development, economic structure, level of education already attained and willingness of the people to undergo higher education determine the pattern of education in advanced countries. In contrast, the main criteria in poor countries are resources, both human and physical, as well as the ability of the State to utilize them.

### L. *Pre-census Population Studies* :

The research projects of the Pre-Census Population Studies Unit are :

(i) *Pre-Census Population Studies* : The purpose of pre-census population studies conducted in collaboration with the Registrar-General, India, is to compile material on population of any region of India up to 1872, when the first census was planned. There are plans to publish eight volumes in all, one relating to the period upto 1800, one volume for each decade from 1801 to 1871. The first volume entitled *Report on the Population Estimate of India* was published by the Registrar-General, India, in 1965.

The second volume, on which a preliminary draft was prepared in 1970-71, contains 200 population estimates. The first part entitled *Report on the Population Estimates of India, 1811-20 (with additional material for 1821-1830; Part I. Eastern region* is being submitted to the Registrar-General, India, for publication.

*Pre-Census Atlas* : During the year, map drawing was concentrated on the eastern region. Thus a map of Bengal and Bihar 1813, Assam 1826-1827, Orissa 1820, Burdwan 1814 identified on the map of 1961, maps of districts of Bihar and Patna, Shahabad, and Bhagalpur were drawn. Economic and population data were displayed in series of old district maps as suggested by the Map Officer of the Registrar-General, India, who is rendering technical advice on the pre-census atlas. A series of maps of famine and pestilence was also prepared.

(ii) *Economic Studies* : Studies on historical trends in national economy continued during the year.

*A Socio-Economic Bibliography of India* : The broad object of this bibliographical project is to compile all available printed material bearing on the socio-economic situation in India from the remote past up to date. *A Socio-Economic Bibliography of India, 1870-1970* was submitted in 1970-71 to the Indian Institute of Advanced Study. Collaboration was offered to the publication of another volume *Industrialisation of India, 1919-1930: A Bibliography*.

During the year, a complete inventory of *British Parliamentary Papers of India, 1801-1949*, was arranged chronologically. Work on government publications continued.

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*Prices and Wages in West Bengal, 1870-1970* : The following data on prices have been compiled. The object is to build an index from 1700 to 1970 filling up gaps as far as possible. (1) Bengal : rice 1720-1970 with gaps; (2) Calcutta : rice 1753-1963; mustard oil, 1753-1815; Hooghly : rice, 1700-1953; wheat, 1700-1878; gram, 1700-1878; mustard oil, 1700-1786; Howrah : rice, 1700-1953; Burdwan : rice, 1783-1940; salt, 1783-1930; mustard oil, 1783-1812; there are wide gaps for the period 1830-1870 and 1820-1970. Attempts are being made to construct a preliminary index on the basis of data already compiled.

*Statistical Survey of Gorakhpur, 1814* : Dr. Francis Buchanan, appointed by the East India Company to conduct a comprehensive statistical survey of Bengal, conducted a survey in six districts of Bengal and Bihar in 1807-14. The Bihar and Orissa Research Society published a portion of the material. The entire manuscript was microfilmed from the India Office Library by the Indian Statistical Institute. It is intended to publish this valuable material with a suitable introduction. Work continued on the manuscript of Gorakhpur district.

(iii) *Sociological Studies* : A scheme on the "enlistment of scheduled castes and untouchables in India and their attributes" was prepared for the Indian Council of Social Science Research. There are plans to study the attributes of the castes from early British rule.

### M. *Computing Machines and Electronics Laboratory* :

The work of the Computing Machines and Electronics Laboratory during the year may be broadly classified under the following : (i) Theoretical Research, (ii) Experimental Research, and (iii) Design, Development and Construction.

Among the items of research may be mentioned :

(i) *Theoretical Research* : 1. Applied Probability, 2. Theoretical Physics, 3. Fluid Mechanics, 4. Flame stabilisation of Rectangular Cavity and Turbulent Flame Front, 5. Flow Model in a Hydrocyclone, 6. Tidal Flow in river Hooghly, 7. Flow Analysis in Electrochemical Machines, 8. Exterior Ballistics and 9. Digital Filtering Theory.

(ii) *Experimental Research* : 1. Memory Technology, 2. Speech Communication and Pattern Recognition Problems.

(iii) *Design, Development and Construction* : Some investigations have been conducted on the design and development of peripheral equipment of the digital computer. One high-speed paper tape reader with the control and electronics has been developed.

Some studies were made in the design of a small desk-top calculator (mini-computer). The instrument for computer teaching and education is in the final stage of completion. The instruments designed at the Institute for hard-of-hearing children were successfully commissioned by the Government of Tripura.

### 2.3 *Statistical Quality Control (SQC)* :

The SQC Division started functioning with three specialists in 1962 with a modest annual grant from the Government of about Rs. 50,000, to train engineers, technologists,

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workers, etc. and promote as well as develop the methods of quality control in Indian industries. With six factories and a yearly receipt for service of about Rs. 5,000 at its inception, the Division now services about 70 industrial establishments, scientific institutions, etc. and with a receipt of Rs. 10 lakhs annually covers almost two thirds of its expenditure. It has now a specialist staff complement of about 60.

In nearly two decades, the Division has trained over 10,000 executives, engineers, technologists and workers in short-term and specialised courses, produced over 200 specialists, serviced over 1,000 factories, brought out over 500 pamphlets, booklets, articles and other popular literature and conducted about 200 seminars, symposia, discussion-meetings, and conferences, to promote quality control over these years, in the country.

*Training:* During the year, over 1,900 executives, engineers, supervisors and workers in factories were trained in general and specialised courses in Quality Control.

About 50 specialists were turned out from the three Post-graduate Diploma Schools at Calcutta, Bombay and Madras. Fifteen apprentices were trained to develop their professional abilities.

Over 40 training manuals were developed in various specialised topics to suit engineering, chemicals, pharmaceuticals, textiles and electrical industries serviced by the Institute.

*Service:* Most of the attention during the year was centred on improving and developing quality control in factories from a system standpoint. This decidedly called for intensive effort. Sixty-six plants were thus covered, 396 reports were submitted to the management on the various studies conducted, and 39 plants in which quality control systems had been established were advised to manage on their own. The staff were duly trained. Twentyone new factories were taken up for servicing.

A significant opportunity opened up during the year to take up SQC in Administration. The Department of Administrative Reforms, Ministry of Home Affairs, Government of India, showed keen interest in the application and development of quality control in the various departments and Ministries of the Government of India to explore stepping up the operational efficiency of administration. The Institute finalised standing arrangements with the Department to undertake SQC and Operational Research studies and training on a continuing basis.

Six specialists left the services of the Institute during the year. The committed load of service and training were, however, satisfactorily met, by improvised planning and rational deployment of the available specialists in the Division. There was also a significant improvement in the promotional and publication effort of the Division. Judged from the growing job-opportunities for the quality control specialists, it is heartening that more and more managements in the country have begun increasingly to appreciate the role and scope that scientific quality control techniques can play in stepping up product-quality and productivity of manufactured goods.

*Promotion and publication:* Pilot studies were launched in the biggest public utility service in the country—Railways. Project reports and proposals for commencing

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detailed SQC studies were finalized. The Railway Board has sought the assistance of the Institute to explore improvements in systems of servicing and reservations of goods traffic.

The specialists of the Division participated in 13 seminars, conferences and gave 56 talks and lectures on various topics of quality control. Seven papers were published, highlighting the applications of quality control in various industries. The specialists paid 67 promotional visits to new plants, conducted 19 preliminary surveys on which 45 reports were prepared.

During the period, the Division published the proceedings of the Fifth All India Conference on Quality Control held in March 1971 and also the proceedings of Symposium on SQC in Developing Countries.

*Research*: A significant breakthrough was achieved in research; seven papers were published dealing with improved techniques and procedures in quality and operational research and 10 more have been taken up for publication.

*Special Activities*: The Division launched two new projects. One of them dealt with the assessment of current status of quality control in Indian industry and the other was a methodological study concerned with the measurement and evaluation of total Quality Control in a plant. Results are being analysed.

### 2.4 Library and Information Services:

The Central Library at Baranagar had a collection of 1,30,687 books and bound journals; 33,061 reprints, monographs, specialised technical reports, besides a large collection of maps, microfilms and photoprints. During the year, the Library received 2,607 current periodicals—883 through subscriptions, 1025 on an exchange basis and 699 as gifts. The services of the branch libraries at Bombay, Bangalore, Baroda, Cochin, Coimbatore, Delhi, Giridih, Madras and Trivandrum were co-ordinated with the Central Library to serve the researchers, students and staff working at those centres.

*Membership*: The total membership of the Library increased to 2,380 (1,860 research and other staff members of the Institute, students attached to the Research and Training School, 315 outside student members, 160 sessional members and 45 Institute members). One hundred sixty-five persons were given special permission to use the Library during the period.

*Acquisition*: The Library purchased 1,116 books and other documents, received 274 books on an exchange basis and 460 books as gifts and also added 558 official reports and data books. The Library received scientific and technical publications in Russian and Japanese languages in exchange for publications of equal value from the Lenin State Library; the Fundamental Library of Social Sciences, USSR; the Library of the USSR Academy of Sciences; M.E. Saltykov Schedrin State Public Library, USSR, and the Institute of Developing Economics, Tokyo. Thirty-two new periodicals were added to the Library, of which 17 were on subscription, one on an exchange basis and 14 as gifts. The Library also acquired back-runs of two periodicals on mathematics to make the collection more comprehensive. Exchange arrangements were continued with 164 foreign and 65 Indian institutions; periodicals and other serials were received from them in exchange for the *Sankhyā*, the *Indian Journal of Statistics*.

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*Accession :* During the period, 2,329 books and other documents were accessioned, of which 250 were official reports and data books.

*Technical processing :* The Library classified 1,814 books and 43 official reports and catalogued 2,672 books and 43 official reports. The figures for book classifications and catalogue cards revised were 48 and 198 respectively. During the period, 234 reprints were catalogued and added to the reprints collection; 8,663 cards were filed and 271 copies of books added to the collection. The Library processed and indexed 1,682 old files, 2,375 newspapers and 5,766 maps.

*Circulation :* Seventeen thousand seven hundred forty-one books and 23,169 journal parts or volumes were issued on reference and 12,928 books on lending. Besides, 1255 official reports, 460 maps 78 newspapers and 64 old files were issued for reference use. The Library sent 68 books and journals to the Branch libraries. In inter-library loan transactions with 18 local and out-station libraries, the number of books borrowed and loaned was 69.

*Reference and bibliographic services :* The Library issued selected reading lists on different subjects, compiled bibliographies and documentation lists on request and answered 870 short reference questions.

*Publications :* The Library continued to bring out regularly the *Monthly Bulletin* and *List of Selected Periodicals*. The *Index to Statistical Literature* was maintained on cards for internal reference.

*Translation service :* The Translation Unit provided the research workers with translations from foreign languages and translated 16 documents; of these 8 documents from Russian, 5 from German, 2 from French and 1 from Chinese were translated into English. The number of pages translated was 220. Oral translations were provided to the specialists on demand. A programme was taken to translate "The Theory of Multivariate Analysis" (ta hen ryoku kaiseki ron)—a collection of essays edited by Professor Kitagawa of the Tohoku University, Japan, published in 1966. The translation is in progress.

*Photography and reprographic service :* The Reprography Unit and the Photography Unit microfilmed 19,837 pages of scientific treatises and other reading materials and prepared 9,137 pages of photoprints. The other activities of the Photography Unit include photostat copies of maps, plans and drawings—142; reproduction of old photography, drawings and charts—304; bromide enlargements—4,567 and photographs—1,012. The number of pages (of original documents) xeroxed was 2,075 and the total number of pages printed was 7,403. Two hundred slides were also prepared for the scientific departments of the Institute. Microfiche negatives of 97 documents (3,705 pages in all) were prepared during the period. The Library also extended reprographic service to the Indian National Scientific Documentation Centre (INSDOC) and several other outside institutions.

*Circulating Library :* The Workers' Circulating Library had a collection of 25,332 books and the total number of members was 1,766. During the period, the Circulating Library added to its collection 501 books, of which 58 books were in English, 389 in Bengali and 54 in Hindi. It issued 44,849 books to the members and 470 books to Branch libraries.

### 2.5 Documentation Research and Training Centre (DRTC), Bangalore

The six candidates, admitted to the Documentation Course for 1970-71, completed their formal training. They are now working on the trend report to qualify for the Associateship in Documentation.

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Seven candidates were admitted to the Documentation Course (1971-72) which commenced on 15 April 1971.

*Research* : The main subjects of research were : 1. Classification, 2. Cataloguing, and 3. Documentation.

*Seminars and conferences* : The following seminars were organised by the DRTC : 1. Seminar on Reference Service, 24-30 May 1971; 2. DRTC Annual Seminar, 14-18 February 1972; (details of these two seminars are given in the chapter on "Seminars and Conferences conducted by the Institute"); and 3. Seminar on Mechanised Information Retrieval, organised in collaboration with the British Council, on 17 February 1972.

*Publications* : The DRTC continued to collaborate with the Sarada Ranganathan Endowment for Library Science in publishing the quarterly *Library Science with a Slant to Documentation*. The following were the other DRTC publications : 1. DRTC Annual Seminar (9) 1972, Volume of Papers, pp. 556. 2. Mid-year Seminar on Reference Service (May 1971)—working paper and proceedings, pp. 380. The following books by the DRTC staff were printed/mimcographed :

1. "Education and Library System of the Nation" by S. R. Ranganathan. Published by Mysore Library Association, Bangalore, pp. 68.
2. "Use of Documentation" by A. Neelameghan. pp. 168 (mimcographed).

*Paper contributed* : During the period, the staff of the DRTC contributed 53 papers to seminars and conferences and for publication in library science periodicals.

*Consultancy service* : The DRTC provided consultancy service and guidance to several public sector industries, research institutions, government departments, universities, etc. for setting up and organising their library and documentation services. Among them may be mentioned the Hindustan Aeronautics Ltd., Bangalore; Central Food Technological Research Institute, Mysore; Council of Scientific and Industrial Research; Directorate of Medical Sciences; Ministry of Defence, New Delhi; Delhi University and Jawaharlal Nehru University, Delhi.

*Lectures* : The staff members delivered 18 lectures on documentation and allied subjects in India and abroad.

*Library* : The library received 354 books, 97 bound volumes of periodicals, and two new periodicals.

Talks on 18 subjects were given by the DRTC staff under the auspices of outside organisations. Seventeen colloquia were also organised.

### 3. INTERNATIONAL STATISTICAL EDUCATION CENTRE (ISEC), CALCUTTA

The International Statistical Education Centre (ISEC) is operated jointly by the International Statistical Institute and the Indian Statistical Institute, under the auspices of the UNESCO and the Government of India. The Twentyfifth Term functioned under a Board of Directors with Professor P. C. Mahalanobis as Chairman.



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Twenty trainees from ten different countries in the Middle-East, South and South-East Asia, the Far East and also from the Commonwealth countries of Africa attended the regular course.

The Government of India awarded 13 fellowships for the foreign trainees in the Twentyfifth Term, under the Technical Cooperation Scheme of the Colombo Plan (10), and the Special Commonwealth African Assistance Plan (SCAAP) (3). There were three trainees outside the Colombo Plan and the SCAAP for the regular course—one each from the following countries : Republic of China (Taiwan), Fiji Islands and Malaysia. One of the Colombo Plan scholars from Iran was on a special course to study housing and construction statistics under the auspices of the ISEC at the Central Statistical Organisation and the National Sample Survey Division of the Indian Statistical Institute.

The Twentyfifth Term opened on 1 June 1971. English is the medium of instruction at the Centre. The training imparted included lectures, laboratory work, project training, assisted reading and field work. The first three months at Calcutta were devoted to general Statistical Methods including Auxiliary Mathematics, Computational Techniques, Probability Theory, Numerical Mathematics, Sampling Techniques, Economics, Economic Statistics and Statistical Organisation and Procedure. As in the previous terms, a six-week training in governmental statistics was given at the Central Statistical Organisation, New Delhi, during October-November 1971. From February 1972 up to the end of March 1972, specialisation courses on an individual basis were given in the following fields : Large Scale Sample Surveys, Economic Planning, Data Processing, Statistical Quality Control and Vital Statistics and Demography. During the last four months, general lectures were also given on Probability Theory, Vital Statistics and Demography, Sampling Theory, Statistical Distribution, Inference. Large-Scale Sample Surveys with special reference to National Sample Surveys. Advanced Statistical Methods, Analysis of Variance and Elements of the Theory of Design of Experiments, Economic Statistics and Economic Planning.

Seventeen trainees who took the regular course were all successful in the final examination and were awarded Certificates of Merit.

Professor M. Tasaka, Faculty of Engineering, Osaka State University, Japan, acted as the Visiting Professor during the term. He delivered a series of lectures on some aspects of the Statistical Quality Control to the general body of students. He also conducted a specialisation course on Statistical Quality Control for a selected group of students. Professor N. Ishida, Tokyo College of Economics, delivered a course of lectures on Index Number Theory to the trainees.

### 4. NATIONAL SAMPLE SURVEY

*National Sample Survey Project :* This Division of the Indian Statistical Institute functions as the technical wing of the Government of India's National Sample Survey Organisation.

The twentyfifth and twentysixth rounds of the regular National Sample Survey and the Annual Survey of Industries for 1969 and 1970 were in operation during the period under review. Five different countrywide enquiries were conducted in the socio-economic surveys. Schedule 18-series which is the main enquiry of the twenty-sixth round, is

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intended to collect detailed information on landholding particulars as well as debt and investment aspects of both rural and urban households.

The activities of the Division covered the following types of work during the year :

(a) statistical planning of the surveys including sample designs, concepts and definitions, methods of collecting primary information, selection of sample villages and urban blocks, preparation of schedules of the different enquiries, training of field workers and technical work relating to field enquiries ;

(b) programming of statistical processing and the laying down of detailed specifications;

(c) conducting field work in the State of West Bengal and the city of Bombay, together with experimental researches for the improvement of sampling design and techniques; and

(d) the processing of NSS data and preparation of statistical reports based on them.

The processing and tabulation work covered the data collected in the twentieth to twenty-sixth rounds of socio-economic surveys and the Annual Survey of Industries, 1968 and 1969.

The tabulation and processing work was carried out in Calcutta (Baranagar), Delhi and Giridih. The number of schedules scrutinised was 57.3 thousand, the number of cards punched was about 2803.90 thousand and there were about 13,751 thousand card passages.

The equipment consisted of sixteen tabulator units with necessary auxiliary machines, of which eight units were at Calcutta, four at Delhi and four at Giridih.

The field work of the twentyfifth round (NSS) in West Bengal was completed in June 1971 and that of the twentysixth round which commenced in July 1971 is still in progress.

The preliminary work on planning and sample designing for the twentyseventh round of the NSS has already been taken up.

*Training* : The training programme on survey techniques were arranged for research apprentices of the RTS, members of the Indian Statistical Service, statistical officers from Government departments and the trainees of the International Statistical Education Centre and the UN, UNAIID, FAO and other fellowship holders.

Some of the senior staff attended meetings of the NSSO Governing Council related to NSS work and programme, and participated in regional training conferences.

Five NSS draft reports, approved for printing, were revised in the light of the comments received from the Central Statistical Organisation (CSO) and finalised version of the reports were submitted to the Government for printing. Six draft reports were prepared and submitted to the Government of India during the period (*Annexure 3*).

Sixteen draft reports prepared by State Governments on the basis of the NSS State sample data forwarded to the Institute by the CSO were examined and the Institute's comment on them were communicated to the CSO during the year (*Annexure 3*).

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The staff members prepared three technical papers during the year.

*Special Studies Unit* : The following developmental studies were carried out during the period under review :

1. The series of experiments for trying out alternative sample designs in crop estimation surveys and studying their relative merits, were continued during the spring (1970-71) and autumn seasons in several districts of West Bengal. Apart from an estimation of acreage and outturn of the principal crops, a number of invariants such as house and housesite, roads, paths etc., which do not change abruptly from season to season were also enumerated to provide an objective check over the quality of data collected.

2. A scheme for a continuous crop-estimation survey with crop-cutting experiments carried out from month to month throughout the year has been taken up from the winter season in a few selected districts in West Bengal. A new approach to cover all the harvests (paddy), irrespective of the conventional seasons, has been made.

3. Type studies on fish-catch estimation obtained through household interviews and an accounting of local production against household consumption of fish were completed in March 1972 at Barasat (24 Parganas).

4. A study on cultivation practices, an accounting of various operations, utilisation of man-power and animal power from day to day which were started in January 1971 in a rural centre in Midnapur district, were completed in March 1972. An objective assessment of cereal consumption in individual households by a direct weighing of cereals to be consumed on specific days was also conducted to be contrasted against data collected by the usual method of household interview.

5. A type study was undertaken in February-March 1972 in two selected villages in Midnapur district to investigate the variation of medical indications such as blood pressure, pulse rate etc. caused by recurring diseases. Sampled individuals were examined by medical practitioners at a regular interval of one month.

### 5. PROFESSIONAL EXAMINATIONS

All the four open professional examinations were held during 1971—(i) Statistician's Diploma, (ii) Computer's Certificate, (iii) Statistical Field Survey, and (iv) Punched Card Machine. The Statistician's Diploma and the Computer's Certificate examinations were as usual held twice during the year in May and November; the Punched Card Machine examinations were held once in May and the Statistical Field Survey examinations only once in November.

Six of the examination centres—Bombay, Calcutta, Delhi, Giridih, Lucknow and Madras—have always some candidates to offer. Both during the sessions in May 1971 and November 1971, additional centres were opened at Bangalore and Hyderabad. The largest number of candidates appear from the centres in Calcutta and Delhi.

The details of candidates who registered and appeared for the examinations during the year 1971 are given below :

(i) *Statistician's Diploma Examination* : During 1971, 142 candidates (70 in May; 63 in November) registered for the examinations and 22 candidates (13 in May; 9 in

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November) failed to appear in any of the papers. Of those who finally appeared in 1971, 67 candidates (35 in May; 32 in November) passed in one or more papers.

### (ii) *Computer's Certificate Examination :*

Thirty-seven candidates (20 in May; 17 in November) registered for the examination in 1971. Only 2 candidates in November 1971 failed to appear in any of the papers. Of those who finally appeared, 16 candidates (8 in May; 8 in November) passed in one or more papers.

### (iii) *Statistical Field Survey Examinations :*

(a) In November 1971, three candidates had registered for the Field Survey Diploma examinations. Two appeared and only one passed in all the papers.

(b) In November 1971, two candidates registered for the Field Survey Senior Certificate Examination. One was absent and the other candidates who appeared in Paper II along with his field Survey Diploma Examination, passed.

(c) In November 1971, only one candidate registered for all the three papers in the Field Survey Junior Certificate Examination. He passed in all the three papers.

### (iv) *Punched Card Machine Examinations :*

In May 1971, the only candidate who registered for one paper of the Punched Card Machine Operators Certificate examination, appeared but failed. In May 1971, two candidates registered for two papers each of the Punched Card Data Processing Diploma examination. Both these candidates appeared but only one passed in one paper.

*Number of successful candidates qualifying for the award of Diplomas and Certificates in Open Professional Examinations :* The number of candidates who had successfully completed the entire professional examinations and qualified themselves for the award of Diplomas and Certificates during the year 1971 are given below.

*Statistician's Diploma :* Four candidates (2 in May; 2 in November) qualified.

*Computer's Certificate :* Two candidates (1 in May; 1 in November) qualified.

### *Statistical Field Survey Examinations :*

- (i) *Diploma :* One candidate qualified.
- (ii) *Senior Certificate :* No candidate qualified.
- (iii) *Junior Certificate :* One candidate qualified.

### *Punched Card Examinations :*

- (i) *Data Processing Diploma Examination :* No candidate qualified.
- (ii) *Machine Operator's Certificate Examination :* No candidate qualified.

## 6. CONFERENCES AND SEMINARS CONDUCTED BY THE INSTITUTE

6.1 *Seminar on Reference Service :* The third Mid-year Refresher Seminar on Reference Service was inaugurated in the Documentation Research and Training Centre,

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Bangalore, 24-30 May 1971, by Dr. S. R. Ranganathan, National Research Professor in Library Science and Honorary Professor, DRTC. Fifty delegates from all over the country attended. The various factors which had to be considered to organise an effective reference service formed the theme of the seminar. To facilitate discussion on proper lines, a working paper consisting of 15 chapters was prepared by the teaching staff of the DRTC. Eighteen propositions, arising out of the working paper, were discussed in the seminar.

6.2. *Seminar on Documentation* : The Ninth Annual Seminar on Documentation, held in the Documentation Research and Training Centre, Bangalore, 14-18 February 1972, was inaugurated by Dr. S. R. Valluri, Director, National Aeronautical Laboratory. About 80 delegates participated. The broad areas of discussion were : 1. Abstracting, Indexing and Reviewing periodicals; 2. Pattern of use of documents by specialists; and 3. Comparative study of schemes for library classification.

6.3 *Seminar on Mechanised Information Retrieval* : In collaboration with the British Council, the Documentation Research and Training Centre, Bangalore, organised a Seminar on Mechanised Information Retrieval on 17 January 1972. Fifty librarians and other interested persons attended. Dr. E. V. Krishna Murthy, Applied Mathematics Division, Indian Institute of Science, was the moderator.

6.4 *Seminar on Hindi Phonetics* : The Seminar on Hindi Phonetics, organised by the Indian Statistical Institute, in New Delhi, 24-25 February 1972, was inaugurated by Professor S. C. V. Aiyar, Director, National Council of Educational Research and Training. About 200 delegates attended. Professor Djordje Kostic, Director, Institute for Experimental Phonetics and Speech Pathology, Belgrade, Yugoslavia, who had been conducting research in linguistics in collaboration with the Indian Statistical Institute, delivered the key-note address on "The acoustic structure of Hindi speech sounds."

A number of questions were raised in the Seminar in connection with the phonetic structure of Hindi speech sounds, and their role and inter-relationships in the formation of word meanings. The problem was discussed from phonetic, linguistic, psycholinguistic, semantic and electro-acoustic points of view. The material on Hindi phonetics was also discussed from the point of view of teaching Hindi as a second language to non-Hindi-speaking people. The relation between Hindi phonetics and speech pathology, specially the problem of acquiring Hindi by hard-of hearing people, was also discussed.

6.5 *Summer Institute on Social Survey Research Methodology* : On behalf of the Indian Statistical Institute, the Sociological Research Unit and the United States Educational Foundation in India, New Delhi, jointly sponsored the Summer Institute on Social Survey Research Methodology, at Puri and Calcutta, May-June 1970.

6.6 *Summer Course on Research Methodology in Social Sciences* : Sponsored by the Indian Council of Social Science Research and in collaboration with the statisticians of the Indian Statistical Institute, the Sociological Research Unit organised a eight-week Summer Course on Research Methodology in Social Sciences, July-August 1971, for 30 researchers (mostly registered for the Ph.D. degree).

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### 7. VISITING SCIENTISTS

A number of distinguished foreign scientists participated in the research, training and other scientific activities of the Institute during the year. Some of them came to the Institute on invitation and spent fairly long periods at the Institute to assist in the regular work, while others came for short periods and gave lectures and seminars. Most of them were available for consultations by research workers and teachers of the Institute.

I. The following scientists visited the Institute on invitation and worked for fairly long periods during the year 1971-72. The duration of the visit is mentioned within brackets against each name.

DR. **MAKHAZ G. ABDUSHELISHVILI**, Director, Department of Anthropology, Institute of Archaeology and Ethnography, Academy of Sciences, Georgian SSR, and Professor, Tbilisi State University, came with a team of three Soviet scientific workers from the USSR Academy of Sciences, on a joint anthropological research project (31 March 1971-26 May 1971). The other members of the team were : (i) DR. (MRS.) **IRINA MIKHAILOVNA SEMASHKO**, Institute of Ethnography, (ii) DR. **V. P. VOLKOV-DUBROVIN**, Institute of Ethnography and Museum of Moscow State University, and (iii) DR. **A. A. VORONOV**, Department of Anthropology, Institute of Ethnography.

The Soviet scientists worked jointly with a team of four workers from the Anthropology and Human Genetics Research Unit to study five caste groups, namely, Rajput, Ahir, Jat, Gujar, and Chamar (Julaho) in villages around Delhi city. The results will appear in series of volumes to be published in English and Russian.

DR. **RUDOLF ALTEVOGT**, Director, Zoology Institute, Münster University, Münster, Federal Republic of Germany and Mrs. **Rosamunde Altevoigt** (26 February 1972-22 March 1972) discussed research work in the Crop Science Unit. They visited the Sunderbans to study Fiddler Crabs and also visited the following organisations in Calcutta : Zoological Survey Office, Zoological Gardens, Botanical Survey, and the West Bengal Forest Department.

MR. **N. M. BLAKE**, Department of Human Biology, John Curtin School of Medical Research, Australian National University, Canberra (10-26 April 1971), came on his third visit to work in the Anthropometry and Human Genetics Unit. Mr. Blake, an expert in the electrophoretic study of enzymes, is an associate of Dr. R. L. Kirk, who had initiated some projects on human genetics during earlier visits.

DR. **PRAMIT CHAUDHURI**, University of Sussex, United Kingdom, (1 August 1971-8 December 1971), gave lectures on development planning to the students of the two-year research course in economics, at the Planning Unit, Delhi. He worked on economic policy problems of a mixed economy. *Seminar* : Some aspects of economic policy in a mixed economy.

PROFESSOR **NOZOMU ISHIDA**, Tokyo College of Economics, (18 November 1971-29 March 1972) delivered a course of lectures on Index Number Theory to the trainees of the International Statistical Education Centre, Calcutta.

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Dr. P. C. JOSHI, Deputy Economic Adviser, Department of Economic Affairs, Ministry of Finance, Government of India (15 October 1971-23 January 1972) joined the Planning Unit, Delhi, to work on an econometric model of the sugar industry in India. *Seminar* : The sugar cycle : a diagnosis.

Dr. G. KELLERMANN and Mrs. KELLERMANN, Research Assistants of Professor H. Walter, Anthropologisches Institut der Johannes-Gutenberg, Universität Mainz, Federal Republic of Germany (29 January 1972-21 March 1972) worked in the Anthropometry and Human Genetics Research Unit on a population genetics programme among two caste groups.

PROFESSOR RAJINDER K. KOSHAL, Department of Economics, Ohio State University, USA (5 August 1971-21 March 1972) taught macro-economic theory to the trainees of the two-year research course in economics at the Planning Unit, Delhi. He contributed two papers for presentation at the Eleventh Indian Econometric Conference. He also had discussions with officials of government agencies on health problems connected with air pollution. *Seminar and Lecture* : (i) Marginal cost-pricing in the transportation industry, (ii) Resource allocation in transport industry in India : a marginal cost analysis.

PROFESSOR DJORDJE KOSTIC, Director, Institute for Experimental Phonetics and Speech Pathology, Belgrade, Yugoslavia (3 January 1972-11 March 1972) came on his fourth visit to the Institute in connexion with the programme of fundamental linguistic research being carried out in collaboration between the Indian Statistical Institute and the Institute for Experimental Phonetics and Speech Pathology.

Professor Kostic stayed in New Delhi, Hyderabad and Calcutta in connection with his research and advisory work. In New Delhi, he took an active part in the Seminar on Hindi Phonetics, 24-25 February 1972, and delivered three lectures. He visited a number of educational institutions and research organisations for discussions on the phonological structure of the Hindi language, dialectological variations in Hindi phonology, problems of language teaching, pronunciation of Hindi announcers, speech rehabilitation, teaching Hindi in non-Hindi speaking areas and the efficacy of contrastive phonetics method in language teaching.

In Hyderabad, he visited the Osmania University in connection with the organisation of a programme of fundamental linguistic research in the University. He discussed with other educationists the situation in Andhra State regarding literacy and speech and hearing problems, and the recording of Telugu speech sounds for spectrographic analysis to be presented at the proposed Telugu Phonetics Seminar.

In Calcutta, he discussed with the scientists of the Institute, the application of statistical methods to linguistic data and future plan and programme of research in the Linguistic Research Unit. He conducted research in collaboration with the technical personnel of the Institute on (i) Suprasegmental elements in the Bengali language, (ii) Psychophonetic research with the Philips Millor Reproducer, and (iii) Determination of hearing norms in Indian subjects.

*Lectures* : (i) The acoustic structure of Hindi speech sounds, (ii) A detailed analysis of Hindi vowels, (iii) A detailed analysis of Hindi constants. (all three lectures were

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delivered at the Seminar on Hindi Phonetics, New Delhi, 24-25 February 1972), (v) Phonetics and Speech Pathology (Osmania University, Hyderabad, 14 February 1972).

MR. KENZHO MATSUTANI, Senior Overseas Research Officer, Institute of Developing Economies, Tokyo, Japan (Arrived 16 March 1971) has been working at the Planning Unit, Delhi, on a study on "Social Changes and the Impact of Industrialization in India, with special reference to Bihar, Punjab and Mysore." He is expected to work in the Institute for two years.

PROFESSOR NORMAN WINGATE PIRIE, F.R.S., Head, Biochemistry Department, Rothamsted Experimental Station, Harpenden, Herts, United Kingdom (4-22 February 1972) came on a third visit in connection with research for exploring the possibilities of producing protein from green leaves to supplement food requirements in India.

DR. PAMELA ROBINSON, University College, London (14-30 January 1972) came to discuss problems of research with staff members of the Geological Studies Unit. She participated in the meeting of the Advisory Committee of the G.S.U. She gave an interesting seminar on the comparison of Gondwana Vertebrates from India and South Africa.

DR. ANDRE G. ROBYNS, Research Scientist, National Foundation for Scientific Research, National Botanical Gardens of Belgium in Brussels; Visiting Professor at the Smithsonian Flora of Ceylon Project, Royal Botanical Gardens, Peradeniya, Ceylon (18-24 April 1971). Dr. Robyns is a world authority on the plants belonging to the Bombacaceae group, on which the Crop Science Unit has conducted research for the last ten years. He had discussions with technicians of the Unit and visited the Botanical Gardens to examine some plants of common interest.

PROFESSOR MASAO TASAKA, Faculty of Engineering, Osaka University, Osaka, Tokyo (7 December 1971-20 March 1972) was the visiting professor at the International Statistical Education Centre, Calcutta, during its twentyfifth term. He delivered a series of lectures on some aspects of Statistical Quality Control and also conducted a specialisation course on the same subject.

DR. DANIEL THORNER, Department of Economics, University of Sorbonne, Paris (24 September 1971-24 October 1971) worked both in Calcutta and Delhi. Seminars : (i) Famine in Bangla Desh : conflicting orders of magnitude, (ii) Famine in Bangla Desh : a non-self-fulfilling prophecy ?

II. *The following are some of the scientists who paid short visits and gave lectures and/or seminars, and participated in conferences.*

DR. MALCOLM S. ADISESHIAH, Director, Madras Institute of Development Studies, (15 February 1972). *Lecture* : Some problems in the development of library and documentation services.

PROFESSOR A. BISWAS, Delhi School of Economics, Delhi (6-7 September 1971). *Lecture* : Sraffa's system of production.

PROFESSOR S. K. CHATTERJEE, Indian Institute of Science, Bangalore (31 May 1971). *Lecture* : Antenna (DRTC, Bangalore).



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DR. A. R. DRAI, Head, Department of Sociology, University of Bombay, (9 February 1972). *Lecture* : Scope of sociology (DRTC, Bangalore).

DR. J. V. DESHPANDE, Manchester-Sheffield School of Probability and Statistics, University of Sheffield, U.K. (16-18 August 1971). *Lecture* : Tests based on linear functions of ordered ranks.

DR. JOHN WAGUN DICKEY, Department of Civil Engineering and Environmental and Urban System, Virginia Polytechnic Institute and State University, U.S.A. (14 September 1971). *Seminar* : Technique for optimal replacement of activities in zones (TOPAZ) for metropolitan planning.

PROFESSOR C. R. EKAMBARAM, Director, Institute of Mass Communication, New Delhi (26 August 1971). *Lecture* : Some aspect of mass communication. (DRTC, Bangalore).

DR. JACK B. FISHER, Fairchild Tropical Gardens, Miami, Florida, U.S.A. (9 August 1971). *Lectures* : Experimental studies on the hormonal control of branching in a tropical ornamental shrub.

PROFESSOR R. W. GOLDSMITH, Department of Economics, Yale University, USA (19-27 January 1972). *Lectures* : The study of long-term trends in financial development.

DR. D. J. GUBLER, Johns Hopkins University Centre for Medical Research and Training, Calcutta (6 May 1971). *Lecture* : Transmission dynamics of urban filariasis in Calcutta.

PROFESSOR ROBERT HERDT, University of Illinois, USA (19 April 1971). *Seminar* : A model of wheat agriculture in North-West India.

PROFESSOR E. A. J. JOHNSON, Johns Hopkins University, Baltimore, USA (19 April 1971). *Seminar* : Market towns and spatial development.

DR. A. KABI, Manager, Service Department, UKCIS, England (17 January 1972). *Seminar* : Mechanised information retrieval (DRTC, Bangalore).

DR. JIBI KABRI, Head, Department of Library Science, Charles University, Czechoslovakia (3 December 1971). *Lecture* : National library system of Czechoslovakia (DRTC, Bangalore).

PROFESSOR K. R. KADIYALA, Purdue University, USA (31 July 1971). *Seminar* : Estimation of simultaneous equations.

PROFESSOR JAN KUČERA, Department of Mathematics, Washington State University. (25-29 July 1971). *Lectures* : (i) Multipliers of temperate distributions, (ii) Accessibility of a central problem.

DR. (MRS.) SUSEELA KUMAR, Librarian, British Council, Madras (14-18 February 1971). *Lecture* : Reference service (DRTC, Bangalore).

DR. SURHAMAY KUNDU, University of California, Berkeley, USA (3 February 1972). *Lecture* : Some recent results in graph theory.

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DR. S. C. LAL, Vico-Chancellor, Allahabad University, Allahabad (29 April 1971).  
*Lecture* : Importance of documentation (DRTC, Bangalore).

PROFESSOR G. S. MADDALA, University of Rochester, USA (9 August 1971). *Seminars* :  
(i) Likelihood methods of the estimation of distributed Lag Models, (ii) Likelihood methods  
for estimation of large econometric models.

DR. ANOVAR ABDUL MALEK, Chief of Research, Centre National de la Recherche  
Scientifique (Centre d'Etudes Mouvement Sociaux) Paris (11-14 November 1971). *Lectures* :  
The new balance of world power and the future of political and social theory.

DR. S. NATARAJAN, University of Manchester, U.K. (21-23 July 1971). *Lecture* :  
The isomorphism problem in Ergodic theory.

SRI ABDUL RAHMAN, Business Information Officer, Andrew Yule & Co., Calcutta  
(12 June 1971). *Lecture* : Information service to management (DRTC, Bangalore).

SRI M. V. RAOANATHAN, Hindustan Machine Tools Ltd., Bangalore (27-30  
April 1971 and 21-25 March 1972). *Lectures* : Translation (DRTC, Bangalore).

MR. ANTHONY SANTIAGO, Department of Primary Education, Orohid Section,  
Government of Singapore (10 February 1971). *Lecture* : Enneametric systematics of know-  
ledge (DRTC, Bangalore).

DR. M. SIRSI, Department of Microbiology and Pharmacology, Indian Institute of  
Science, Bangalore (2 September 1971). *Lecture* : Steroidal hormones. (DRTC, Bangalore).

DR. K. P. SRINATH, Department of Statistics, Bangalore University (20 March 1972).  
*Lecture* : Statistical approaches for administrative decisions (Mysore State Branch).

PROFESSOR DAVID STARRETT, Department of Economics, Harvard University, USA  
(17 March 1972-7 April 1972) came to work in the Planning Unit, Delhi. He gave a series  
of lectures to the students of the two-year research course. *Seminars* : (i) Money and  
transaction costs, (ii) The optimal degree of increasing returns : Optimal size of a city.

DR. V. V. N. SOMAYAJULU, N.O.A.E.R., New Delhi (28 August 1971). *Seminar* :  
Some methodological problems in inter-industry analysis.

PROFESSOR ANDRE TIANO, Department of Economics, University of Paris; French  
National Institute of Statistics and Economic Studies; accompanied by Mrs. Tiano. (25-29  
July 1971). *Seminar* : The problem of disguised unemployment in North Africa.

DR. T. E. WEISSKOPF, Department of Economics, University of Harvard, USA  
(18 December 1971). *Lecture* : Radical economics in the United States.

III. *The following are some of the visitors who came to the Institute for short periods  
during the current year on different assignments.*

DR. CHARLES BOWE, Director, U.S. Educational Foundation in India, New Delhi  
(16 November 1971).

MR. PETER VON BUTLER, Consul, Consulate-General Office, Federal Republic of  
Germany (16 March 1972).

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MR. TASUKU HORI, Deputy Chief, Administrative Division, Institute of Developing Economics, Tokyo (17 March 1972).

PROFESSOR H. KAWAI, Department of Comparative Politics, Faculty of Law, Gakushuin University, Tokyo (8-14 April 1971).

SHERI N. M. KETKAR, Director, SSCD, Indian Council of Social Science Research, New Delhi (6 October 1971), (DRTC, Bangalore).

DR. R. L. KIRK, John Curtin School of Medical Research Australian National University, Canberra, Australia. (23-25 November 1971), came on his fourth visit in connexion with some collaborative studies on enzyme variants in the Anthropometry and Human Genetics Research Unit.

MR. MASAO KITAZAWA, Researcher, The Study Centre on Asian Trade Structure, Tokyo (9 September 1971).

PROFESSOR KOSTEMANS, A.J.G.H., Director, Botanical Gardens, Indonesia (5-7 April 1971 and 21-22 April 1971).

PROFESSOR SELJI NABEYA, Department of Statistics, Hitotsubashi University, Kunitachi, Tokyo (22-25 February 1972).

MR. KOHEI OHKATA, Secretary, Japan Committee for Studies in Economic Development in India and Japan (21 March-18 April 1971 and 10-14 December 1971).

DR. HENRY P. SCHAPPER, Department of Agricultural Economics, University of Western Australia, Nedlands, Australia (25 October 1971).

MR. J. E. SCHOFIELD, Chief Librarian, British Council, New Delhi (1 December 1971). (DRTC, Bangalore).

DR. K. C. SEAL, Director (Planning), Ministry of Health and Family Planning, Government of India, New Delhi (24 February 1972).

DR. K. V. SRIDHARAN, Director, National Institute of Social Science, Bangalore (26 August 1971) (DRTC, Bangalore).

DR. R. C. SRIVASTAVA, Department of Mathematics, Ohio State University, USA (20 June-25 July 1971) worked on some problems of characterisation of distribution.

DR. H. WALTER, Anthropologisches Institut der Johannes-Gutenberg, University Mainz, Mainz, Federal Republic of Germany (29 October 1971-4 November 1971) came for discussion on a collaborative project with the Anthropometry and Human Genetics Unit.

MR. KATO YUZO, Research Fellow (History), Institute of Oriental Culture, University of Tokyo (5-11 October 1971).

DR. GEORGE ZAIDAN, Population Projects Department, World Bank, Washington (29 July 1971).

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### 8. HONOURS, AWARDS AND SPECIAL ASSIGNMENTS

#### (i) *Honours and Awards :*

Professor T. A. Davis was elected a Scientific Fellow of the Zoological Society of London. He was also made an Associate Editor of the *Fibonacci Quarterly*, a mathematical journal published from California.

Professor M. Mukherjee (*National Income*) was elected President, Indian Association for Research in National Income and Wealth in 1972, for four years.

Dr. Supriya Sengupta (*Geology*) was elected to the Council, International Association of Sedimentologists.

#### (ii) *Special Assignments :*

Dr. N. Bhattacharyya (*Economic Research*) joined the Delhi School of Economics as a Visiting Fellow from 26 July 1971 for nine months.

Professor M. Mukherjee (*National Income*) was entrusted to organise the session on Economic Accounting for Developing Countries, one of the subjects to be included in the programme of the General Conference, International Association for Research in Income and Wealth, proposed to be held in Hungary in 1973.

Professor M. Mukherjee was invited to serve as the Chairman of a Committee to be set up by the Department of Statistics, Cabinet Secretariat, Government of India, to advise on the accounts that should be prepared at the State level.

Professor A. Neelamegham (*Documentation Research & Training*) was appointed Research Director by the Andhra University, for guiding candidates for the doctoral degrees in library science.

Professor Neelamegham was appointed a member of the Working Group on Documentation Centres and Specialist Libraries. State Planning Commission of Tamilnadu.

### 9. CONFERENCES, SCIENTIFIC TOURS AND ASSIGNMENTS ABROAD

#### (i) *Conferences and Scientific Tours :*

##### *Professor P. C. Mahalanobis : Tours Abroad*

*U.S.A.* (29 June-7 September 1971) : Professor P. C. Mahalanobis, accompanied by Mrs. Mahalanobis arrived in New York on 29 June in connection with his work as Consultant to the United Nations. They stayed in New York as the guests of Mr. Gerard Piel till 7 August.

Professor Mahalanobis and Mrs. Mahalanobis left New York on 7 August for Washington where Professor presented a paper, "Some observations on recent development in sample surveys" at the 38th Session, International Statistical Institute, 11-20 August 1971.

On 21 August they went to Chicago staying there till the 24th. Professor Mahalanobis had a discussion with Dr. Chandrasokhar about his work on Fractile Graphical Analysis.

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Returning to New York on 24 August, they stayed there till 7 September, again as guests of Mr. Gerard Piol who gave a dinner in their honour on 26 August. Professor Mahalanobis was taken rather seriously ill on the 27th but inspite of this he worked hard to finish his report as Consultant to the U.N. which he submitted before leaving New York for London on 7 September.

*England (7-15 September)* : Arriving in London on 7 September, Professor and Mrs. Mahalanobis stayed there till the 15th in the Royal Society. At London they met, among others, Lord and Lady Blackett and Sir Harry Campion.

*Scandinavia (15 September-2 October)* : Professor and Mrs. Mahalanobis arrived at Stockholm on 15 September. On the 16th, Professor Mahalanobis was introduced at the Institute for International Economic Studies in the forenoon. After a luncheon meeting at the Wenner-Gren Center Foundation, Professor Mahalanobis spoke on 'The Future of the Indian Economy' at the National Ekonomiska Foroningen in the afternoon. On the 17th at a luncheon meeting organized by the Swedish International Development Authority (SIDA), Professor Mahalanobis led a discussion on Indian Planning Experiences. In the evening at a ceremony at the town hall, Professor Mahalanobis was formally presented the degree of honorary doctorate awarded to him three years ago. His important engagement at Stockholm was a meeting on the 20th with statisticians at the Institute for International Economic Studies.

On the 21st, Professor and Mrs. Mahalanobis arrived at Gothenburg where he spoke on Development Planning in India in the morning. In the afternoon, he had a discussion with Professor Herman Wold who later gave a reception and dinner in his honour.

On the 22nd, Professor and Mrs. Mahalanobis arrived at Bergen in the forenoon. In the afternoon Professor Mahalanobis spoke on "Statistical Methods in Ecological Studies" at the Bergen School of Economics.

Returning to Stockholm on the 23rd, Professor Mahalanobis, met members of the Swedish-Indian Society at a dinner meeting at which he spoke on Indian Statistics. The next day, the 24th he spoke on mathematical statistics at Statistisforsamfundet. On the 25th he met young economists at a dinner. On the 26th evening there was a meeting at the Wenner-Gren Center at which Mrs. Mahalanobis recounted her reminiscences of Rabindranath Tagore.

Professor and Mrs. Mahalanobis arrived at Uppsala in the forenoon of 27 September. Professor Mahalanobis had a crowded programme on the day : at 12 noon he had a discussion with a group working on India and Pakistan at the Department of Cultural Geography of the Uppsala University at which the Head of the Department, Professor Gunnar Arpi was present; the next engagement was a luncheon meeting jointly organised by the Departments of Statistics, Economics, Economic History and Cultural Geography of the University at which the Professors of the Departments were present; at 4 p.m. Professor Mahalanobis gave a lecture organized by the Department of Economics of the University and presided over by the Head of the Department Professor Bentzal. The subject was "The Role of Science in the Progress of the Underdeveloped Countries." On the 28th Professor Mahalanobis gave a lecture in the morning at the Department of Economic History of the University on "The

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Method of Measurement of Progress in the Developing Countries." The same day they returned to Stockholm.

At Stockholm on the 29th, after lunch with members of the Institute for International Economic Studies, Professor Mahalanobis participated in a seminar on "Problems of Developing Countries at National and International Levels." Professor and Mrs. Mahalanobis left for Belgrade on 2 October.

*Yugoslavia (2-15 October)*: Professor Mahalanobis gave a lecture in the morning of 4 October in the Government Statistical Office in Belgrade. In the evening he left Belgrade for Portoroz, stopping the night at Lubiana. On the way to Portoroz, Professor Mahalanobis stopped at the Academy of Sciences at Slovenia, where, the President being ill he was received by the Vice-President from whom Professor Mahalanobis tried to get a clear picture of the scientific work being done in Yugoslavia. Professor Mahalanobis also discussed with the Vice-President the possibilities of exchange of scientific information between India and Yugoslavia.

Professor Mahalanobis inaugurated on the morning of 6 October the Yugoslav Statistical Association Conference at Portoroz and received a tremendous ovation. This was followed by a seminar attended by 25 mathematical statisticians in Professor Mahalanobis's hotel room. On the 7th Professor and Mrs. Mahalanobis returned to Belgrade where they stayed for a week during which Professor Mahalanobis worked with Professor Kostic and his colleagues.

*U.S.S.R. (15-22 October)*: Professor and Mrs. Mahalanobis left for Moscow on 15 October arriving there in the evening. During a week's stay Professor Mahalanobis had discussions with Professors Kapitza, Engelhardt and Kolmogorov. They left Moscow for India on the 22nd night.

### *Dr. C. R. Rao: Tours Abroad*

*Switzerland, U.S.A. (28 June-25 September 1971)*: Dr. C. R. Rao left for Geneva on 28 June 1971 from Delhi to attend a meeting of the Scientific Group on Research in Epidemiology and Communication Science of the W.H.O., 28 June-2 July.

From 26 July to 6 August 1971, he participated in the Seminar on Techniques of Data Analysis, Fort Collins, Colorado. He presented a paper on the analysis of growth data.

He attended the Thirty-eighth International Statistical Conference held at Washington, D.C., during 10-20 August, as a delegate from India.

He gave an invited address on the estimation of variance and covariance components—the Minquo theory at the Annual Meeting of the Institute of Mathematical Statistics held at Fort Collins, Colorado, 23-26 August 1971.

Before returning to India, he attended the International Symposium on Combinatorial Analysis held during 8-11 September 1971 at Fort Collins, Colorado, and presented a paper on "Some combinatorial problems of arrays and applications to design of experiments."

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During his foreign tour, Dr. Rao gave lectures at Philadelphia, Dayton and Bloomington in the U.S.A. and in Geneva, on the Characterizations of Probability Distributions through Linear Functions and Analysis of Growth Data. He returned to India on 25 September 1971.

Shri G. Bhattacharyya (*Documentation Research and Training*) left India on 29 September 1971 to attend the first conference on the "Conceptual Basis of Classification of Knowledge", Ottawa, Canada, 1-5 October 1971. He presented a paper, "From knowledge classification to library classification," prepared jointly with Dr. S. R. Ranganathan. On his way back home, he undertook a lecture-cum-study tour in Canada, USA, UK and the USSR.

Dr. (Miss) Qamar Zafar Hossain (*Immunochemistry*) left India on 30 July 1971 to participate in the First International Congress of Immunology, Washington D.C., 1-8 August 1971. She returned to India on 14 August 1971.

Professor M. Mukherjee (*National Income*) left India on 30 August 1971 to attend the Conference of the International Association for Research in Income and Wealth, Ronneby, Sweden, 30 August-4 September 1971. He presented a paper and also participated in a group discussion on the technical problems involved in the UN project on International Comparison of National Accounts Aggregate. He returned to India on 6 September 1971.

Professor R. Mukherjee (*Sociology*) left India on 20 November 1971 to attend the UNESCO's Eastern Asian Region Exports Meeting on "Nation-building and State-formation", Singapore, 21-28 November 1971. He presented a paper.

Professor A. Neelamegham (*Documentation Research and Training*) left India on 26 June 1971 to attend the International Symposium on UDC in relation to other Indexing Languages, Herceg-Novi, Yugoslavia, 28 June 1971-1 July 1971. He contributed a paper, "A theoretical foundation for UDC: its need and formulation." On his way back to India he paid a visit to the VINITI, State Public Library for Science and Technology and the Lenin Library in Moscow, from 4 to 8 July 1971. He returned to India on 10 July 1971.

Shri S. M. Sundara Raju (*Statistical Quality Control*) left India on 22 June 1971 to participate as a representative of the Institute, in a Seminar on Pharmacokinetics, Baale, Switzerland, 20-26 June 1971. He also undertook by arrangement with the European Organisation for Quality Control, a survey of quality control in some factories in Austria, France, Italy, Netherlands and Switzerland. He returned to India on 17 July 1971.

Shri M. V. Raman (*Demography*) attended, as a member of the Indian delegation, the Regional Seminar on Population Aspects of Social Development, organised by the ECAFE in Bangkok, 11-20 January 1972.

Professor S. K. Roy (*Botany*) left India on 23 May and was in the USSR from 23 May 1971 to 14 November 1971 under the Indo-Soviet Cultural and Scientific Exchange Programme. On his way back, he also visited some other European countries from 14 November 1971 to 24 December 1971. He initiated a research project in the Moscow University and also held discussions and gave seminars in a number of biological research institutes, agricultural research stations, and university departments of biology in Moscow,

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Leningrad, Tashkent, Ashabad, Ufa, Novosibirsk, and Tbilisi. He also visited a number of institutes in London, Stockholm, Uppsala, Lund, Svalof, Frankfurt, Rome, Athens, and Thessaloniki. He returned to India on 24 December 1971.

Dr. (Miss) A. Sengupta (*Family Planning*) was in the U.S.A. on a W.H.O. grant for about a year from February 1971 to February 1972 to work at the University of Harvard and the University of California at Berkeley.

She attended the annual meeting of the Population Association of America, Washington D.C., 22-24 April 1971, to study some of the population control programmes. She visited the University of California at Los Angeles; Population Council, New York; University of Hawaii and East-West Centre, Honolulu; Family Planning Association of Japan, Tokyo; Korean Institute for Family Planning, Seoul; and the Family Planning Association, Hong Kong.

Dr. Supriya Sengupta (*Geology*) left Calcutta on 22 August 1971 to participate in the Eighth International Sedimentological Congress at Heidelberg, Federal Republic of Germany (23 August—11 September 1971) and to undertake sedimentological research in the Geomorphology Laboratory, Uppsala University, Sweden (September 1971—March 1972). He returned to Calcutta on 2 April 1972.

At the Eighth International Sedimentological Congress sponsored by the International Association of Sedimentologists, Dr. Sengupta presented two papers and served as the Chairman in one of the sessions on Quantitative Sedimentology. He participated in the field excursions organised by the Congress and also attended the Council meeting of the International Association for Mathematical Geology.

During his stay abroad, Dr. Sengupta delivered lectures on his research at the following places: Uppsala University, Cambridge University, Geological Society of Sweden, Stockholm, and the Geological Survey of Czechoslovakia, Prague.

Shri N. Srinivasan (*Statistical Quality Control*) went on a tour to study quality control in the United Kingdom from 3 September 1970 to 20 April 1971 on a Colombo Plan Fellowship.

Dr. T. N. Srinivasan (*Planning and Regional Survey, New Delhi*) participated in the Second Working Party of the Participants in the Project on Exchange Control, Liberalization and Economic Development, New York, 3-5 June 1971. During his tour, Dr. Srinivasan gave a seminar on "Farm Size and Productivity" at the Ohio State University, U.S.A.

Dr. T. N. Srinivasan participated in the Winter Working Party of the same project held in New York during 21-26 February 1972 and presented a first draft incorporating some of the results of the India Study. He also gave a seminar at the University of Minnesota at Minneapolis on 28 February 1972.

### (ii) Assignments Abroad :

Shri J. K. Aikat (*National Sample Survey*) rejoined in September 1971 after completing one year's training under the Colombo Plan, as a research fee student at the London School of Economics.



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Dr. D. Basu (RTS) left on 1 October 1971 for one year to take up an assignment as a visiting professor at the University of Manchester, U.K.

Dr. L. S. Bhat (*Planning and Regional Survey, New Delhi*) attended a meeting of the group of experts to finalise a Manual on Regional Planning for the ECAFE at Bangkok, 15-30 September, 1971. Dr. Bhat has been the coordinator in the preparation of the Manual.

Dr. L. S. Bhat served as a consultant to the ECAFE at Bangkok for six weeks during 16 December 1971 to 26 January 1971. During this assignment, the Manual on Regional Planning was finalised for publication and a summary report was prepared.

Shri Paul Jacob (*National Sample Survey*) returned in February 1972 after receiving higher training in statistics at the Dominion Bureau of Statistics, Canada, under the Colombo Plan.

Dr. T. Krishnan (RTS) left on 1 January 1972 for one year to accept a visiting appointment at the University of Western Australia, Perth.

Shri R. K. Lahiri (*Economic Research*) left India on 29 November 1970 to participate in a course on economic development at the Institute for the Study of Economic Development, Naples, Italy, for about six months up to 31 May 1971, on a fellowship from the Italian Ministry of Foreign Affairs.

Dr. S. K. Mitra (RTS) left on 10 May 1971 for one year to accept an assignment as a visiting professor at the University of Indiana, USA. His stay has been further extended for one year.

Shri S. R. Mukherjee (*National Sample Survey*) returned from the U.K. on 2 April 1971, after completing the one-year diploma course in urban studies at the Centre for Urban Studies, London. He also obtained the diploma in urban studies from the University of London.

Shri Surendra Munshi (*Sociology*) left on 30 October 1971, on leave for two years, to study at the Faculty of Sociology, University of Bielefeld, Federal Republic of Germany.

Shri Ardhendu Roychowdhury (*National Sample Survey*) left for Canberra, Australia, in January 1972 for training in data processing and systems study under the Colombo Plan.

#### 10 CONFERENCES AND SCIENTIFIC ASSIGNMENTS IN INDIA

Shri Pratul Bandyopadhyay (*Electronics*) gave a talk on "Photon-neutrino weak coupling, degenerate sea of neutrino and gravitational phenomena" at the Conference on Elementary Particles and Cosmology, Bangalore, 6-10 November 1971.

Dr. Amitabha Basu (*Anthropometry and Human Genetics*) participated in the International Seminar organized on the occasion of the S. C. Roy Centenary Celebration (1871-1971), by the Indian Anthropological Association, University of Ranchi and the Council of Social and Cultural Research, Bihar, and held at Ranchi during 4-10 November 1971. Dr. Basu also acted as the Rapporteur in Session IV (Physical Anthropology).

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Dr. Amitabha Basu participated in the Seminar on Indian Anthropology Today sponsored by the University Grants Commission and the University of Calcutta and held at Calcutta during 15-18 February 1972.

Dr. Amitabha Basu participated in the Seminar on Anthropological Field Studies on the Peoples of India, organised by the Indian Anthropological Society and Max Muller Bhavan, and held at Calcutta during 24-26 March 1972.

Dr. L. S. Bhat (*Planning and Regional Survey, New Delhi*) participated in a seminar on Market Towns and Spatial Development in India organised by the National Council of Applied Economic Research, New Delhi, 15-17 April 1971. Dr. Bhat discussed the pattern of market towns in Karnal Area with reference to the existing settlement hierarchy.

Dr. Bhat participated in a seminar on Problems of Micro Level Planning for Development organised by the National Institute of Community Development at Hyderabad, 11-12 October 1971. A paper on Planning Rural Growth Centres for Integrated Area Development was discussed.

Dr. Bhat participated in the research and teaching programme of the Centre for Regional Development, Jawaharlal Nehru University, New Delhi. He has been a consultant to the Centre for Regional Development since January 1971.

Dr. L. S. Bhat participated in the Seminar on Regional Imbalances, Problems and Policies organised by the Indian Institute of Public Administration, New Delhi, 3-4 March 1972. He contributed a paper on "The Process of Regional Development and the Issues relating to Regional Imbalances in Development."

Dr. D. K. Bose (*Economic Research*) attended the Eleventh Econometric Conference, December 1971. He was nominated a member of the Planning Commission Study Group on MHD Process of Power Generation.

Shri G. S. Chatterjee (*National Income*) attended the Eighth Conference, Indian Association for Research in National Income and Wealth, Lucknow, 3-5 February 1972. He presented a paper.

Shri B. Dey (*National Income*) attended the Eighth Conference, Indian Association for Research in National Income and Wealth, Lucknow 3-5 February 1972, and presented a paper.

Dr. Ambarish Ghosh (*Electronics*) attended the First Annual CASAMCU Research Symposium organised by the Centre of Advanced Studies in Applied Mathematics, Calcutta University, in Calcutta, 26-28 March 1972. He attended the Sixteenth Congress, Indian Society of Theoretical and Applied Mechanics, Calcutta, 29 March-1 April 1972. He presented a paper each on both occasions.

Shri R. K. Lahiri (*Economic Research*) participated in a seminar on the "Character of the Indian State" organised by the Indian School of Social Sciences, Madras, 23-27 October 1971.

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Professor M. Mukherjee (*National Income*) attended the following :

(i) Summer Institute organised by the Gokhale Institute of Politics and Economics, Poona, 15 May-3 June 1971, and delivered a course of lectures on national income.

(ii) Council meeting, Indian Association for Research in National Income and Wealth, Bombay, 22 May 1971.

(iii) A meeting convened by the Indian Council of Social Science Research in Delhi on 2 August 1971 to discuss the research survey on national income prepared by Professor M. Mukherjee.

(iv) Joint meeting, Advisory Committees on (a) Collection of Data for National Income, and (b) Compilation and Analysis of National Accounts in Delhi, 8 and 9 September 1971. Professor Mukherjee presided over the second meeting.

(v) A meeting of the Subject Committee in Statistics concerned with the production of text books in the regional language at the university level in West Bengal, 7 July, 1971.

(vi) Eighth Conference, Indian Association for Research in National Income and Wealth, Lucknow, 3-5 February 1972. Professor Mukherjee presented a paper and presided over the technical and business sessions.

(vii) Eleventh Conference, Indian Econometric Society, 3-5 March 1972. Professor Mukherjee presided over a session and also presented a paper.

(viii) A meeting of the Indian Working Group on International Comparisons of National Product, Delhi, 14 March 1972.

(ix) Seminar on "Indian Economy—Performance and Prospects" organised by the Centre of Advanced Study in Economics, University of Bombay, 25-28 March 1972. He chaired the session on income distribution and presented a paper.

Sm. Alokanda Mitter and Shri Joydeep Sarkar (*Linguistic Research*) attended the Pan-Indian Group Meeting on the Atlas Interpretation Task for the project "Gross Cultural Generalities of Affective Meaning System". Hyderabad, 9-20 August 1971. The meeting was sponsored by the Center for the Comparative Psycholinguistics, University of Illinois, USA.

Sm. Bina Roy (*National Income*) attended the Eighth Conference, Indian Association for Research in National Income and Wealth, Lucknow, 3-5 February 1972. She presented a paper.

Shri Probas Roychaudhuri (*Electronics*) gave a talk on "Cosmic X-Ray background, big-bang cosmology and neutrino emission" at the Conference on Elementary Particles and Cosmology, Bangalore, 5-10 November 1971.

Shri R. P. Saha (*National Sample Survey*) attended the ninth meeting of the Standing Committee for the Improvement of Industrial Statistics and the meeting of the working group on sampling design for the Annual Survey of Industries 1971, New Delhi, December 1971.

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Shri M. R. Saluja (*Planning and Regional Survey, New Delhi*) attended a Seminar on Quantitative Economics organised by Sardar Patel Institute for Economic and Social Research, Ahmedabad, 13-16 September, 1971.

Mrs. K. Saradmoni (*Planning and Regional Survey, New Delhi*) attended the Eighth Indian Conference on National Income, Lucknow 3-5 February 1972. She read a paper on "Changes in employment and earning in the manufacturing industries : an Inter-State examination."

Shri B. N. Sarkar (*Demography*) attended the Seminar on Demography and Statistics organized by the Banaras Hindu University, Banaras. April 1971 and presented a paper.

Shri S. C. Srivastava (*Planning and Regional Survey, New Delhi*) attended the Combined Annual Workshop on Coordinated Projects on Agronomic Experiments and Long Term Fertilizer Experiments held at the University of Agricultural Sciences, Bangalore, 8-12 November 1971.

Dr. T. N. Srinivasan and six workers of the Planning Unit, Delhi, attended the Eleventh Econometric Conference, Hyderabad, 3-5 March 1972. They participated in the deliberations of the conference and presented papers.

### 11. FAMILY PLANNING RESEARCH UNIT

The activities during the year were related to the following three continuing projects being conducted by the Family Planning Research Unit : (i) Institutional Studies, I.S.I., 1968, (ii) Growth of Family Size, Calcutta, 1964-69, and (iii) Fertility Study II, Hooghly, 1967-68.

(i) *Institutional Study, I.S.I.* : The main findings of the survey conducted on employees of the Indian Statistical Institute are given briefly. The age standardized couple fertility rate of 145.6 in 1962-63 (base-line survey) came down to 139.2 in 1963-64 and to 135.4 in 1966-67. This rate rose to 148.1 in 1967-68 (current survey). The survey shows that the overall fertility level is higher for Class IV workers (202.8) than that for Class III workers (142.0) and those in higher professions (62.9).

(ii) *Growth of Family Size, Calcutta* : This study on standard fertility surveys (1964-68) in Calcutta City was undertaken to measure the impact of five years of family planning programme in Calcutta City Project Area. The main findings are : after registering a gradual fall during 1964-68 from 24.7 to 19.9 in one centre and from 26.0 to 22.9 in another centre of the project, the birth rate seems to be unresponsive to further decline. The overall average 'completed interval between latest two births' does not show any significant increase from the base-line survey to the fourth resurvey and stands at about 40 months. The 'incomplete' or 'open' interval measuring the time-span between the dates of survey and the last live birth termination, however, seems to have increased significantly during the study period. Thus, it increased by 8.1 months from 62.6 to 70.7 in one centre and by 9.4 months from 64.2 to 73.6 in another centre. An increasing 'open' interval is generally associated with a greater practice of family planning.

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(iii) *Fertility Study II, Hooghly* : The following phases of the work were done during the period : (i) Sub-sample wise tabulation of fertility data, (ii) estimation of births, and (iii) calculation of rates. The analysis is being made.

(iv) *Other Studies* : The analysis for the survey data (about 700 couples) collected from extended areas of Calcutta City Project has been completed. The survey was undertaken for examining the extent of diffusion of five years of family planning programme in the adjoining localities. The report is being prepared.

A post-communication Action Research Survey was undertaken in the Calcutta City Project Area to assess the effect of five years of intensive family planning programme among the target couples.

### 12. PUBLICATIONS

The following were published during the year.

*Sankhyā* : *The Indian Journal of Statistics*, the official organ of the Institute : Series A, Volume 33, Parts 2, 3 and 4; Volume 34, Part 1. Series B, Volume 33, Parts 1 & 2 and 3 & 4; Volume 34, Part 1.

The following books were published by the Statistical Publishing Society :

1. Data Inventory on Social Sciences, India, First Phase : 1967-68, by R. Mukherjee and others, pp. 160.
2. Lectures on the Theory of Probability by Yu. A. Rozanov, pp. 114 (published jointly with the USSR Academy of Sciences and the Indian Statistical Institute).
3. A Short Outline of Bengali Phonetics by Djordje Kostic and Rhea S. Das, pp. 174.

The Research and Training School issued 111 technical reports during the period, of which 49 reports were in the Mathematics-Statistics group and 62 were on other subjects.

The list of papers published is given in *Annexure 2*.

### 13. SOCIETY-TYPE ACTIVITIES : BRANCHES

13.1 *Mysore State Branch : Annual General Meeting* : The Chairman, Secretary and members of the Executive Committee for 1971-72 were elected at the Eighteenth Annual General Meeting of the Branch held on 13 August 1971. Other office-bearers were elected at the first meeting of the Executive Committee held on 21 August 1971.

*Membership* : There were 44 members at the end of the year (Life members : 8; Institutional members : 5; and ordinary members : 31), compared to 41 members in the previous year.

*Admission Tests* : The selection tests for admission to the M.Stat., B.Stat. degree courses and the SQC diploma course, etc. were held in Bangalore on 20 June 1971.

*One-year Evening Courses in Statistics* : Twenty candidates were admitted to the course which commenced on 13 October 1971. Qualified staff from the following organisations participated in the teaching programme : (i) Post-graduate Department of Statistics,

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Bangalore University, (ii) Hindusthan Aeronautics Ltd., and (iii) Statistical Quality Control Unit, I.S.I.

*Surveys:* (i) At the request of the Mysore State Financial Corporation, the Branch has undertaken a survey of electronic industries in the Bangalore Metropolitan Area with a view to determine the trend of growth of manufacture of electronic components by the several units in Bangalore in relation to the consumer needs of the different types of parts and equipment which may be needed in the next five years. The survey is being organised in co-operation with the Statistics Department, Bangalore University and the Small Industries Service Institute.

(ii) Data involving 40,000 students has been collected on a Working Survey on Living and Working Conditions of Students of Bangalore University. The coding of the data of the 2,000 questionnaires (6% sample) for analysis on punched card system has been completed. Action is being taken for further analysis.

13.2. *Bombay Branch: National Sample Survey:* The work of the twentyfifth round of the NSS was completed and the twenty-sixth round was started in August 1971. The local training conference for the field staff of Bombay was held during 15-17 July 1971. The work of the twenty-sixth round is progressing according to programme.

*Professional Examinations:* The Statistician's Diploma Examination was held in the Bombay Centre during May and November 1970.

*Evening Course:* Twenty-two candidates were admitted to the One Year Evening Course in Statistical Methods and Applications for the 1971-72 session.

*Council and Annual General Meetings:* The Council and Annual General Body meetings of the Bombay Branch were held on 17 March 1972. The office bearers for 1971-72 were confirmed.

*Admission Tests:* The Bombay Branch conducted the following admission tests on behalf of the Psychometry Unit, Research and Training School: (i) Hindusthan Steel Ltd., (ii) M.B.A. Panjab University, and (iii) Indian Institute of Management.

*Lecture:* "Applications of Statistical Techniques in Marketing Planning" by Shri K. R. K. Murty, M.A., F.R.S.S., Executive Officer, Glaxo Laboratories, Bombay, 5 June 1971.

*Obituary:* Shri S. L. Pillay, Council Member of the Bombay Branch and Officer-in-Charge of the NSS Unit of ISI, Bombay, expired on 21 April 1971.

## 14. LAND AND CONSTRUCTION

There was no major construction in the year under review. But certain important developments took place in the Institute's construction programme for Baraugar and Delhi during the Fourth Plan Period.

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On the basis of master plans for construction in Delhi and Baranagar, certain funds were recommended by the Section 8(1) Committee for the year 1970-71 for the Fourth Plan period and these were also approved by the Government on 9 April 1971 :

### *Baranagar :*

1. Library buildings (65,000 sq.ft.)	..	..	..	Rs. 22.50 lakhs
2. Extension of RTS building (35,000 sq.ft.)	..	..	..	Rs. 12.75 lakhs
3. Students' Hostel (one)	..	..	..	Rs. 5.25 lakhs
4. Staff quarters including Class IV staff quarters	..	..	..	Rs. 5.00 lakhs
			<b>Total</b>	<b>Rs. 45.50 lakhs</b>

*Delhi :* Rs. 32.00 lakhs for construction work (70,000 sq.ft.).

The Council of the Institute in its meetings held on 29 May 1971 and 19 June 1971 set up Works Committees for construction in Delhi and Baranagar with the following duties and functions :

- (a) appointment of a firm of architects to execute the project;
- (b) approval of the layout plan for the campus drawn by the architect and laying down priorities and specifications etc. of buildings within the resources available;
- (c) appointment of contractors to execute the project;
- (d) sanctioning of funds for the project at various stages of the plan;
- (e) any other major policy decision not covered by (a), (b), (c) and (d) subject to directions from the Council.

The Council of the Institute in its meeting held on 22 January 1972 extended the life of the Committee till the end of the Fourth Plan Period, i.e., 31 March 1974.

Messrs Kanvido & Rai and Professor A. K. Banerjee were appointed architects for Delhi and Baranagar respectively.

At an annual general meeting of the Institute held on 22 January 1972, a representative each from the members of the Institute was nominated for inclusion in the Works Committees for Delhi and Baranagar.

During this period, the Institute received possession of an area of 3.69 acres of land from the Delhi Development Authority (DDA). Thus, the Institute has so far received possession of a total area of 14.69 acres of land in Delhi from the DDA.

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### PART II : ANNEXURES

#### **Annexure I : List of President, Vice-Presidents, Office-Bearers, Members of Council, Governing Body and Members of the Committees of the Council and Governing Body.**

*President* : Professor S. N. Bose, F.R.S., D.Sc., F.N.I., National Professor.

*Honorary Vice-Presidents* : 1. Dr. C. D. Doshmukh, B.A. (Cantab.), D.Sc. (Hony. Calcutta and I.S.I.), Bar-at-Law (former President). 2. Shri K. P. S. Menon, I.C.S. (Retired).

*Vice-Presidents* : 1. Professor P. C. Mahalanobis, F.R.S., D.Sc., F.N.I. 2. Dr. S. R. Ranganathan, M.A., D.Litt. (Hony.), F.I.A., National Professor. 3. Shri Pitambar Pant, M.Sc. 4. Shri S. Dutt, I.C.S. (Retired). 5. Shri Vishnu Sahay, I.C.S. (Retired).

#### THE COUNCIL : 1971-72

*Chairman* : Shri S. C. Roy, M.A., B.L., Director, NICCO of India Ltd., Calcutta.

*Vice-Chairmen* : 1. Professor T. R. Seshadri, F.R.S., Emeritus Professor, Department of Chemistry, University of Delhi. 2. Dr. C. R. Rao, M.A., M.Sc., Ph.D., Sc.D., (Cantab.) F.N.I., F.R.S., Director, Research and Training School, Indian Statistical Institute. 3. Professor K. N. Raj, University of Delhi and Centre for Development Studies, Trivandrum. 4. Dr. N. Das, I.C.S. (Retired), Ph.D. (Lond.). 5. Dr. J. C. Ray, M.D., F.N.A. 6. Shri Satis Chandra Sen, M.A., LL.B.

*Additional Vice-Chairmen* : 1. Chairman, Bombay Branch : Shri S. K. Wankhede (1969-70). 2. Chairman, Kerala Branch : Professor A. Aiyappan (1969-70). 3. Chairman, Mysore State Branch : Professor R. R. Umarji (1970-71).

*Treasurer* : Shri G. Basu, B.A., F.S.A.A., F.C.I.S., F.C.A., F.C.I.W.A., J.P.

*Secretary* : Professor P. C. Mahalanobis, F.R.S., D.Sc., F.N.I.

*Joint Secretary* : Professor H. C. Ghosh, M.A., LL.B., P.R.S., Retired Chief Director, National Sample Survey, Government of India

*Members of Council* : 1. Dr. B. P. Adhikari, M.Sc. (Cal.), Dr.es.Sc. (Paris), Professor, Research and Training School, Indian Statistical Institute. 2. Dr. Atma Ram, D.Sc., F.N.A., F.S.G.T., Ex-Director General, Council of Scientific and Industrial Research, Government of India. 3. Dr. Bani Prasad Banerjee, B.E., M.S., Ph.D. 4. Shri P. K. Basu, M.A., I.A. & A.S., Retired Director, Defence Audit, Government of India. 5. Shri H. Bhaya, M.A., Acting Chairman, Hindustan Steel Ltd. 6. Dr. D. K. Bose, M.A., Ph.D., Indian Statistical Institute. 7. Dr. P. K. Bose, M.Sc., D.Phil., Pro-Vice-Chancellor, Calcutta University. 8. Dr. A. B. Chowdhury, M.B.B.S., D.Phil., F.A.M.S., F.N.I., Chairman, Division of Parasitology & Deputy Director, School of Tropical Medicine, Calcutta. 9. Dr. S. W. Dharmadhikari, M.Sc., Ph.D. (California), Department of Statistics, M.S. University of Baroda. 10. Professor H. C. Ghosh, M.A., LL.B., P.R.S. Retired Chief Director, National Sample Survey, Government of India. 11. Dr. D. D. Joshi, M.Sc., Dr.es.Sc., (Paris), Professor of Statistics, Institute of Social Sciences, University of Agra. 12. Shrimati Nirmal Kumari Mahalanobis, Chairman, Hospitality Committee, Indian Statistical Institute. 13. Dr. B. S. Minhas, M.A., Ph.D., Member, Planning Commission, Government of India.



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14. Dr. Ashok Mitra, M.A., D.Sc. (Econ.), Chief Economic Adviser, Ministry of Finance, Department of Economic Affairs. 15. Dr. R. Mukherjee, M.Sc. (Cal.), Ph.D. (Cantab.), Indian Statistical Institute. 16. Shri S. M. Sundara Raju, M.Sc., Head, SQC Division, Indian Statistical Institute. 17. Dr. Ashok Rudra, Ph.D., Department of Economics, Visva Bharati, Santiniketan. 18. Shri N. C. Songupta, I.C.S., Chief Secretary, Government of West Bengal. 19. Dr. B. R. Seshachar, D.Sc., F.N.I., President, Indian National Science Academy. 20. Dr. T. N. Srinivasan, Ph.D., Professor, Planning Unit (Delhi), Indian Statistical Institute.

*Government nominees on the Council (Rule 6.1(b)(1) :* (1) Cabinet Secretary, (Shri T. Swaminathan, I.C.S.), or his representative. (2) Joint Secretary, Ministry of Finance, Department of Expenditure, Government of India, (Shri A. P. V. Krishnan). (3) Director, Central Statistical Organisation and ex-officio Joint Secretary, Department of Statistics (Dr. N. T. Mathew).

*Co-opted members (Rule 6.1c) :* Nil.

\**Ex-officio Members (Rule 6.1b) Secretary of each local branch :* (1) *Bombay Branch :* Professor P. N. Phutane (1969-70) Secretary, Bombay Branch, Indian Statistical Institute. (2) *Kerala Branch :* Dr. (Miss) A. George (1969-70) Secretary, Kerala Branch, Indian Statistical Institute. (3) *Mysore State Branch :* Professor Srinagabhushana (1971-72) Secretary, Mysore State Branch, Indian Statistical Institute.

#### MEMBERS OF GOVERNING BODY OF THE RESEARCH AND TRAINING SCHOOL : 1971-72

1. Shri S. C. Roy, Chairman (*ex-officio*). 2. Professor P. C. Mahalanobis, Honorary Secretary (*ex-officio*). 3. Dr. C. R. Rao, Director, RTS (*ex-officio*). 4. Shri A. K. Ganguli, Editor, Capital (P) Ltd., Calcutta (*Associated Chambers of Commerce of India*). 5. Dr. S. Misra, (*Indian Economic Association*). 6. Shri G. K. Bhagat, Messrs. Bengal Potteries Ltd. (*Federation of Indian Chambers of Commerce and Industry*). 7. Dr. N. T. Mathew, Director, Central Statistical Organisation (*Government of India*). 8. Shri A. P. V. Krishnan, Joint Secretary, Ministry of Finance, (*Financial Adviser to the Department of Statistics, Government of India*). 9. Professor S. S. Srikhande, F.N.I., Head of the Department of Mathematics, University of Bombay, (*National Institute of Sciences of India*). 10. Shri V. V. Divatia, Advisor, Department of Statistics, Reserve Bank of India, (*Reserve Bank of India*). 11. Professor S. K. Bose, Director, Indian Institute of Technology, Kharagpur, (*Inter-University Board of India & Ceylon*). 12. Dr. Bhabatosh Dutta, M.A., Ph.D. 13. Dr. B. R. Seshachar, D.Sc., F.N.I. 14. Dr. A. B. Chowdhury, M.B.B.S., D.Phil., F.A.M.S., F.N.I., Deputy Director, School of Tropical Medicine, Calcutta. 15. Dr. B. P. Adhikari, M.Sc. (Cal.), Dr. ex. So. (Paris). 16. Shri Partha Ray, I.A.S. 17. Dr. D. K. Bose and 18. Dr. J. C. Ray, M.D., F.N.A. (*Council of the Indian Statistical Institute*).

#### MEMBERS OF DIFFERENT COMMITTEES : 1971-72

##### *Finance Committee of the Governing Body*

1. Chairman of the Institute (*ex-officio*) or a Vice-Chairman, authorised by him;  
2. Secretary of the Institute (*ex-officio*) or in his absence, a Joint Secretary; 3. Director of

\* Branch Chairmen's names shown under Additional Vice-Chairmen.

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the Research and Training School (*ex-officio*) or a Joint Director, if any in charge of RTS; 4 & 5. Two representatives of the Government of India (Dr. N. T. Mathew and Shri A. P. V. Krishnan); 6. Representative of the Reserve Bank of India on the Governing Body (Shri V. V. Divatia); 7 & 8. Two representatives to be elected by Governing Body from amongst themselves (Dr. B. R. Seshachar and Dr. B. P. Adhikari).

### *Finance Committee of the Council*

1. Chairman of the Institute (*ex-officio*) or his nominee; 2. Secretary of the Institute (*ex-officio*) or his nominee; 3. Director of the Research and Training School (*ex-officio*) or his nominee; 4. Dr. B. P. Adhikari; 5. Dr. B. P. Banerjee; 6. Dr. Bhabatosh Dutta; 7. Dr. P. K. Bose; 8. Professor H. C. Ghosh; 9. Dr. Atma Ram; 10. Shri S. R. Mukherjee (*Non-member Secretary*) or in his absence, a person nominated by the Secretary or the Chairman; 11 & 12. Two representatives nominated by the Government of India, Cabinet Secretary (Shri T. Swaminathan) or his representative and Joint Secretary, Ministry of Finance (Shri A. P. V. Krishnan).

### *\*Journal Committee of the Institute*

1. Dr. S. N. Bose, F.R.S., National Professor and President of the Institute; 2. Shri D. B. Lahiri; 3. Dr. B. S. Minhas; 4. Dr. Sujit K. Mitra; 5. Dr. Jogabrata Roy; 6. Dr. Amartya Sen; 7. Dr. D. Basu; 8 & 9. Editors of *Sankhyā* (*ex-officio* Professor P. C. Mahalanobis and Dr. C. R. Rao); 10. One representative of the Governing Body of the Research and Training School—Dr. S. S. Shrikhande; 11. One member to be nominated by the Secretary of the Institute in consultation with the Director of the Research and Training School; 12. Dr. J. K. Ghosh, *Editorial Secretary*, and 13. Shri A. Mahalanobis, *Secretary*.

### *†Examinations Committee of the Institute*

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\*† The Journal Committee and the Examinations Committee are to continue till reconstituted

\*\* Expressed inability to accept membership. Reported to Council on 29 March 1971.

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Annexure 2 : List of Papers published.

A. MATHEMATICS AND STATISTICS

- P1 ADHIKARI, B. P. (with Chakraborty, Ranajit and Sarma, Y. R.) (1971) : Estimation of OAB gene frequencies with the assumption of restricted random mating. *Abstract Vol. 4th Inter. Congr. Hum. Genet.* 13.
- P2 BHIMASANKARAM, P. (1972) : On generalized inverses of partitioned matrices, *Sankhyā A*, 33, 311-314.
- P3 ——— (1971) : Simultaneous reduction of several hermitian forms, *Sankhyā A*, 33, 417-422.
- P4 ——— (with Mitra, S. K.) (1971) : Generalized inverses of partitioned matrices and recalculation of least squares estimates for data on modal changes, *Sankhyā A*, 33, 395-410.
- P5 ——— (with Mitra, S. K.) (1971) : A characterisation of Moore-Penrose and related results, *Sankhyā A*, 33, 411-416.
- P6 ——— (with Mitra, S. K. and Rao, C. R.) (1972) : Determination of a matrix by its sub-classes of  $g$ -inverses, *Sankhyā A*, 34, 5-8.
- P7 CHAKRABORTY, RANAJIT (1971) : Restricted random mating : a new mating model. *Current Sci.*, 40, 185-186.

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- P8 CHAKRABORTY, RANAJIT (1971): Genetic correlations in equilibrium population. *Sankhyā*, B, 33, 3, 4, 249-258.
- P9 ——— (1971): A note on parent-offspring correlation and inbreeding. *Acta Genet. Med. et. Camel.*, 20, 205-210.
- P10 ——— (1971): A note on counting method of estimation for MNSs blood group system. *Calcutta Stat. Assoc. Bull.*, 20, 93-98.
- P11 ——— (1971): Rethinking on human mating models. Proc. Symposium on 'Genetical Demography'. Part IV. *Proc. 58th Session, Ind. Sc. Cong.*, 120-121.
- P12 ——— (1971): A theorem on isolate mixture. *Abstract Vol. Inter. Symp. Hum. Genet. Waltair, India, March, 1971.*
- (P1) ——— (with Adhikari, B. P. and Sarma, Y. R.) (1971): Estimation of OAB gene frequencies with assumption of restricted random mating. *Abstract Vol. 4th Inter. Cong. Hum. Genet.*, 13.
- P13 GHOSH, J. K.: A new proof of the Bahadur representation of quantiles and an application. *Ann. Math. Stat.*, 42, 1957-1961.
- P14 GHOSH, MALAY (with Sen, P. K.) (1971): On bounded length sequential confidence intervals based on one-sample rank order statistics. *Ann. Math. Stat.*, 42, 180-203.
- P15 ——— (1971): On the Wald optimality of rank order tests for paired comparisons. *Ann. Math. Stat.*, 42, 1770-1776.
- P16 ——— (with Sen, P. K.) (1971): Sequential confidence interval for the regression coefficient based on Kendall's Tau. *CSA Bull.*, 20, 23-36.
- P17 ——— (1971): Robust sequential confidence intervals for the Behrens-Fisher problem. *CSA Bull.*, 20, 77-82.
- P18 ——— (with Sen, P. K.) (1972): On bounded length confidence interval for the regression coefficient based on a class of rank statistics. *Sankhyā*, A, 34, 33-52.
- P19 MAHALANOBIS, P. C. (1971): Some observations on recent developments in sample surveys (38th Session, *International Statistical Institute*, 11-20 August 1971, Washington, 247-261).
- P20 MAITRA, ASHOK (1971): On game-theoretic methods in the theory of Souslin sets. *Fund. Math.*, 70, 179-185.
- P21 ——— (with Parthasarathy, T.) (1971): On stochastic games II. *Jour. Optimization Theory and Applications*, 8, 154-160.
- P22 MITRA, S. K. (with Rao, C. R.) (1971): *Generalized Inverse of Matrices and its Applications*, pp. XVI+240, John Wiley and Sons, Inc., New York.
- P23 ——— (with Rao, C. R.) (1971): Further contributions to the theory of generalized inverse of matrices and its application, *Sankhyā*, A, 33, 289-300.

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- P24 MITRA, S. K. (with Rao, C. R.) (1972) : Generalized inverse of a matrix and its application, *Proc. Sixth Berkeley Symposium on Mathematics, Statistics and Probability*, 1, 610-620.
- (P4) ——— (with Bhimasankaram, P.) (1971) : Generalized inverses of partitioned matrices and recalculation of least squares estimates for data on model changes, *Sankhyā*, A, 33, 395-410.
- (P5) ——— (with Bhimasankaram, P.) (1971) : A characterisation of Moore-Penrose and related results, *Sankhyā*, A, 33, 411-416.
- (P6) ——— (with Bhimasankaram, P. and Rao, C. R.) (1972) : Determination of a matrix by its sub-classes of  $g$ -inverses, *Sankhyā*, A, 34, 5-8.
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- P26 ——— (1971) : Some partitions of and the number of Borel fields on, large finite sets. *Proc. Colloquium on Combinatorial Theory and its Applications*, 1969, 803-811, Balatonfured, Hungary.
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- P28 PANDEY, R. J. (with Chowdhury, A. K.) (1972) : Single sampling plans by attributes with three decision criteria, *Sankhyā*, B, 34.
- P29 PARTHASARATHY, T. (1971) : Discounted and positive stochastic games. *Bull. Amer. Math. Soc.*, 77, 134-136.
- P30 RAHA, A. B. (1971) : On completely Hausdorff-completion of a completely Hausdorff space. *Pacific Jour. Math.*, 38, 1, 161-166.
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- P33 ——— (1971) : Some aspects of statistical inference in problems of sampling from finite populations, *Foundations of Statistical Inference*, Holt Rinehart and Winston of Canada, 177-202.
- P34 ——— (1971) : Estimation of variance and covariance components—Minque Theory, *Jour. Multivariate Analysis*, 1, 267-276.
- P35 ——— (1971) : Minimum variance quadratic unbiased estimation of variance components, *Jour. Multivariate Analysis*, 1, 445-458.
- P36 ——— (1971) : Unified theory of linear estimation, *Sankhyā*, A, 33, 370-396.
- P37 ——— (1971) : Data analysis and statistical thinking, *Economic and Social Development, Essays in Honour of C. D. Deshmukh*, Vora and Co., Bombay, 383-392.

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- (P22) ——— (with Mitra, S. K.) (1971): *Generalized Inverse of Matrices and its Applications*, pp. XVI+240. John Wiley and Sons, Inc., New York.
- (P23) ——— (with Mitra, S. K.) (1971): Further contributions to the theory of generalized inverses of matrices and its application, *Sankhyā*, A, 33, 289-300.
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- P40 RAO, T. J. (1971): On the variance of the ratio estimator. *Metrika*, 18, 33-39.
- P41 ——— (1971):  $\pi$  PS sampling designs and the Horvitz-Thompson estimator. *Jour. Amer. Stat. Assoc.*, 66, 872-875.
- P42 ——— (1971): Sampling techniques and their application. *Math. Spectrum*, 3, 57-61.
- P43 SRINHA, B. K. (1971): On the equivalence of Bayesian and non-Bayesian procedures. *CSA Bull.*, 20, 1-22.

B. THEORETICAL PHYSICS AND ELECTRONICS

- P44 BANDYOPADHYAY, P. (with Raychaudhuri, P.) (1971): Comments on Stothers' paper "Astrophysical exclusion of photon-neutrino weak coupling." *Physics-Letters* (North-Holland Publishing Company), 35A, 300.
- P45 ——— (with Raychaudhuri, P.) (1971): Elastic scattering of electrons by fission-antineutrinos. *Il Nuovo Cimento* (Italy), 6A, 328.
- P46 ——— (with Raychaudhuri, P.) (1971): Some remarks on the universal X-ray background. *Astrophysics and Space Science* (Holland), 13, 185.
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- P53 ——— (with Debnath, K. F. and Majumder, A. K.) (1971): Flow in a shallow rectangular cavity. *Indian Jour. Technology*.
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- (P44) ——— (with Bandyopadhyay, P.) (1971): Comments on Stothers' paper "Astrophysical exclusion of photon-neutrino weak coupling." *Physics-Letters* (North-Holland Publishing Company), 35A, 300.
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C. ANTHROPOMETRY AND HUMAN GENETICS

- P56 BASU, A. (1971): Intrinsic rate of neutral increases among the Pahira. *Social Biology*, 18, 194-199.
- P57 ——— (1969): A prospectus for population-biological study of the Indian castes. *Jour. Ind. Anthropol. Soc.*, 4, 1-10.
- P58 DAS, S. R. (with Mukherjee, B. N. and Das, S. K.) (1972): Caste and age variations of the incidence of LDH variants in the Bengali Hindus. *Humangenetik*, 14, 151-154.
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- P60 МАЛЮТОВА, К. С. (with Singh, D. R.) (1971): Hand clasping and arm folding among the Manipuris (India). *Human Heredity*, 21, 203-207.

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- P61 MALHOTRA, K. C. (with Singh, N. R.) (1971): Incidence of cleft-chin among the Brahmans and the Meitheis of Manipur. *Man in India*, 51, 257-259.
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- P65 PAKRASI, K. (with Mukherjee, B. N.) (1971): The Santals of West Bengal: Some social and demographic characters. *Man in India*, 51, 92-110.
- P66 ——— (1971): Infanticide and variation of sex-ratio in a caste population of India. *Acta Medica Austrologica* (Italy), 3, 217-228.
- P67 ——— (1971): *The Uprooted: A Sociological Study of the Refugee of West Bengal*. Editions Indian, Calcutta.
- P68 ——— (with Haldar, A.) (1971): Sex ratios and sex sequences of births in India. *Jour. Biosocial Sciences*, (London), 13, 377-387.

D. CROP SCIENCES

- P69 DAVIS, T. A. (with Basu, S. K.) (1971): Aestivation of perianth of palm fruits. *Phytomorphology*, 21, 219-235.
- P70 ——— (with Ramannajacharyulu) (1971): Statistical analysis of bilateral symmetry in plant organs. *Sankhyā*, B, 33, 259-290.
- P71 ——— (1972): Tapping the wild date. *Principes Jour. Palm. Soc.* 16, 12-15.
- P72 ——— (1972): Effect of foliar arrangement on fruit production in some tropical crop plants. *Tropical Ecology*, Athens: 147-164.
- P73 ——— (1972): Usual and unusual branching in palms. *Glimpses in Plant Research*, 1, 159-180.
- P74 ——— (1972): Patterns of nest building in two social wasps. 14 *Int. Cong. Entomol.*, Canberra, 1, 148.
- P75 ——— (with Basu, S. K.) (1972): Morphology of plam spadex. *National Symp. Plantation Crops*, 1, 12-13.
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E. DEMOGRAPHY

- P79 SEN GUPTA, B. (1970) : Population projections of India : An alternative approach, *Ariha Vijnana*, 13, 2, 237-245.

F. DOCUMENTATION AND LIBRARY SCIENCE

- P80 BEATTACHARYYA, G. (1971) : Education in documentation. *Lib. Sc.*, 8, Paper J.
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- P82 ——— (1971) : Classifying by UDC and CC: A comparative study. *DRTC Annual Seminar*, 9, Paper CB.
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- P85 GOPINATH, M. A. : Lathe production : A depth classification version of CC. *Lib. Sc.*, Paper K.
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- P90 JAYARAJAN, P. (1971) : Development in the universe of subjects, changes in systems for documents finding and user problems : India's contribution to a solution. *Iasic Bull.*, 16, 108-118.
- P91 ——— (1971) : Entry element in the name of a university. *Lib. Sc.* 8, Paper M.
- P92 ——— (1971) : Bulletin of peace proposals : An evaluation. *DRTC Annual Seminar*, 9, Paper AE.
- P93 ——— (with Gopinath, M. A.) (1971) : Classification of complex subjects in CC and UDC. *DRTC Annual Seminar*, 9, Paper CC.
- P94 NEELAMEOHAN, A. (1971) : Taxation : Depth classification version of CC. *Lib. Sc.* 8, Paper F.
- P95 ——— (1971) : International trade : Depth classification version of CC. *Lib. Sc.* 8, Paper L.

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- P96 NEELAMEGHAN, A. (1971): Search for a theoretical basis for UDC: A post-script to the Herceg-Novi Symposium. *Lib. Sc.* 8, Paper P.
- P97 ——— (1971): Sequence of component ideas in a subject. *Lib. Sc.* 8, Paper Q.
- P98 ——— (1971): Use of information in research, invention, and innovation: Case studies. *DRTC Annual Seminar*, 9, Paper BA.
- P99 ——— (1971): Trend of research in notational system for library classification, with particular reference to the Colon Classification. *DRTC Annual Seminar*, 9, Paper CH.
- P100 ——— (1971): Review of "National library of India: by P. N. Kaula". *Deccan Herald*, 4 July 1972.
- P101 ——— (with Gopinath, M. A.) (1971): User-based and user oriented classification system: Sequence of subjects and of components in a subject. *Int. Conf. Information Science*, Israel, 21, 12.
- P102 ——— (1971): Fused main subjects. *DRTC Annual Seminar*, 9, Paper CD.
- P103 ——— (1971): Steam generator production engineering: Depth classification version of CC. *Lib. Sc.*, 8, Paper E.
- P104 ——— (1972): Preparation and production of reference book: Role of guiding principles and standards. *IASLIC Seminar*, 9.
- P105 ——— (1972): An annual review for library science in India: Its need, scope, and publication. *IASLIC Seminar*, 9.
- P106 ——— (with Ranganathan, T.) (1971): Compatibility of UDC with a freely-faceted version of CC: A case study. *DRTC Annual Seminar*, 9, Paper CE.
- P107 ——— (with Ravinchandra Rao, I. K. and Gupta, B. S. S.) (1972): Discovery and re-discovery of antibiotics: A further study. *Lib. Sc.* 9, Paper F.
- P108 RANGANATHAN, S. R. (1971): International book-year. *Lib. Sc.* 8, Paper N.
- P109 ——— (1971): Dominant area for research in classification in the immediate future, *DRTC Annual Seminar*. 9, Paper CA.
- P110 ——— (1971): Ten years of work (in DRTC): A review and a preview. *DRTC Annual Seminar*. 9, Paper D.
- P111 ——— (1971): Simplified rules for the cataloguing of books of tomorrow in a service library. *Lib. Sc.*, 8, Paper G.
- P112 ——— (1972): Colon classification: Notational system, towards a plan for its productive use. *Lib. Sc.*, 9, Paper A.
- P113 ——— (1972): Social sciences: Emergence and scope. *Lib. Sc.*, 9, Paper C.

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- P114 RANGANATHAN, S. R. (1972): Difficulties of government documents. James Childs. Gilbert Mudgo Award (1971). *Lib. Sc.* 9, Paper D.
- P115 ——— (1971): March of library movement in Tamil Nadu. *Friends' Pastime Association*, Literary wing. First Anniversary Souvenir, 16-21.
- P116 ——— (1972): Salutations to Master Motilalji. Shri Sanmati Pustakalaya Trust, Jaipur, 8.
- P117 ——— (1971): Library work: Its hub, foundation and purpose. *Library and Information Science*, Japan 9. 25-37.
- P118 ——— (with Bhattacharyya, G.) (1971): Conflict of authorship: Name of original author merged in title. *Lib. Sc.* 8, Paper H.
- P119 ——— (with Neelamoghan, A.) (1971): Univocal classification system and FID. *Lib. Sc.* 8, Paper D.
- P120 ——— (with Seetharama, S.) (1971): Slimming the abstract of a paper: Symbiosis between the subject heading within a main entry and the abstract. *DRTC Annual Seminar*, 9, Paper AA.
- P121 RAVICHANDRA RAO, I. K. (1971): Obsolescence and utility factors of periodical publications: A case study. *DRTC Annual Seminar*, 9, Paper BJ.
- P122 ——— (with Rewat, Kanti) (1972): Computer programming language: Depth classification version of CC. *Lib. Sc.*, 9, Paper B.
- P123 SEETHARAMA, S. (1971): Human diseases: Depth classification version of CO. *Lib. Sc.*, 8, Paper B.
- P124 ——— (with Gopinath, M. A.) (1971): Classification of books on disease in medicine: A comparative study of CC and UDC class numbers. *DRTC Annual Seminar*, 9, Paper CC.

G. EMBRYOLOGY

- P125 BRAHMACHARY, R. L. (with Tapeswi, P. K. and Ghosal, D.) (1971): Further investigations on transcription in *Limnaea* (molluso), *Zeitschrift fur Naturforschung*, 26b, 271.
- P126 ——— (with Ghosal, D. and Tapeswi, P. K.) (1971): Rhythmic incorporation of  $p^{32}$  and  $C^{14}$ -Uracil in early mitotic cycles of *Limnaea* (molluso) eggs, *Zeitschrift fur Naturforschung*, 26b, 822.
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- P128 ——— (with Palchoudhury, S. and Tapeswi, P. K.) (1971): Further investigations on transcription and translation in *Limnaea* embryos, *Canadian Jour. Biochemistry*, 49, 926.

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### H. GEOLOGY

- P129 BONDYOPADHYAY, SHIBDAS (1971): Pebble orientation in relation to cross-stratification: a statistical study. *Jour. Sedim. Pet.*, 41, 585-587.
- P130 KUTTY, T. S. (with Roy Chowdhury, T.) (1971): The Gondwana sequence of the Pranhita-Godavari Valley and its vertebrate faunas. *Proc. Papers. IInd. Gond. Symp., S. Africa*, 303-308.
- (P130) ROY CHOWDHURY, T. (with Kutty, T. S.) (1971): The Gondwana sequence of the Pranhita-Godavari Valley and its vertebrate faunas. *Proc. Papers. IInd. Gond. Symp. S. Africa*, 303-308.
- P131 SENGUPTA, SUPRIYA (with Rao, J. S.) (1971): Quantitative approach to paleocurrent analysis: treatment of direction data, VIII *Inter. Sedim. Congr. Heidelberg*.
- P132 ——— (1971): Morphology and genesis of fluvial cross-bedding from the Kamthi formation. *VIII Inter. Sedim. Congr. Heidelberg*.

### I. LEAF PROTEIN

- P133 MATAI, S. (with Bagchi, D. K. and Chanda, S.) (1971): Leaf protein from some plants in West Bengal. *Jour. Science & Engineering*, XXIV, 7 July, 102-105.

### J. PLANNING, ECONOMIC STATISTICS AND ECONOMETRICS

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**Annexure 3 : List of National Sample Survey Reports**

(The date of submission to the Government of India is given in brackets)

srl. no.	draft report no.	title of the report
(1)	(2)	(3)
<b>3.1 DRAFT REPORTS REVISED AND FINALISED FOR PRINTING</b>		
1.	214	Tables with notes on the Annual Survey of Industries, 1967 : Sample Sector— Summary Results. (April 1971).
2.	217	Tables with notes on Housing Condition, 19th round. (July 1971).
3.	218	Tables with notes on Household Distribution Trade (Schedule 17.1), 20th round (December 1971).
4.	219	Tables with notes on Villages and Towns in India (Schedules 0.2 & 0.2)— Some Results, 22nd round (October 1971).
5.	222	Tables with notes on the Annual Survey of Industries, 1966 : Sample Sector— Detailed Results (February 1972).
<b>3.2 DRAFT REPORTS SUBMITTED TO THE GOVERNMENT OF INDIA</b>		
1.	224	Some results of land utilisation survey and crop-cutting experiments, 23rd round (May 1971).
2.	225	Tables with notes on household consumer expenditure, enterprise and demo- graphic particles (Sch. 17), 20th round (June 1971).
3.	226	Tables with notes on farm practices, 22nd round (July 1971).
4.	227	Tables with notes on capital formation, (Schedule 16), 19th round (July 1971).
5.	228	A preliminary report on pilot study on employment and unemployment in urban areas, 1969 (based on the data of the first six visits, Schedule U), 23rd round (August 1971).
6.	229	Tables with notes on non-household small scale manufacture (Schedule 2.2), 23rd round (August 1971).

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3.3 LIST OF NSS DRAFT REPORTS PREPARED BY STATE GOVERNMENTS ON WHICH COMMENTS WERE FORWARDED TO THE GOVERNMENT OF INDIA

(The date of submission of the Institute's comments is indicated in brackets)

sl. no.	title of the report	prepared by State (name)
(1)	(2)	(3)
1.	Report on Consumer Expenditure 20th & 21st rounds (July 1971)	Andhra Pradesh
2.	Report on Farm Practices, 22nd round (February 1972)	Andhra Pradesh
3.	Report on land-holdings, 16th round (January 1972)	Madhya Pradesh
4.	Report on Housing Condition, 18th round (November 1971)	Manipur
5.	Report on Schedule 5 series, 18-25th rounds (November 1971)	Manipur
6.	Report on Consumer Expenditure, 18th round (July 1971)	Manipur
7.	Report on Agricultural Holdings, 16th round (November 1971)	Maharashtra
8.	Report on rates of birth and death etc. of rural populations, 15th round (August 1971)	Maharashtra
9.	Report on Indebtedness, 16th round (July 1971)	Maharashtra
10.	Report on Consumer Expenditure, 18th round (July 1971)	Maharashtra
11.	Report on crop-cutting experiments, 21st round (March 1972)	Maharashtra
12.	Report on Urban Labour Force, 19th round (September 1971)	Tripura
13.	Report on Consumer Expenditure, 17th round (August 1971)	Tripura
14.	Report on Village Statistics, 18th round (October 1971)	Tripura
15.	Report on household industry and rural assets, 20th round (November 1971)	Uttar Pradesh
16.	Report on Employment and Unemployment, 22nd round (March 1972)	Uttar Pradesh

## PART III

### Statement of Accounts and Auditors' Report for the year 1971-72.

#### AUDITORS' REPORT

We report that we have audited the Balance Sheet as at 31st March 1972, of—

- a) the Indian Statistical Institute.
- b) "Other Funds."

signed by us under reference to this report and the relative Income and Expenditure Accounts for the year ended on that date with the books and records maintained by the Institute and produced to us and information and explanations given and subject to and read with the notes thereon and also subject to the remarks given below have found them to be in accordance therewith.

The remarks referred to above are :

#### BALANCE SHEET

##### 1. Fixed Assets :

a) Asset Registers were not maintained for Land, Land & Development, Buildings, Overbridge, Sheds and Structures, Printing Press and Monotype Accessories, SRC Equipment, H T Electricity and H T E I for UNTAA. Registers for other assets though maintained leave much scope for improvement in as much as :

- i) Assets as per financial accounts could not be compared with those of the Asset Registers as the cumulative totals of different types of assets were not shown in the Asset Registers;
- ii) Location of assets were not disclosed;
- iii) Description of assets e.g., model, identity numbers, etc. were also not shown.

b) Values of fixed assets acquired on dates prior to 31st March, 1952 were taken from those appearing in the Inventories prepared as on that date.

c) Certificates from the officers concerned regarding the existence and condition of the movable assets as at 31st March 1972, belonging to the Institute and to different Funds under it, were not produced before us for the purpose of verification at the time of audit. The Institute did not take timely steps for a physical verification of the movable assets as at 31st March 1972, the inventory of which is necessary for audit purpose. Moreover, maintenance of records of fixed assets at any particular unit offer little scope of comparing a physical verification list with local records. The values shown in the Balance Sheets are as per General Ledger of the Institute.

d) Land : In respect of the following lands "Possession Certificates for Items I-VI and Grant Certificate for Item VII" were produced before us for the purpose of verification. No Deed of Purchase or Deed of Lease duly stamped and registered was produced