INDIAN STATISTICAL INSTITUTE

QUESTION PAPERS

for

COMPUTER'S CERTIFICATE EXAMINATIONS

May & November 1977

203 BARRACKPORE TRUNK ROAD
CALCUTTA 700035

Price : Rupees Two only

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination – May 1977

Paper I (Practical) : Elementary Computation

Time: 5 hours Full marks: 100

(a) Figures in the margin indicate full marks.

(b) Use of calculating machines is not permitted.

GROUP A

(Answer all questions from this group)

1. Using contracted method, find any one of the following (correct to 4 places of decimal) –

i) $1 + \frac{1}{1.5} + \frac{1}{1.5.9} + \ldots$

ii) 0.284978 X 12.25325 (7)

2. With the help of mathematical tables find the following, correct to 5 places of decimal in each case :

(i) $\sqrt{14.2}$, (ii) $e^{0.8}$, (iii) $(1.1)^{.8}$

(iv) $\log_e 5.67$ (v) 1/97.28 and (vi) antilog $\bar{4}.4771213$ (2x6)=12

3. Evaluate any one of the following :–

i) $\frac{5}{2^2 \cdot 3^2} + \frac{7}{3^2 \cdot 4^2} + \frac{9}{4^2 \cdot 5^2} + \ldots + \frac{19}{9^2 \cdot 10^2}$

ii) $x + 5x + 25x^2 + \ldots + 15625x^6$ when $x = 0.8$ (7)

4. With the help of suitable formulae evaluate any two of the following :

i) $8 - (0.993)^3 - (1.007)^3$

ii) $(5.275)^2 (5.275 - 4.575) + (5.275)^2 (4.575 - 5.275) + (4.575)^2 \times 5$

iii) $(2.5)^2 + (1.6)^2 + 4$

[State the formulae used.] (2x2)=4

Please turn over

5. Use the values $\log_{10} 2 = 0.3010300$, $\log_{10} 3 = 0.4771213$, $\log_{10} 7 = 0.8450980$, $\log_{10} 8986649 = 6.9535977$ and $\log_{10} 41369 = 4.6166753$ when required :

i) Find $\left(\frac{7.2 \times 6.3}{62.5}\right)^{\frac{1}{3}}$ correct to 4 places of decimal

ii) Extract the 7th root of 0.0020736 correct to 4 places of decimal.

iii) Solve for x

$$5^{6x} \cdot 7^{x+2} = 3^{2x-3}$$

correct to 4 places of decimal

[No credit will be given if you use any information not given in this question.] (3x3)=9

6. (a) Round off the following numbers to 4 significant digits

(i) 363042 (ii) 0.000038

Find also the absolute and relative errors due to rounding off in each case.

(b) Find the number of trustworthy figures in $(3.3864)^4$ assuming that the number in parentheses is correct to its last figure but no farther. (6+5)=11

GROUP B

(Answer all questions from this group)

7. The following table gives the values of a function $f(x,y)$ for different values of x and y.

y \ x	60	61	62
65	1.3489	1.3559	1.3630
66	1.3773	1.3848	1.3923
67	1.4060	1.4140	1.4221

Find by linear interpolation f(61.4, 66.5). (10)

8. Draw the graph of

i) $y = x^2$

ii) $y = 10$

iii) $x = 2$ and

iv) $x = 0$

Hence find graphically the area bounded by these graphs. (5+1+1+1+3)=11

Please turn over

9. Solve graphically the following equations :

i) $x + y = 8$; $xy = 12$

ii) $x^2 - 3.5x + 3 = 0$ (5+5)=10

10. EITHER

Draw the graph of the function $y = x^3 - 2x - 8$ plotting points at an interval of 0.2 between $x = 2$ to $x = 3$.

From the graph, obtain the root of the equation $x^3 - 2x - 8 = 0$ correct to 1 place of decimal.

OR

Draw the graph of the function

$$f(x) = \frac{e^{-m} \cdot m^x}{x!}$$

for $x = 0, 1, 2, 3, 4$ & 5 given that $m = 3$. . . . (8)

11. The following table gives the cumulative percentage of households by size of land holdings.

size of land holdings (in acres)	0.00	1.00	2.50	5.00	7.50	10.00
cumulative percentage of households	5.3	36.4	56.2	76.3	86.7	91.6

size of land holdings (in acres)	15.00	20.00	25.00	30.00	50.00	80.00
cumulative percentage of households	96.1	97.0	98.7	99.2	99.8	100.00

Plot the points on a graph paper and draw a free hand smooth curve. Estimate from the graph, the percentage of households having size of land holdings less than or equal to 7.00 acres. (7+2)=9

NEATNESS (For Groups A and B)

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination – May 1977

Paper II (Practical) : Compilation and Presentation of Statistics

Time : 3 hours Full marks : 100

(a) Figures in the margin indicate full marks.

(b) Use of calculating machines is not permitted.

GROUP A

(Answer all questions from this group)

1. The direct and other capital investments by foreign countries in India was as follows at the end of March 1960.

The direct investment for petroleum was 887 by U.K. and 428 by U.S.A. There was no direct investment by other countries for petroleum. Other capital investment for petroleum was 135 for U.K., 350 for U.S.A. and 161 for other countries.

The direct and other capital investment on manufacturing was 2217 and 698 by U.K., 676 and 2086 by U.S.A. and 914 and 2311 by other countries respectively.

The only direct capital investment for mining was 37 by U.K. Other capital investment for mining was 27 by U.K. and 51 by other countries, U.S.A. having no investment.

The total investment on petroleum was 982 by U.K., 784 by U.S.A. and 181 by other countries. The total investment for manufacturing was 2915, 2762 and 3225 by U.K., U.S.A. and other countries respectively. For mining the total investment was 64 by U.K., nil by U.S.A. and 51 by other countries respectively.

Total direct and other capital investments on these three industries was 3,141 and 830 by U.K., 1,134 and 2,442 by U.S.A. and 914 and 2,543 by other countries. Overall total investment by U.K., was 3,971, by U.S.A. was 3,546 and by other countries 3,457 for these three industries.

Present the above information in a suitable statistical table with appropriate headings. (15)

2. The distribution of university students by type and level of education was published in 1963–64 by the Ministry of Education. Eight types of education were considered – arts, science, commerce, law, engineering, business management and administration, education/vocational training, and music and fine arts.

The levels of education considered were pre-university, first degree, post-graduate degree, diploma/certificate, and post-graduate diploma/certificate. Within each level of education boys and girls were considered separately.

Prepare a blank tabular layout with suitable headings for presenting the number of students in each type and level of education by sex. Make provision for meaningful totals and sub-totals. (15)

Please turn over

3. Name the official publications which provide current statistics for any three of the following. Also mention in each case the name of the agency issuing the publication and the periodicity of the publication.

a) Number of post-cards sold by the Postal departments in India for any two years.

b) Yearly production of iron ores by the States of India.

c) Number of sterilizations during a year in India.

d) Liabilities and assets of the Reserve Bank of India.

e) National Income at current prices. (3x3)=9

4. From any official publications supplied, collect the information on any three of the following. Mention also the name of the publication consulted, its reference period, page number and the periodicity of the publication, in each case. Give foot-notes, if necessary.

a) Number of employment exchanges in India for any two years.

b) Index numbers of the area under Maize for any two years in India.

c) Manufacture of Benzene and Acetone in India in any two months.

d) Gross earning of government Railway for any two years.

e) Death rate in India for any two years. (3x3)=9

5. The table below was copied from a Statistical Pocket Book.

Table : Number of Officers of Commercial Banking Companies

Year	1	2	3	4	5	Total
Scheduled Banks:	2,646	2,853	4,338	6,417	6,780	23,184
Indian	2,582	2,886	4,317	6,310	6,678	22,763
Foreign	64	67	70	107	112	421
Non-scheduled Banks:	1,473	1,240	725	721	216	3,675
Total :	9,119	4,193	5,113	6,638	6,996	27,059

There are five copying mistakes in these figures. Locate the mistakes by circling the figures and supply the correct ones. (1)

GROUP B

(Answer all questions from this group)

6. The revenue of the Government of India from different sources for a certain year are given below:

Source	Revenue (in million Rs.)
1. Customs	21.76
2. Taxes on income (other than corporation tax)	16.32
3. Corporation tax	6.80
4. Excise (Central)	13.60
5. Others	9.52

Draw a pie chart for the above data. (6)

Please turn over

(cs)

7. The percentage distribution of Indian Couples in the Rural Sector by the number of children born alive as obtained from the data collected through the National Sample Survey is given below.

number of children (1)	percentage of couple (p.c) (2)	number of children (1)	percentage of couple (p.c) (2)
0	27.78	7	4.08
1	14.18	8	3.77
2	11.68	9	1.51
3	10.61	10	0.79
4	9.92	11	0.60
5	8.06	12	0.17
6	6.25		

Represent the above data by

(a) frequency polygon,

(b) step diagram (less than type) (6+6)=12

8. From a table of random numbers, 1000 totals of 10 random digits were built up.

The frequency distribution of these totals is given below.

Class range (1)	Frequency (2)	Class range (1)	Frequency (2)
14 - 16	2	44 - 46	137
17 - 19	1	47 - 49	119
20 - 22	3	50 - 52	104
23 - 25	9	53 - 55	86
26 - 28	16	56 - 58	64
29 - 31	37	59 - 61	40
32 - 34	56	62 - 64	18
35 - 37	77	65 - 67	9
38 - 40	86	68 - 70	5
41 - 43	130	71 - 73	1

Draw a histogram and Ogives of both less than & greater than types to represent the data. (3x5)=15

Please turn over

9. In an anthropometric survey, the measurements of total facial length (TFL) and upper facial length (UFL) in mms. as collected from a sample of 100 persons, are given below.

Sl. no.	TFL	UFL	Sl. no.	TFL	UFL
(1)	(2)	(3)	(1)	(2)	(3)
1	126	59	51	125	66
2	115	64	52	127	58
3	123	68	53	112	67
4	114	66	54	116	58
5	116	67	55	108	61
6	114	62	56	117	62
7	126	66	57	113	58
8	126	57	58	114	66
9	127	63	59	115	65
10	117	60	60	102	53
11	115	58	61	124	60
12	110	62	62	120	68
13	112	68	63	119	64
14	113	61	64	105	57
15	112	61	65	109	56
16	110	61	66	103	58
17	115	65	67	118	64
18	114	60	68	110	65
19	120	66	69	115	63
20	120	65	70	110	62
21	127	59	71	103	61
22	108	60	72	104	54
23	100	60	73	98	43
24	109	60	74	114	60
25	126	58	75	108	65
26	108	61	76	108	59
27	118	65	77	108	60
28	113	54	78	115	67
29	118	62	79	109	64
30	117	62	80	109	65
31	121	63	81	114	61
32	117	66	82	116	55
33	127	61	83	109	62
34	115	65	84	114	60
35	102	58	85	112	62
36	107	58	86	105	58
37	126	60	87	120	69
38	110	62	88	102	58
39	108	61	89	120	69
40	115	63	90	102	58
41	116	69	91	110	58
42	114	65	92	110	67
43	124	67	93	117	62
44	99	54	94	109	60
45	120	65	95	114	58
46	112	63	96	107	65
47	110	62	97	102	56
48	104	64	98	107	58
49	105	60	99	123	64
50	125	66	100	110	56

Prepare a bivariate frequency table using suitable class intervals. (15)

NEATNESS (for Groups A and B) (4)

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination – May 1977

Paper III (Practical) : Selected Techniques of Computation

Time : 5 hours Full marks : 1

(a) Figures in the margin indicate full marks.

(b) Use of calculating machines is permitted.

GROUP A

(Answer all questions from this group)

1. In the following table one of the values of y is erroneous. Identify and correct the erroneous figure by means of difference table.

x	y
15	13.260
16	14.144
17	15.028
18	15.912
19	16.792
20	17.680
21	18.564
22	19.448
23	20.332

(6)

2. Using divided difference formula, find y for x = 0.1 from the following table.

x	y
0.0	132.651
0.2	140.877
0.3	157.464
0.4	166.375
0.7	195.112
0.8	216.000

(14)

3. Compute by Simpson's one-third rule the value of $\int_0^1 \frac{dx}{1+x^2}$, taking 11 ordinates. (Give the result correct to 5 places of decimal.) (14)

4. The following table gives the values of $y = \frac{2}{\sqrt{\pi}} \int_0^x e^{-x^2} dx$ for certain values of x. Find the value of x when y equals $\frac{1}{2}$.

x	y
0.47	.4937452
0.48	.5027498
0.49	.5116683
0.50	.5204999

( )

Please turn over

(MS)

GROUP B

(Answer all questions from this group)

5. Find the two positive roots of the following equation correct to three decimal places :

$$x^3 - 5.34x^2 - 64.88x + 168.39 = 0,$$

given that they lie between 2 and 3 and 10 and 11. (16)

6. Solve by pivotal condensation method or otherwise :

$$\begin{aligned} x + 2y - 3z + 11t &= -10.7 \\ 2x - 3y + z - 4t &= 11.4 \\ 2x - y + 5z - 6t &= 29.2 \\ 10x + 3y - 3z + 4t &= -0.2 \end{aligned}$$ (13)

7. Evaluate the following determinant :

$$\begin{vmatrix} 0.48 & -1.32 & 2.16 & 0.21 \\ 1.32 & 0.68 & -3.25 & 0.81 \\ 2.35 & 1.32 & 4.11 & 0.26 \\ -1.33 & 6.32 & 1.35 & 4.10 \end{vmatrix}$$ (10)

NEATNESS (for Groups A and B) (1)

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination - May 1977

Paper IV (Practical) : Descriptive Statistics

Time : 5 hours Full marks : 100

(a) Figures in the margin indicate full marks.

(b) Use of calculating machines is permitted.

GROUP A

(Answer all questions from this group)

1. The following table gives the frequency distribution of Heights in Centimetres for 200 males belonging to a particular region in India.

Height (Cm.)	Frequency
144.6 - 149.5	2
149.6 - 154.5	4
154.6 - 159.5	27
159.6 - 164.5	62
164.6 - 169.5	70
169.6 - 174.5	31
174.6 - 179.5	3
179.6 - 184.5	2

Compute the following for the frequency distribution given above

i) the mean
ii) the median
iii) the mode
iv) the standard deviation
v) the coefficient of variation
vi) the 3rd quarter
vii) the seventh decile (D_7) and
viii) the 90th percentile (P_{90}) (3x2+3+4x2)=17

2. The mean and standard deviation of a frequency distribution based on a sample of 100 observations were calculated as follows :

Mean ($\bar{x}$) = 9.368

Standard deviation (s) = 4.399

But, later it was discovered that an observation 2.9 was mis-read as 9.2. Calculate the mean ($\bar{x}$) and standard deviation (s) correctly. (2+3)=5

Please turn over

3. The following table shows the marks obtained by 400 examination candidates in English (x) and in Mathematics (y).

Marks in Mathematics (y)	Marks in English (x)								Total (y)
	10–	20–	30–	40–	50–	60–	70–	80–	
10 –	1	5	8	–	1	–	1	–	16
20 –	5	12	16	1	1	–	–	–	35
30 –	–	19	20	12	4	1	–	–	47
40 –	–	6	18	29	15	2	–	–	70
50 –	2	5	18	30	35	–	1	–	91
60 –	–	3	8	12	18	30	7	2	80
70 –	–	–	2	4	5	16	10	4	41
80 –	–	–	–	–	2	4	6	8	20
Total (x):	8	41	90	88	81	53	25	14	400

i) Compute the co-efficient of correlation between x and y;

ii) Find the linear regression equation of y on x;

iii) Estimate the probable score in Mathematics of a candidate who scores 75 in English. (9+3+1)

4. (a) On a certain date the Ministry of Labour Retail Price Index was 204.6. Percentage increases in prices over July 1944 were : Rent and Taxes 65, Clothing 220, Fuel and Light 110 and Miscellaneous Items 125. What was the percentage increase in Food Group ?

[Weights for the different groups were as follows: Food 60, Rent and Taxes 16, Clothing 12, Fuel and Light 8, Miscellaneous Items 4]

(b) The table below gives the wholesale prices P ($ per box) and quantities Q (in thousand boxes) of certain varieties of citrus fruits produced in U.S.A. during the years 1959, 1961 and 1964

Fruits	1959		1961		1964	
	P	Q	P	Q	P	Q
Grape Fruit Florida	$1.41	30,500	$ 1.40	35,000	$3.94	31,000
Lemons, California	$7.12	17,100	$ 7.18	15,200	$8.38	13,500
Orange, California, Navel	$7.66	13,500	$10.26	7,000	$7.20	15,600
Oranges, California Valancia	$8.36	17,300	$ 7.04	13,100	$6.68	16,000
Oranges, Florida	$3.32	91,500	$ 5.99	113,400	$6.18	86,200

Using the above data, compute the wholesale price indices for the years 1961 and 1964 using 1959 as base by the following methods: (i) Laspeyre's, (ii) Paasche's and (iii) Fisher's Ideal.

(4+4+4+2)=14

Please turn over

(0:11)

GROUP B

(Answer all questions from this group)

5. i) Fit a third degree polynomial of y on x to the following data :

x :	0	1	2	3	4
y :	8.15	12.17	17.50	24.98	42.82

ii) Find the expected values of y for each value of x.

iii) Plot both the observed and expected values on the same graph paper. (8+4+4)=16

6. The following data relate to index of imports (x_1), index of gross domestic product (x_2) and general price index (x_3) for the years 1948-1956.

year	x_1	x_2	x_3
1948	100	100	100
1949	106	104	99
1950	107	106	110
1951	120	111	126
1952	110	111	113
1953	116	115	103
1954	123	120	102
1955	133	124	103
1956	137	126	98

Find the multiple regression equation of x_1 on x_2 and x_3 and compute the multiple correlation coefficient $R_{1.23}$. (12+6)=18

7. The following table gives the yield of rice (per acre) in West Bengal for a number of years. Determine the trend values by the method of moving average.
(Credit will be given for proper choice of the period.)

Year	yield of rice (maund per acre)
1946 - 47	9.96
1947 - 48	9.88
1948 - 49	9.75
1949 - 50	10.26
1950 - 51	10.86
1951 - 52	9.98
1952 - 53	10.53
1953 - 54	13.48
1954 - 55	10.43
1955 - 56	11.11
1956 - 57	10.81

(14)

NEATNESS (for Groups A and B) (4)

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination – May 1977

Paper V (Practical) : Elementary Statistical Methods

Time : 5 hours Full Marks: 100

(a) Figures in the margin indicate full marks.

(b) Use of calculating machines is permitted.

GROUP A

(Answer Question 1 and any three of the rest from this group)

1. The number of women at different ages (in completed years) giving birth to a child in a year, per 1000 women at each age were as follows :

age	number of mothers	age	number of mothers
15	15	28	135
16	35	29	120
17	60	30	110
18	100	31	95
19	140	32	85
20	175	33	75
21	185	34	65
22	195	35	60
23	190	36	50
24	190	37	40
25	180	38	35
26	165	39	30
27	145	40	20

Compute the mean age of mother at child birth, and the second and fourth moments about the mean (correct to one place of decimal). (4+7+7)=18

2. In 1000 extensive sets of trials for an event of small probability, the number of successes were as follows :

number of successes	0	1	2	3	4	5	6	7
frequency	305	365	210	80	28	9	2	1

(a) Fit a Poisson distribution.

(b) Represent graphically the observed and expected frequencies. (6+4)=10

3. Correlation coefficients between two variables obtained from samples of size 67 and 30 were computed to be .75 and .60 respectively. Test whether there is a significant difference between the two coefficients at 5% level. (10)

4. The observed proportions of calorie consumed (per consumer unit) from cereals were 81.42% in Maharashtra and 77.88% in Madhya Pradesh, the sizes of the samples being 854 for Maharashtra and 1028 for Madhya Pradesh. Test whether the proportion of calorie consumption from cereals in Maharashtra is higher than that of Madhya Pradesh. (10)

Please turn over

5. (a) Find the sample size at 99 percent confidence level so that the sample standard deviation does not differ from the population standard deviation by more than 5 percent.

(b) Four unbiased coins were tossed 480 times and each time the number of heads turning up was observed. The results are shown in the following table.

	number of heads				
	0	1	2	3	4
observed frequency	32	112	192	121	23

Find the expected frequencies assuming the distribution to be Binomial. (5+5)=10

GROUP B

(Answer all questions from this group)

6. (a) Select a random sample of 10 villages with replacement from a region having 280 villages by using random numbers. State the procedure adopted and give reference to random number table used (title, page, row, column).

(b) Suppose three schools A, B and C contain 700, 650 and 850 students respectively. Select a sample of 5 students at random without replacement from all the 2200 students. State the procedure adopted and give reference to random number table used (title, page, row, column etc.) (9+9)=18

7. Eight varieties of a pulse were tested in a randomized block experiment having four blocks (replications). The yield data (in os. per plot) for the 32 plots are shown below. Analyse the data to find out if the varieties differ significantly. Also test the difference between variety six and variety eight.

variety \ block	1	2	3	4
1	17.5	20.0	15.0	31.5
2	28.0	16.0	30.0	20.0
3	22.0	21.0	14.0	25.0
4	19.5	11.0	12.0	17.5
5	21.0	22.0	15.5	23.5
6	25.0	27.0	23.5	30.5
7	14.0	15.0	16.0	17.0
8	11.0	18.0	13.0	11.0

(14+4)=18

Please turn over

8. The values of thickness of rods are given below for ten samples of four rods each. Draw the control chart for the mean and comment on the state of control.

Sample	Values
1	14, 8, 12, 12
2	11, 10, 13, 8
3	11, 12, 16, 13
4	15, 12, 15, 16
5	15, 12, 13, 10
6	13, 8, 15, 16
7	14, 12, 12, 10
8	11, 10, 8, 13
9	14, 9, 12, 9
10	12, 10, 12, 14

$A_2 = 0.720$
$D_2 = 4.698$ (12)

Neatness (for Groups A and B) (4)

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination – November 1977

Paper I (Practical): Elementary Computation

Time: 5 hours Full marks: 100

(a) Figures in the margin indicate full marks.

(b) Use of calculating machines is not permitted.

GROUP A

(Answer all questions from this group)

1. Evaluate any three of the following using short-cut methods. (No credit will be given for working through routine process)

i) $(998)^2$

ii) $(.95)^3 + (1.05)^3 + 6 \times .95 \times 1.05$

iii) $(43 + \frac{1}{43})(43 + \frac{1}{43}) - (43 - \frac{1}{43})(43 - \frac{1}{43})$.

iv) $\frac{8.9 \times 8.9 - 6.4 \times 6.4}{8.9 + 6.4}$ (3X3)=9

2. Find the sum of any one of the following :

i) $(1^2-1)+(2^2-2)+(3^2-3)+ \ldots +(21^2-21)$.

ii) $(1^3+1)+(2^3+2)+(3^3+3)+ \ldots +(15^3+15)$ (5)

3. Using 'contracted method' evaluate correct to two places of decimal

EITHER the product

21.1324 X 0.345721

OR the quotient

31.67924 ÷ 0.323414 (5)

4. Evaluate any one of the following :

i) $t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$ where r = 0.52, n = 38

correct to three places of decimal.

ii) $Z = \frac{1}{2}\log_e \frac{1+r}{1-r}$ for r = 0.45

correct to four significant figures. (5)

Please turn over

5. (a) Find the value of $\log_{10}(\frac{49}{3})^{\frac{1}{2}}$ correct to three places of decimal given that $\log_{10}2 = 0.3310$ and $\log_{10}7 = 0.8451$.

(b) Find the antilog (4.0261189) to the base 10, correct to three places of decimal.

(c) Find the square root of 0.0265 upto four significant digits using logarithms.

(d) Find the value of $\log_{e}8.1$ correct to two places of decimal. (5+3+4+2)=14

6. (a) Round off the numbers 4.49995001 and 0.00315 to four places of decimal. Also round off the second number to one significant digit.

(b) Using Barlow's table find the difference between $\sqrt{3.3}$ and $\sqrt{3.1}$ correct to three significant figures.

(c) An approximate value of the mathematical constant π is given by

$$3 + \cfrac{1}{7 + \cfrac{1}{16}}$$

Taking the correct value of π to be 3.14159, calculate the absolute and the percentage error. (3+4+5)=12

GROUP B

(Answer all questions from this group)

7. The following table gives employment figure in agriculture in U.S.A. during 1930 to 1939

year	no. of persons employed (in lakhs)	year	no. of persons employed (in lakhs)
(1)	(2)	(1)	(2)
1930	110	1935	124
1931	108	1936	128
1932	112	1937	130
1933	118	1938	135
1934	122	1939	140

Draw a graph to indicate the changes in employment over time. Use this graph to estimate the volume of employment in 1940 and in 1929. (6+2+2)=10

8. Using suitable interpolation formula find the value of f(x) for x = 32.4 when the following data are given

x	31	32	33	34	35
f(x)	29791	32768	35937	39304	42875

Using the above data find the value of x (in 2 places of decimal) when f(x) = 40000. (6+4)=10

Please turn over

9. Draw the graph of the following equations :

$y = 8$, $y = 5x + 3$ and $2x - 3y = 0$

and find graphically the area bounded by these three lines. (2+2+2+4)=10

10. Draw graphically the function :

(a) $f(x) = 5.3^x - 1$

for values of x between x = 1 to 5. Plot at least 5 points.

(b) Solve graphically

$x \log_{10} x - 1.2 = 0$

correct to 2 significant digits. (5+5)=10

11. The following table shows the cumulative percentage of population (x) and cumulative percentage of share of total income (y) :

x	0	6.4	23.1	39.4	41.4	52.5	61.4	72.0	81.4	90.2	100.0
y	0	1.5	8.8	13.0	20.5	29.3	37.8	49.1	61.0	74.8	100.0

i) Plot y against x and join the points by a smooth free-hand curve.

ii) Draw the line y = x.

iii) Measure the area enclosed between this line and the curve. (4+1+5)=10

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination – November 1977

Paper II (Practical) : Compilation and Presentation of Statistics

Time : 3 hours Full marks : 100

(a) Figures in the margin indicate full marks.

(b) Use of calculating machines is not permitted.

GROUP A

(Answer all questions from this group)

1. In a survey on medical and general health of population living in a region, the nutritional status of persons were assessed clinically. The population was divided into three groups by nationality for purposes of this survey. The following results were obtained :

Twelve hundred and three (1203) persons were clinically examined for their nutritional status. Half (50 per cent) of the persons examined were found to be in good nutritional condition and 29 per cent of persons were in fair nutritional condition. 16 per cent of persons had moderate anaemia and 5 per cent had marked anaemia. The Tibetans showed the best nutrition, 84 per cent of them (that is, 50 persons) being in good nutritional state. The Nepalese showed the poorest nutrition, only 37 per cent out of 600 Nepalese being in good nutritional state. Among "others" in the region, 324 persons were in good nutritional state, 132 persons fair, 69 persons with moderate anaemia and 11 persons with marked anaemia.

Among Tibetans, 11 per cent had fair nutritional state and 4 per cent had moderate anaemia. Only one person had marked anaemia.

Among Nepalese, 35 per cent had fair nutritional state, 23 per cent had moderate anaemia and the rest had marked anaemia.

The distribution of males and females by nutritional state was worked out taking all nationalities together. Out of 1203 persons, 834 were males and 369 were females. The females were, on the whole, worse off than males in regard to nutritional state.

453 males and 149 females were in good nutritional state.

20 per cent of males and 35.8 per cent of females were in fair nutritional state.

40 males and 20 females had marked anaemia.

Present the above data in a neat tabular form with proper column headings, title for the table and other specifications for easy reference. Both the number of persons and the percentage of persons (rounded off to the nearest whole number) under different classifications should be shown in a suitable manner to facilitate comparision. (15)

Please turn over

2. From the data collected in a sample survey of hospitals in Calcutta Metropolitan area, it is proposed to estimate the average number of days stayed in the hospital by the patients operated and discharged in a year. This average will be split up into two components as "before operation" and "after operation".

The averages will be worked out separately for seven classes of operations: orthopaedic, eye, ENT, Gyne, chest, others and all classes.

The averages will be worked out for different class of hospitals namely, (a) government hospitals, (b) non-government hospitals and (c) all hospitals.

The above classified averages will be worked out separately for (i) teaching hospitals in Calcutta, (ii) non-teaching hospitals in Calcutta, (iii) hospitals outside Calcutta and (iv) all hospitals taken together.

Prepare a blank tabular layout with appropriate column headings, title for the table and other specifications for reference. (8)

3. The following table shows the percentage distribution of workers in a development project by group, sex, age and occupation.

age (years)	group: tribal			non-tribal			combined		
	male	female	total	male	female	total	male	female	total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
cultivator									
1. 35 and below	4.8	7.6	12.4	7.6	1.0	8.6	12.4	8.6	21.0
2. above 35	1.0	1.0	1.9	-	-	-	0.9	1.0	1.9
3. total	5.7	8.6	14.3	7.6	1.0	8.6	13.3	9.5	22.9
agricultural labourer									
4. 35 and below	10.5	7.6	18.1	12.4	3.8	16.2	22.9	11.4	34.3
5. above 35	5.7	1.9	7.6	2.9	1.0	3.8	8.6	2.9	11.4
6. total	16.2	9.5	25.7	15.2	4.8	20.0	31.4	14.3	45.7
other agricultural workers									
7. 35 and below	1.9	1.9	3.8	2.9	-	2.9	4.8	1.9	6.7
8. above 35	-	-	-	-	-	-	-	-	-
9. total	1.9	1.9	3.8	2.9	-	2.9	4.8	1.9	6.7
others									
10. 35 and below	3.8	2.9	6.7	9.5	-	9.5	13.3	2.9	16.2
11. above 35	1.9	0.9	2.8	5.7	-	5.7	7.6	1.0	8.5
12. total	5.7	3.8	9.5	15.2	-	15.2	20.9	3.8	24.8
all occupations									
13. 35 and below	21.0	20.0	41.0	32.4	4.8	37.2	53.4	24.8	78.2
14. above 35	8.6	3.8	12.3	8.5	1.0	9.5	17.0	4.8	21.8
15. total	29.5	23.8	53.3	40.9	5.8	46.7	70.4	29.6	100.0

Scrutinise the above table and detect the mistakes, if any. Record the correct and wrong figures giving reference to the cell by row number and column number. (6)

Please turn over

4. From the official publications placed on the table, extract information on the following items :

i) Present the information in a suitable form.

ii) Relevant foot-notes required for understanding the information should be given such as, time period, units, base year, table number, page number etc.

iii) The complete name of the publication, agency issuing the publication and the periodicity of publication should be given in respect of each item of information.

Attempt any four of the following :

(a) Net ton-kilometres and passenger kilometres carried by Railways of Belgium in any one latest available year.

(b) Registered parcels and registered letters carried by the Post Offices in India in any one latest month.

(c) Paid up capital and total borrowings of Industrial Finance Corporation of India for any one latest available month.

(d) Average wholesale prices of coffee and caustic soda in any one latest available year, in India.

(e) Total number of deaths in any one latest available month and infant mortality rate in any one latest available year for Maharastra.

(f) Average daily employment of women in coal mines and in all mines taken together in India for any one latest year. (3X4)=12

5. Give the name of the official publication which provide information on the following items. In each case, mention the name of the agency issuing the publication and the periodicity of the publication.

Attempt any four of the following :

(a) All India index number of wholesale prices of rice and sugar for any one month.

(b) Average stay per tourist (days) in India from Canada and Sweden in any one year.

(c) Expenditure on education in Indian Government Colleges (degree and post-graduate standard) for general education for boys, from Government fund, in any one year.

(d) Number of persons unemployed and seeking employment in clerical and related services in Egypt in a specified month in any one year.

(e) Gram & Gram products imported into Madhya Pradesh from Uttar Pradesh in any one year.

(f) Stocks of coal held by collieries in India in any one month. (3X4)=12

Please turn over

GROUP B

(Answer all questions from this group)

8. The investment on different heads in the 3rd Five-year Plan in India was as given in the table below :

Item	Proposed investment in crores (Rs.)
1. Agriculture, minor irrigation and community development	1,475
2. Major and medium irrigation	640
3. Power	975
4. Village and small industries	435
5. Industries & minerals	2,500
6. Transport and communication	1,650
7. Social service	1,725
8. Inventories	800
Total	10,200

Represent the data in a suitable chart. (10)

OR

The table below gives the value of imports to and exports from India during April – November 1955 and April – November 1956 in crores of Rupees. Represent the data in a suitable chart.

	Items	April – November 1955	April – November 1956
Imports	Machinery	73.5	105.8
	Iron & steel	34.3	88.0
	Other metals	16.4	26.2
	Other imports	293.8	315.0
	Total	418.0	535.0
Exports	Oil	26.2	13.4
	Cotton	24.6	10.9
	Mn. ore	10.6	6.8
	Cotton textiles	42.2	40.1
	Jute manufacture	83.3	79.5
	Other exports	201.5	227.3
	Total	388.4	378.0

(10)

Please turn over

7. The table below gives the outer diameter of certain type of rollers. The measurements given in the table are deviations from 2.220 mm. They are arranged for convenience into 40 subgroups of 5 observations each in order of measurements.

Measurements of outer diameter of 220 rollers

sub group no.	individual measurements					sub group no.	individual measurements				
	1	2	3	4	5		1	2	3	4	5
1	34	31	54	26	29	21	31	25	31	29	1
2	33	27	43	32	20	22	25	38	25	10	0
3	30	04	24	28	35	23	27	16	28	31	2
4	14	31	18	30	33	24	27	32	27	37	3
5	44	26	23	37	37	25	21	19	30	20	3
6	39	43	37	20	21	26	30	34	28	33	2
7	11	42	25	42	02	27	10	30	21	30	2
8	35	11	31	41	25	28	41	28	41	31	1
9	27	43	24	30	33	20	34	43	18	20	4
10	59	49	27	34	34	30	28	27	42	42	2
11	29	39	24	24	36	31	35	12	27	42	4
12	38	20	45	31	11	32	24	13	28	26	2
13	33	11	19	30	37	33	35	26	26	16	3
14	30	37	40	23	27	34	20	28	13	32	1
15	23	15	25	28	20	35	06	16	48	21	3
16	40	32	34	37	25	36	30	13	19	33	1
17	25	23	37	13	26	37	49	40	35	37	4
18	24	09	25	27	38	38	39	16	40	19	3
19	25	31	32	33	37	39	27	32	09	37	2
20	31	22	39	14	27	40	19	16	40	33	2

Prepare a frequency distribution (using class intervals – 0.5 to 7.5, 7.5 to 15.5 etc.) and draw the corresponding histogram and the ogives. (19+645+5)=28

8. Thirty prepared specimens of a synthetic rubber were tested for abrasion loss in cc per HP hour (y) and hardness in degree shore (x). The results are given in the table below.

sl. no.	x	y	sl. no.	x	y
1	45	372	16	68	196
2	55	206	17	75	128
3	61	175	18	83	97
4	66	154	19	88	64
5	71	136	20	59	249
6	71	112	21	71	219
7	81	55	22	80	186
8	86	45	23	82	155
9	53	221	24	69	114
10	60	166	25	51	341
11	61	164	26	59	340
12	68	113	27	65	283
13	79	102	28	74	267
14	81	32	29	81	215
15	56	228	30	86	148

Prepare a two-way frequency table. (12)

NEATNESS (Groups A and B) (4)

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination – November 1977

Paper III (Practical) : Selected Techniques of Computation

Time : 5 hours Full marks : 100

(a) Figures in the margin indicate full marks.

(b) Use of calculating machines is permitted.

GROUP A

(Answer all questions from this group)

1. Complete the following table.

x	y	x^2	y^2	xy	x+y	x^3	y^3	x^3+y^3
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
8	6							
12	8							
-0	-6							
11	7							
13	-0							
-14	10							
16	11							
Total								

(8)

2. Compute by Trapezoidal rule the value of the integral

$$\int_0^1 \frac{dx}{\sqrt{e^x + x - 1}}$$

taking 11 ordinates, correct to four places. (12)

3. Use Lagrange's Formula to find the value of y at x = 102 or the value of x at y = 13.5 from the table :

x	93.0	96.2	100.0	104.2	108.7
y	11.38	12.80	14.70	17.07	19.91

(15)

4. From the following table of x and f(x), find f(x) for x = 0.0341 by a suitable interpolation formula.

x	f(x)
0.01	08.4342
0.02	48.4302
0.03	31.7775
0.04	23.4402
0.05	18.4542

(15)

NEATNESS (2)

Please turn over

(NO)

GROUP B

(Answer all questions from this group)

5. Solve :

$$\begin{aligned} 32x - 10y + 21z + 12t &= 35.82 \\ -13x + 42y - 7z - 19t &= -24.53 \\ 21x - 7y + 9z + 32t &= 33.29 \\ 12x - 10y + 32z + t &= 33.38 \end{aligned}$$ (20)

6. Find, by the method of iteration, a root of :

$$2x - \log_{10} x - 5.9295 = 0$$

in the neighbourhood of 3, correct to 4 decimal places. (15)

7. i) Evaluate the determinant

$$\begin{vmatrix} 3.5836 & -2.3088 & 1.6140 \\ -3.8294 & 0.6427 & 3.7214 \\ 3.8632 & 2.2308 & -2.3714 \end{vmatrix}$$

ii) Find co-factor of the element in the second row and third column of the above determinant.

iii) Find the minor of the element in the first row and second column. (7+4+4)=15

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination – November 1977

Paper IV (Practical) : Descriptive Statistics

Time : 5 hours Full marks : 100

(a) Figures in the margin indicate full marks.

(b) Use of calculating machines is permitted.

GROUP A

(Answer all questions from this group)

1. The following table gives the frequency distribution of a certain variable x.

Class	Frequency	Class	Frequency
15 –	2	45 –	20
20 –	5	50 –	17
25 –	8	55 –	16
30 –	11	60 –	13
35 –	15	65 –	11
40 –	20	70 – 75	5

Compute the following :

i) arithmatic mean
ii) standard deviation
iii) median
iv) first and third quartiles
v) quartile deviation for the distribution. (5X3)=15

2. i) Find the Geometric Mean (G.M.) and the Harmonic Mean (H.M.) of the following distribution.

x	: 3	4	5	6	7	8	9	10	11
Frequency (f)	: 2	5	9	14	15	8	6	3	1

ii) A group has $\bar{x} = 10$ $n = 80$, $\sigma^2 = 4$. A sub-group of the above has $\bar{x}_1 = 11$, $n_1 = 40$, $\sigma_1^2 = 2.25$.
Find the mean and standard deviation of the other sub-group. (6+2+3)=11

3. Draw the Lorenz Curve for the Income distribution given below :

Range of Income	Number of persons ('000)	Group Income (£ '000)
£. 100 –	2667	731,600
£ 250 –	1872	940,500
£ 500 –	253	357,500
£ 1000 –	82	233,750
£ 2000 –	34	195,250
£ 5000 and over	12	291,500

Estimate the coefficient of concentration (Lorenz ratio) graphically. (6+3)=9

Please turn over

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination – November 1977

Paper V (practical) : Elementary Statistical Methods

Time : 5 hours Full marks : 100

(a) Figures in the margin indicate full marks.

(b) Use of calculating machines is permitted.

GROUP A

(Answer all questions from this group)

1. The following gives the frequency distribution of the number of red balls (x) found in 350 samples of 10 balls each, drawn at random with replacement, from an urn containing a mixture of red and black balls.

x	no. of samples	x	no. of samples
(1)	(2)	(1)	(2)
0	2	6	26
1	22	7	8
2	63	8	1
3	76	9	0
4	96	10	0
5	56	total	350

Fit a binomial distribution to the above data with probability of drawing a red ball, $p = \frac{1}{3}$. Also test the goodness of fit. (18)

OR

The first four moments of a distribution about the value 28.5 are 0.204, 7.144, 42.409 and 454.689. Calculate the corresponding moments about the mean.

Calculate also β_1 and β_2.

It was later found on scrutiny that one value was wrongly recorded as 69 instead of 96. If the number of observations is 100, re-calculate the first four moments about the value 28.5 (6+3+9)=18

2. The following constants are obtained from measurements on length in mm.(x_1), volume in cc.(x_2) and weight in gm.(x_3) of 300 eggs.

$\bar{x}_1 = 55.93$ $s_1 = 2.26$ $r_{12} = 0.578$

$\bar{x}_2 = 51.48$ $s_2 = 4.39$ $r_{13} = 0.581$

$\bar{x}_3 = 50.53$ $s_3 = 4.41$ $r_{23} = 0.974$

Obtain the linear regression equation of egg-weight on egg-length and egg-volume. Hence estimate the weight of an egg whose length is 58.0 mm and volume is 52.5 cc. (9+3)=12

OR

An insurance salesman sell policies to five men, all of identical age and good health. According to the actuarial tables the probability that a man of this particular age will be alive 30 years hence is 7/10. Find the probability that in 30 years (a) all five men, (b) at least 3 men, (c) only 2 men, (d) at least 1 man will be alive. (3+3+3+3)=12

Please turn over

3. Answer any two of the following :

(a) The heights of two sets of sampled persons are measured and the following observations are noted :

sample	no. of persons measured	mean height	sum of squares of deviations from mean (in c_n^2)
(1)	(2)	(3)	(4)
sample 1	9	167	232
sample 2	10	170	271

Test the hypothesis that the two samples are drawn from the same population. (10)

(b) In an elementary school examination in spelling, the mean grade of 32 boys was 72 with a standard deviation of 8, while the mean grade of 36 girls was 76 with a standard deviation of 6. Test whether girls are better in spelling than the boys. (10)

(c) The following data give the height (x) in centimetres and weight (y) in kilogrammes of 8 persons :

Person :	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Height (x):	156	168	162	172	176	165	169	158
Weight (y):	52	73	62	75	65	66	68	63

Calculate the linear regression coefficient of weight (y) on height (x) and test whether this coefficient is significantly different from zero. (10)

GROUP B

(Answer all questions from this group)

4. EITHER

Samples of 5 pieces of a certain part of stove were taken every 15 minutes in order of production from a certain production process and overall length for each piece was measured. Specifications for length are 0.830 inch ± 0.010 inch.

From the data given below, examine by drawing control charts for $\bar{x}$ and R, whether the process is under control and comment on your findings.

Sample	Measurement				
1	0.838	0.837	0.834	0.833	0.833
2	0.836	0.834	0.835	0.837	0.836
3	0.832	0.837	0.833	0.837	0.839
4	0.833	0.835	0.836	0.834	0.833
5	0.835	0.837	0.832	0.832	0.833
6	0.839	0.836	0.833	0.837	0.835
7	0.834	0.834	0.834	0.834	0.835
8	0.831	0.832	0.834	0.832	0.831
9	0.834	0.832	0.833	0.832	0.832
10	0.831	0.832	0.832	0.832	0.833
11	0.835	0.836	0.834	0.833	0.831
12	0.837	0.833	0.831	0.834	0.834
13	0.835	0.836	0.835	0.837	0.836

(For n = 5, use the values of the constants as $A_2 = 0.577$; $D_3 = 0$; $D_4 = 2.115$) (10)

Please turn over

4. (contd.) OR

The table below gives the number of articles inspected during the first 20 days of a month for a machine in the production process. The corresponding numbers of defects are also given.

Plot a suitable control chart for the proportion defectives and comment whether the process is under control.

Table : Inspection record of a defective machine.

Date	Number Inspected	Defective	Date	Number Inspected	Defective
(1)	(2)	(3)	(1)	(2)	(3)
1	140	6	11	124	2
2	140	8	12	90	8
3	153	9	13	137	6
4	161	1	14	111	4
5	149	9	15	150	4
6	151	3	16	124	4
7	110	3	17	166	13
8	120	5	18	153	7
9	153	6	19	142	5
10	150	3	20	143	5

(10)

5. The results of a Latin Square experiment with six treatments designated as A, B, C, D, E & F are given below. The yields of different plots are shown below the treatments.

Analyse the data and give your comments on the results.

E 633	B 527	F 652	A 300	C 504	D 416
B 489	C 475	D 415	E 488	F 571	A 282
A 384	E 481	C 483	B 422	D 334	F 646
F 620	D 448	E 505	C 439	A 323	B 384
D 452	A 432	B 411	F 617	E 594	C 466
C 500	F 505	A 259	D 366	B 326	E 420

(15)

6. (a) Draw a sample of size 12 with replacement from the frequency distribution of diameter of a brass bars.

Diameter	Frequency
2.11 – 2.20	18
2.21 – 2.30	52
2.31 – 2.40	127
2.41 – 2.50	193
2.51 – 2.60	113
2.61 – 2.70	65

Explain the procedure used in drawing the sample and give reference to table used. Calculate the arithmetic mean of the sample drawn above.

Please turn over

6. (b) (Contd.) Suppose there is a pond exactly in the shape of a hemisphere of radius 50 ft. (Obviously the upper surface of the pond forms the plane boundary and the bottom forms the curved surface boundary) Locate six points at random inside the pond in order to sample the water for bacteriological examination. A depth of two feet from the upper surface is to be excluded from sampling. (8+5)=13

7. The volume measurement of 10 pots taken by four investigators are given below. Each investigator took two measurements of every pot. Make an analysis of variance of the data to examine whether the variations in measurements among different investigators differ significantly and also find whether there are significant differences between pots.

Volume in cc. of pots

Pot	Investigator			
	A	B	C	D
1	38,40	27,34	39,30	41,46
2	42,40	42,40	35,40	38,47
3	38,40	23,43	34,42	46,50
4	12,12	20,16	15,26	17,22
5	26,18	28,22	19,30	11,26
6	6, 8	15,20	8,14	12,16
7	50,52	52,50	44,52	51,50
8	34,26	40,41	30,42	34,24
9	22,24	31,28	26,30	30,17
10	48,24	50,53	52,42	50,47

(12)