

INDIAN STATISTICAL INSTITUTE

10



QUESTION PAPERS

for

COMPUTER'S CERTIFICATE EXAMINATIONS

May & November 1976

203 BARRACKPORE TRUNK ROAD
CALCUTTA 700035

Price : Rupees Two only

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination - May 1970
 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

(Attempt all questions from this group)

- (a) Round off the following numbers to 5 significant digits :
 (i) 3.08394565 (ii) 5397870
 Find also the absolute and relative errors due to rounding off in each case.

(b) Find the number of trustworthy figures in the quotient $878.3/404.2$ assuming that both numbers are approximate and true only to the number of digits given. $(4 \times 2 + 3) = 11$
- Using logarithmic tables

(a) find the number of zeroes preceding the first significant digit in $(0.0987)^{20}$;

(b) extract the 5th root of 84.52 correct to four places of decimal. $(4 + 1) = 5$
- (a) Given $\log_{10} 2 = 0.3010300$, $\log_{10} 7 = 0.8450980$, $\log_{10} 3 = 0.4771213$

i) find the logarithm (base 10) of $\frac{4/5 \times 10^2 / 2}{3 / (18 \sqrt{2})}$, to 6 places of decimal;

ii) solve for x: $2^{x+3} + 2^{x+1} = 350$ to 4 places of decimal.
 $\sqrt{\text{No credit will be given if you use any other information not supplied in this question.}}$

(b) Without the help of mathematical tables, find the logarithm of 144 to the base $2\sqrt{3}$. $(4 \times 2 + 2) = 10$
- Evaluate any two of the following with the help of suitable formulae:

i) $(1.2)^2 + (3.3)^2 + 3.72$

ii) $(1.34)^3$

iii) $(1.2)^3 - 3 \times 1.2 \times 0.2 - 0.208$ $(2 \times 2) = 4$
- Use contracted method to evaluate $(547.58 \times 0.009746234) / 0.6454322$ correct 3 places of decimal. (9)
- Evaluate any one of the following:

i) $\frac{1}{1+x^2} + \frac{1}{1+(x+1)^2} + \dots + \frac{1}{1+(x+8)^2}$ for $x = 1.5$

ii) $(1.1)^2 + (1.2)^2 + \dots + (3.0)^2$ (6)

~~Please turn over~~

GROUP B

(Attempt all questions from this group)

7. The following table gives the values of a function $f(x)$ for certain values of x :

x	$f(x)$
3	0.193308
4	0.195127
5	0.197794
6	0.199336
7	0.200449
8	0.2014952

Find by linear interpolation,

- i) The value of $f(x)$ when $x = 5.682$
 ii) The value of x for which $f(x) = 0.208$ (5+5)=10
8. Draw the graphs of the equations
 (i) $x+2y = -12$ (ii) $x - 2y = -12$ and (iii) $x = 3$
 Also find graphically the area bounded by them. (2+2+1)+5= 10

9. EXERCISE

Solve graphically

(i) $2x+3y = 0.8$ (ii) $x^2 - 4x + 3.8 = 0$ (5+5)=10
 $5x-2y = 9.5$

Q1

Tabulate the values of $y = \frac{\sin x}{2 \cos x}$ for $x = 10^\circ, 15^\circ, 20^\circ,$

25° and 30° . Plot these values on a graph paper and find from the graph the value of y when $x = 22^\circ$. (10)

10. Draw the graph of any one of the following:
 i) $y = 1.4 + 0.2\sqrt{x} + 2.2x$ (plot at least 8 values between $x=1$ and $x=5$).
 ii) $y = 1 - e^{-2x}$ for values of x between 0 and 4, plotting at least 8 points. (8)
11. The following table shows the average money supply in India during the years 1963-64 to 1970-71 except that for the year 1965-66.

year	average money supply (in Rs. crore)	year	average money supply (in Rs. crore)
(1)	(2)	(1)	(2)
1963-64	3268	1966-67	5577
1964-65	3429	1967-68	6110
1965-66	3725	1968-69	6514
1969-70	4177	1969-70	7270
1970-71	4630	1970-71	8771

Represent the data graphically and draw a smooth free hand curve through the plotted points. Hence, estimate from the graph the amount of average money supply during the year 1965-66. (10)

NEATNESS (Groups A and B)

(4)

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination - May 1976

Paper II (Practical) : Compilation and Presentation of Statistics

Time : 5 hours

Full marks: 100

- (a) Figures in the margin indicate full marks.
(b) Use of calculating machines is not permitted.

GROUP A

(Attempt all questions from this group)

1. A family budget enquiry in Rural and Urban areas of West Bengal was carried out and the information on household indebtedness during the year 1963-61 was also collected.
- In the report for urban areas, percentage distribution of outstanding loans taken by different households for four different purposes from 4 major sources viz. State Government, Bank, Co-operative and others were studied. It was reported that the outstanding debt utilised for the purchase of land, construction and repair of houses was 63.66%. Of the total (being the maximum among the four different purposes of loans), while 19.21 % was for trade and allied purposes, 12.40 % for meeting expenses on deaths and marriages and other religious ceremonies, and the rest for medical and educational expenses, purchase of furniture, utensils and clothing etc.
- The State Government's contribution of loan towards purchase of land & construction etc. was 52.40 % of the total loan; however the State Government's contribution was 59.35 % of the total loan. The percentages of total loan provided by the State Government for medical and educational expenses etc. and death, marriage and other religious ceremonies were 3.37% and 1.13% respectively.
- There were no outstanding debts on account of medical and educational expenses etc. and death, marriage and other ceremonies, to the Bank. The contribution by the Bank formed 3.91% of the total loan, a major portion (3.33%) of which was utilised for purpose of purchase of Land, construction etc.
- The percentage of total loan contributed by other sources for all purposes was 23.35; the same by Co-operatives was 13.66, the break-down being 5.44, 1.25, 4.25 and 2.72 for the purpose of purchase of land, construction etc.; medical & educational expenses etc.; death, marriage etc.; and trade and other purposes respectively.
- Tabulate the above information in a suitable table giving proper heading.

(12)

Please turn over

2. The following table shows the Percentage distribution of employed registrants (as on the date of enquiry) according to Educational standard, Economic status and Sex.

Educational standard	ECONOMIC STATUS					
	Earner			Earning dependant		
	Male (2)	Female (3)	Total (4)	Male (5)	Female (6)	Total (7)
Illiterate	7.16	0.27	7.43	0.10	-	0.10
Non-Matric	66.10	0.85	66.95	3.25	-	3.25
<u>Matriculates:</u>						
(a) Technical	0.00	-	0.81	-	0.06	0.06
(b) Non-Technical	14.88	0.81	15.67	2.75	-	2.75
Sub-total :	15.67	0.81	16.48	2.11	-	2.11
<u>Graduate or Diploma Holder:</u>						
(a) Technical	0.30	0.02	0.32	-	-	-
(b) Non-Technical	2.78	0.12	2.90	0.20	0.71	0.43
Sub-total:	3.08	0.23	3.31	0.26	0.17	0.43
Total	92.51	2.16	94.17	5.52	0.17	5.69

Educational standard	ECONOMIC STATUS					
	Others			Grand total		
	Male (8)	Female (9)	Total (10)	Male (11)	Female (12)	Total (13)
Illiterate	-	0.04	0.04	7.28	0.31	7.57
Non-matric	-	-	-	66.15	0.65	70.79
<u>Matriculates:</u>						
(a) Technical	-	-	-	0.87	-	0.87
(b) Non-Technical	0.06	0.00	0.10	16.99	0.83	17.82
Sub-total	0.06	0.02	0.10	17.86	0.83	18.69
<u>Graduate or Diploma Holder</u>						
(a) Technical	-	-	-	0.30	0.02	0.32
(b) Non-Technical	0.43	-	-	3.44	0.38	3.42
Sub-total	-	-	-	3.34	0.40	3.74
Total	0.08	0.06	0.14	97.61	2.39	100.00

After proper scrutiny, find out the errors if any and display the correct and wrong figures in a manner considered most appropriate.

3. From the official publications placed on the table, extract information on the following items:
- (i) Present the information in a suitable form.
 - (ii) Add foot-notes about units, base year etc. when required.
 - (iii) Give complete relevant information about the publication, the agency issuing the publications, the periodicity of publication and the particular issue consulted.

Attempt any three of the following:

20051 Production of Razor Blades (in number) in West Bengal during any month of any recent year.

Please turn over

3. (b) Electricity sold (in million K.W.Hr.) to ultimate consumers in any one State of India during a recent year.
- (contd.) (c) Quantity of Lignite and Limestone (in quintals) exported to West Bengal from Bihar during any recent year.
- (d) Number of offices of Commercial Banks in rural areas of Andhra Pradesh during any recent year (stating the position as on certain date).
- (e) Production of wheat in tonnes in Canada and U.S.A. for any recent year.
- (f) Total length of National Highways in Madhya Pradesh as on 31st March for a recent year. (3x3)=9
4. Given the names of the official publications which provide information on the following items. Also mention in each case, the name of the agency issuing the publication, together with the periodicity of the publications:
Attempt any four of the following:
- (a) Total number of Tractors used for agricultural purposes in India in a certain year.
- (b) Monthly wholesale Prices of certain important agricultural commodities and animal husbandry products at selected centres of India.
- (c) Average weekly earnings of workers by components during a month in different coal mines in India.
- (d) Monthly figures in respect of estimated employment in public and private sectors in India.
- (e) Total earnings from passengers carried in different railways of India for a particular year.
- (f) Total amount of ex-gratia paid to the employees in dairy products in different states of India in a particular year.
- (g) Number of assesses among central Govt. employees (India) paying income-tax during a year.
- (h) Total number of students appeared and passed in Matriculation/Higher Secondary and Equivalent examination of different States of India during a year. (3x4)=12
5. Prepare a blank tabular layout with appropriate heading for presenting the percentage distribution of persons in labour force under working population and non-working population seeking employment and persons not in labour force according to age-groups and sex in 1961.
The age-groups are to be classified as 0-14, 15-31, 35-50, 60 and above, and 'age not stated'. Provision should also be kept for sub-totals by sex and for the grand total. (9)

Please turn over

GRUP D.

(Attempt all questions from this group)

6. The following data give the age-distribution for male and female population in India in 1951. Represent the data in a suitable graphical form.

age group	population	
	male	female
0	5,820,783	5,668,107
1 - 4	17,030,283	17,917,518
5 - 14	41,772,097	41,988,861
15 - 24	31,071,972	30,052,335
25 - 34	27,074,713	28,632,987
35 - 44	22,031,930	19,528,364
45 - 54	15,718,658	13,898,327
55 - 64	9,204,648	8,624,304
65 - 74	3,867,562	3,975,667
75 & over	1,620,982	1,750,143

7. The monthly total expenditure and expenditure on some major food items for a sample of 50 families in a town as obtained through a Sample Survey are given below:

family number	total expenditure (Rs.00)	expenditure on major food items (Rs.00)	family number	total expenditure (Rs.00)	expenditure on major food items (Rs.00)
(1)	(2)	(3)	(1)	(2)	(3)
1	187.00	95.37	26	129.00	75.50
2	75.00	55.00	27	145.00	82.00
3	192.00	98.00	28	228.00	112.00
4	235.65	103.00	29	237.00	115.00
5	137.00	85.00	30	225.00	105.00
6	322.00	130.50	31	196.50	87.00
7	218.00	105.20	32	150.00	120.75
8	317.00	150.30	33	145.00	103.50
9	162.50	103.80	34	119.00	75.75
10	235.60	97.15	35	86.00	51.30
11	301.00	129.25	36	250.00	127.00
12	250.00	138.56	37	216.00	103.00
13	175.00	117.75	38	258.00	120.00
14	98.00	78.44	39	141.00	93.00
15	210.00	101.00	40	216.00	102.70
16	418.00	240.00	41	135.00	79.00
17	350.00	260.00	42	268.00	130.50
18	442.00	140.00	43	328.00	156.37
19	167.00	83.75	44	432.00	160.00
20	271.00	113.25	45	158.00	104.00
21	260.00	109.25	46	188.00	100.50
22	157.00	92.50	47	215.00	102.00
23	100.00	80.00	48	345.00	252.00
24	152.00	102.00	49	270.00	110.00
25	199.00	103.37	50	200.00	102.00

- (a) Prepare a two-way frequency table using suitable class interval for total expenditure and expenditure on some major food items.
- (b) Draw the scatter diagram showing the total expenditure against expenditure on major food items, using the data for the first 25 families.

Please turn over

8. The following table shows the statistics of telephone connections to wrong numbers of a certain telephone exchange.

<u>no. of wrong connections</u>	<u>frequency</u>
0 - 2	1
3	5
4	11
5	14
6	22
7	43
8	31
9	40
10	35
11	20
12	18
13	12
14	7
15	6
16	2

Draw a frequency polygon for the above data. (8)

9. The total outlay on rural development proposed in the first five year plan and its breakdown into the major items are given below.

	<u>amount (crores of Rs.)</u>
Agriculture and Community Development	300
Irrigation	187
Irrigation & Power (Multipurpose project)	285
Power	127
Transport & Communication	497
Industry	173
Social Services	339
Rehabilitation	85
Miscellaneous	52

Draw a pie chart to represent the above data. (10)

NEATNESS (Groups A and B) (4)

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination - May 1976

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. Evaluate, correct to 4 places of decimal, the value of e by using the series

$$e = 1 + \frac{1}{1!} + \frac{1}{2!} + \dots + \frac{1}{n!} + \dots \text{ inf.} \quad (12)$$

2. Compute by (i) trapezoidal rule, and by (ii) Simpson's one-third rule the value of the

$$\text{integral} \int_{200}^{1000} \frac{dx}{\log_{10} x}, \text{ taking 9 ordinates.}$$

Give the results upto 5 places of decimal. Which of the two results is more accurate, and why? (3+3+4+2)=12

3. The temperature of a litre of water is 12°C . Find its density by a suitable interpolation formula, using the data in the following table:

Temperature ($^{\circ}\text{C}$)	10	15	20	25	30
Density (gm/cc)	.99974	.99915	.99827	.99713	.99577

What will be the density at 32°C ? (4+4+4)=12

4. Using the data in the table below, find the value of y for $x = 102$, using a suitable interpolation formula:

x	y
03.0	11.38
06.2	12.80
100.0	14.70
104.2	17.07
108.7	19.71

(11)

GROUP B

(Answer all questions from this group)

5. Find a positive root of the equation

$$x^3 - 0.2x^2 - 0.2x - 1.2 = 0$$

Correct to three places of decimal.

(15)

Please turn over

6. Solve graphically, correct to two places of decimal the equations

i) $y^2 = 4x$

ii) $x - 2y = 2$

(12)

7. Solve the system of simultaneous linear equations:

$$x + 2y + 3z = 15.4$$

$$4x + 5y + 6z = 35.2$$

$$7x + 8y + 9z = 55.0$$

by pivotal condensation method.

(18)

8. Evaluate the determinant of the matrix

$$\begin{bmatrix} 1 & 2 & 3 \\ -2 & -4 & -5 \\ 3 & 5 & 6 \end{bmatrix}$$

by sweep out method. Find also the co-factor and the minor of the element in the first row and the second column of the determinant.

$(3+1+1)=5$

NEATNESS (Groups A & B)

(4)

Time: 5 hours

Full marks: 100

- (a) Figures in the margin indicate full mark.
 (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
0 - 15	8
16 - 23	15
24 - 30	28
31 - 50	35
51 - 100	17
101 - 150	12
151 - 175	9
176 - 300	3

- (a) Draw an Ogive and find the median of the given distribution;
 (b) Also compute the mean deviation and the standard deviation of X. $(4+3+4)=11$
2. The following table gives the means and variances of a characteristic for three sections in a group of individuals.

section number of no.	individuals	mean	variance
1	21	3.5	49.12
2	62	3.7	18.23
3	37	8.2	70.18

Compute the mean and the variance of the characteristic for the entire group. $(2+6)=8$

3. Compute the arithmetic mean, geometric mean, and the harmonic mean of the values:

87, 170, 153, 48, 98 and 110.

Also compute the geometric mean of the values of the arithmetic mean and the harmonic mean, as obtained above. $(1+3+3+2)=9$

4. The scores obtained by 10 students in a weekly test in Statistics and Economics are as follows:

sl. no. of student	1	2	3	4	5	6	7	8	9	10
score in Statistics (X)	68	51	08	87	53	55	42	59	72	80
score in Economics (Y)	72	40	82	75	42	62	35	65	75	62

- (i) Compute the coefficient of correlation between X and Y;
 (ii) Find the linear regression equation of X on Y;
 (iii) Estimate the probable score in Statistics of a student who scores 65 in Economics. $(5+4+1)=10$

Please turn over

5. (a) The cost of Living Index in January 1965 with January 1950 as base is 341.19. A person in Calcutta received Rs. 80/- as salary in January 1950, and Rs. 125/- in January 1965. Compare his real wages in the two periods. What should have been his salary in January 1965 to maintain his January 1950 standard of living?
- (b) The table below gives the Crop Production, Q (Million Tg) and Wholesale Crop Price, P (Rs. per Kg) of certain cereals and oil-seeds during 1965-68 and 1970-71.

Year	Crop							
	Rice		Wheat		Barley		Gram	
	Q	P	Q	P	Q	P	Q	P
1965-68	535.4	2.70	812.4	0.40	305.6	0.65	72	9.34
1970-71	650.2	1.80	988.3	1.40	451.2	0.90	98	0.52

Year	Crop									
	Molasses		Jowar		Bajra		Linseed		Mustard	
	Q	P	Q	P	Q	P	Q	P	Q	P
1965-68	50.1	1.50	20.5	0.64	15.2	0.60	14.5	0.60	16.6	1.30
1970-71	82.3	2.12	55.4	0.53	30.1	0.42	13.8	0.42	21.2	2.11

Using the above data, compute the Index No. of Wholesale Prices of Crops for the year 1970-71 taking 1965-68 as base by Laspeyre's and Paasche's formulae. $(2+2)+(3+3)=10$

GROUP B

(Answer all questions from this group)

6. Given the following totals, find the two partial regression coefficients of x_1 on x_2 and x_3 :

$$\begin{aligned}x_1 &= 531.09; & x_2 &= 285.30; & x_3 &= 1800.00 \\x_1^2 &= 15,731.2223 & x_1 x_2 &= 8,536.616; & x_1 x_3 &= 53,814.575 \\& & x_2^2 &= 4,935.6904; & x_2 x_3 &= 29,844.817 \\& & & & x_3^2 &= 46,218.4173.\end{aligned}$$

$$N \text{ (Sample size)} = 18$$

Also find the multiple correlation coefficient, $R_{1,23}$

7. (i) Fit a third degree polynomial of y on x using the data given below; $(6+6+3)=16$
- | | | | | | |
|-------|------|------|------|-------|-------|
| x : | 0 | 1 | 2 | 3 | 4 |
| y : | 4.20 | 4.25 | 6.70 | 13.75 | 21.00 |
- Also,
- (ii) find the expected value of y for each x ;
- (iii) plot both the observed and the expected values on the same graph paper. $(10+3+3)=16$

Please turn over

- 8.. Following are the monthly purchases (in million rupees) of a certain commodity for the years 1954 to 1956.

<u>month</u>	<u>1954</u>	<u>1955</u>	<u>1956</u>
January	174	221	250
February	184	220	285
March	230	278	308
April	218	251	201
May	211	258	308
June	218	275	297
July	202	242	289
August	204	257	202
September	196	235	270
October	211	258	335
November	225	275	345
December	248	314	390

Find the monthly seasonal indices of purchases. (16)

NEATNESS (Groups A and B) (4)

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination - May 1976

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 observations on stature (in cm.) of 20 school boys were recorded as follows:

159, 138, 148, 146, 155, 145, 138, 146, 158, 168,
144, 145, 163, 155, 172, 156, 164, 166, 168, 153.

Compute β_1 and β_2 coefficients for the above set of observations.

(8+5+5)=18

2. Test for independence of the two attributes, intelligence and standard of clothing, of School children using the data given below:

Distribution of school children

clothing standard	intelligence category (in increasing order)						total
	A	B	C	D	E	F	
very good	33	48	113	209	194	39	636
good	41	100	202	255	138	15	751
poor	39	58	70	61	33	4	265
very poor	17	13	22	10	10	1	73
Total	130	219	407	535	375	59	1725

(10)

3. The estimates of percentage of "literate" in the population of a certain region of India (obtained through Sample Surveys) for two different years are given below:

Year	Sample size	Percent literate (estimate)
1965	2400	39.7
1970	1700	40.5

Test whether the literacy rate in the region had improved significantly over the period.

(10)

Please turn over

4. Weldon threw 12 dice 26308 times and noted the number of successes (X) in each throw. The occurrence of a 5 or a 6 on any die was regarded as 'success'. The frequency distribution of X as obtained by him is reproduced below;

number of successes	observed frequency	number of successes	observed frequency
0	185	6	3007
1	1149	7	1331
2	3265	8	433
3	5475	9	105
4	6114	10 or 11	18
5	5104		

Fit a Binomial distribution to the given data, using $p = \frac{1}{3}$, and test for goodness of fit. $(4+6)=10$

5. (a) The correlation coefficient of scores in Physics and English, of 50 students was found to be 0.631.
Test the significance of the observed correlation coefficient.
- (b) The observations on facial length (in cm.) of two groups of college students are given below:
Group 1 : 15.1, 14.3, 11.5, 14.5, 15.4, 12.5, 14.6, 16.6
Group 2 : 12.2, 12.5, 11.2, 12.8, 11.0, 11.6, 12.0, 12.5, 11.8, 12.4, 11.5, 12.0, 11.6, 12.7

Test whether the two groups come from population with same mean facial length. $(4+6)=10$

GROUP B

(Answer all questions from this group)

6. (a) A rectangular region is bounded by the straight lines $x = 50$, $y = 80$ and the two coordinate axis. Select 5 points at random from this region, mentioning the coordinates of the points correct to the nearest integer. Describe the procedure followed by you. $(5+2)=7$
- (b) Obtain a random permutation of the letters ABCDEFGHIJK. (6)
- (c) Draw a random sample of size 5 from a normal population with mean 40 and standard deviation 12. Compute the sample mean. $(5+1)=6$
7. EXERCISE

The determination of visual acuity at three different distances (A, B, and C) was the subject of an experiment. Four different subjects were used for the purpose and each subject was tested twice at each distance. The data recorded are as follows;

Subject	Distance		
	A	B	C
1	12, 13	16, 15	30, 30
2	5, 7	10, 8	18, 21
3	7, 7	28, 25	35, 38
4	10, 14	26, 23	51, 47

Prepare the "analysis of variance" table for the above data and test for the differences in visual acuity among the four subjects. $(8+4)=12$

7. CR
(contd.)

The data below represent sugar yields (tons/acre) of five varieties of sugar beet. The varieties were randomised among the five plots in each of the five blocks.

Block	Variety				
	A	B	C	D	E
1	1.94	1.70	2.23	2.14	1.80
2	2.08	1.96	2.26	2.08	2.23
3	1.86	1.83	2.22	2.16	1.67
4	2.21	1.60	2.08	2.16	2.11
5	2.03	2.13	2.02	2.17	2.01

Make an analysis of variance of the above data and test for significant differences between varieties, and between blocks. $(8+3+3)=12$

8. Construct the layout of a completely randomised design with 4 treatments and each with 3 replications. (8)

9. A process is designed to yield machine parts known as spacers with mean thickness 0.8470 inch. Successive samples of size five each, yield values of the sample mean (\bar{x}) as follows:

.8464, .8465, .8477, .8484, .8473, .8469
 .8472, .8482, .8478, .8474, .8465, .8468
 .8467, .8472, .8470, .8465, .8470, .8471

(The above data are to be read horizontally).

The mean range \bar{R} in these samples is 0.0005. Construct an \bar{X} -chart and comment on the control in the process.

Sample size	Factors for control limits	
	A_2	D_2
5	0.577	4.018
10	0.308	5.469

(10+2)=12

NEATNESS (Groups A and B) (4)

INDIAN STATISTICAL INSTITUTE
Computer's Certificate Examination - November 1976

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 suitable formulae evaluate any three of the following :
 - (a) $(96)^3 - (101)^3 + (2)^3$
 - (b) $(15.04)^2$
 - (c) $(8)^4 + 64$
 - (d) $(3.5)^2 + (6.5)^2 + (4.5)^2 - 3.5 \times 4.5 - 6.5 \times 4.5 - 3.5 \times 6.5$
(3X3)=9

2. Using contracted method, evaluate correct to 3 places of decimal, any one of the following :
 - (i) $(5.07632)^2$
 - (ii) $0.427527/0.678255$ (4)

3. Using logarithmic tables,
 - (i) solve for x:
 $(70)^{x-2} = 994x(7)^{x-3}$
and find
 - (ii) the number of digits in $(543)^9$;
 - (iii) the logarithm of 925 to the base 8
 - (iv) the antilog (- 0.2037534) to the base 10 (3X4)=12

4. Evaluate any one of the following :
 - i) $e^{-\lambda} \frac{\lambda^5}{5!}$ when $\lambda = 3.3$
 - ii) $\frac{1}{\sqrt{2\pi}} e^{-\frac{(x-4.72)^2}{2}}$, when $x = 5.25$ (5)

5. Evaluate any one of the following sums :
 - i) $1^2 - 2^2 + 3^2 - 4^2 + \dots$ to 21 terms;
 - ii) $\sum_{n=11}^{33} (n^3 + \frac{n^2}{2})$ (6)

Please turn over

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

(i) 62.8543 (ii) 0.099938

Find also, in each case, the absolute and percentage errors in your result.

- (b) Find the number of trustworthy figures in $(1.336)^2$ assuming that the number in parenthesis is correct to its last figure but no further. (3M+0) = 12

GROUP B

(Answer any four questions from this group)

7. Find by linear interpolation the value of $F(x,y)$ when $x = 5.137$ and $y = 15.2$, using the values of $F(x,y)$ given in the table below

x	y	13	15	17	19
5.0	0.9759	0.9628	0.9611	0.9529	
5.1	0.9811	0.9773	0.9764	0.9628	
5.2	0.9853	0.9809	0.9760	0.9703	
5.3	0.9897	0.9842	0.9814	0.9773	

(11)

8. Draw the graphs of the following equations :

i) $x = -3$

iii) $x + y = 6$

ii) $y = 3$

iv) $y = 2x - 7$

Also, find graphically the area bounded by these four lines.

(12M+0) = 11

9. Solve graphically :

i) $y - 2x^2 + 2.1 = 0$; $3x + 5y = 16.5$

ii) $10x^2 + 19.6x - 4.288 = 0$

(6+6) = 12

10. Draw the graph of the function :

$$f(x) = 3.4(1 - e^{-x}),$$

plotting at least 5 points between $x = 0$ & $x = 4$.

(5+7) = 12

11. The following table gives the yearly gross national product (GNP) of India at 1960-61 prices for some years. Represent the data graphically and hence estimate the GNP for the year 1969-70.

Year	GNP (Rs. crore at 1960-61 prices)
1961-62	14532
1962-63	11050
1963-64	15792
1964-65	16019
1965-66	16327
1966-67	16307
1967-68	17777
1968-69	19173
1970-71	20228

(9+3) = 12

NEATNESS (for Groups A & B)

INDIAN STATISTICAL INSTITUTE
Computer's Certificate Examination - November 1976

Paper II (Practical) : Compilation and Presentation of Statistics

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. In a certain year two lakhs fiftyfour thousand persons were employed under a State Government. When these persons were classified according to the employment status, it was seen that ninetyfive thousand staff were permanent, one lakh twentyfour thousand were temporary and the rest were classified as 'Others' type of status; their corresponding figures for pay and allowances per month were Rs.21670 (thousand), Rs.21625 (thousand) and Rs.2083 (thousand) respectively. An interesting fact was observed between category of staff and their employment status. That is, the proportion of permanent staff increased with the rise of rank. It was found that there were six thousand permanent Gazetted Officers and two thousand temporary Gazetted Officers out of a total of eight thousand Officers. The percentage of All Gazetted Officers was only 3.15 of the total Govt. servants. Although the total inferior staff was exactly 10 times the Gazetted Officers, the number of permanent staff of this category was only fourteen thousand. There were one hundred sixtysix non-Gazetted superior staff in all and the expenditure incurred on account of their pay and allowances were Rs.32436 (thousand) per month. The distribution of total number of non-Gazetted (superior) staff by status of employment (viz permanent, temporary and others) were 75, (thousand), 73 (thousand) and 13 (thousand) respectively while the corresponding figures for their pay and allowances stand at Rs.1,57,13 (thousand), Rs.1,57,55 (thousand) and Rs.1,20 (thousand) per month respectively. Total amount of Rs.5682 (thousand) was spent for permanent and temporary gazetted officers whose break up was Rs.4485 (thousand) and Rs.1217 (thousand) per month respectively. The percentage of permanent and temporary staff to the total strength were 57.40 and 48.82 respectively and their corresponding percentages of expenditure to the total expenditure of Rs.483,81 (thousand) were respectively 47.15 and 46.83. It was also seen that 12.25% of the total expenditure was spent for Gazetted Officers. 17.81 p.c and 35.04 p.c. of the total expenditure were spent for inferior and non-gazetted (superior) staff respectively, the strength being 31.50 p.c. and 65.35% of the total staff under the Government. Tabulate the above information in a suitable table giving proper headings. (10)

Please turn over

2. The following table shows the Percentage distribution of employed registrants (as on the date of enquiry) according to Employment status classified by Educational standard and sex.

Educational standard	Employment Status as on the Date of Enquiry									
	Employer			Employee			Own account			
	Male	Female	Total	Male	Female	Total	Male	Female	Total	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
Illiterate	-	-	-	6.58	3.31	6.82	0.57	-	-	-
Non-Matric	0.70	-	0.70	55.41	0.63	53.40	12.39	0.22	-	-
Matriculate:										
(a) Technical	-	-	-	-	-	0.85	0.58	-	-	-
(b) Non-technical	-	-	-	13.31	0.33	17.14	0.80	-	-	-
Sub-total	-	-	-	17.13	0.83	17.99	0.52	-	-	-
Graduate or Diploma Holder										
(a) Technical	-	0.30	-	0.30	0.32	0.32	-	0.01	-	-
(b) Non-technical	-	-	0.12	0.01	0.38	0.39	0.01	-	-	-
Sub-total	0.02	-	0.02	0.31	0.49	0.71	0.01	-	-	-
Total	0.81	-	0.81	81.47	2.17	84.04	13.59	0.22	-	-

Educational standard	Employment Status as on the Date of Enquiry					
	Male			Female		
	Male	Female	Total	Male	Female	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Illiterate	-	-	-	7.28	0.31	7.57
Non-Matric	-	0.62	0.59	69.18	0.83	70.01
Matriculate:						
(a) Technical	-	-	-	0.84	-	0.84
(b) Non-technical	0.18	-	0.18	12.94	0.83	17.85
Sub-total	0.18	-	0.18	17.86	0.63	18.49
Graduate or Diploma Holder						
(a) Technical	-	-	-	0.30	0.02	0.32
(b) Non-technical	-	-	-	3.04	0.38	3.42
Sub-total	-	-	-	3.34	0.40	3.74
Total	0.18	-	0.18	67.61	0.30	100.00

After proper scrutiny, find out the irregularities and display the correct and wrong figures in a manner considered most appropriate.

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

- (i) Present the information in a suitable form
 (ii) Add foot-notes about units, base year etc. when required.
 (iii) Give complete relevant information about the publication, the agency issuing the publication, and the periodicity of publication.

Attempt any four of the following :

- a) Production of Cement (in tonnes) in Andhra Pradesh during any month of any recent year.
 b) Quantity of wheat flour (in Quintals) exported from Uttar Pradesh to West Bengal during any recent year.

Please turn over

3. (contd.)
- e) Number of Employment Exchanges and number of registrations in India for a particular month of a recent year.
 - d) Production of rice (rough/paddy) in Brazil and Burma for any recent year.
 - e) Total number of motor vehicles on the road in Madhya Pradesh in any recent year.
 - f) Gross earning from passengers carried by all Government Railways in any recent year. (2X1)=12
4. Give the names of the official publications which provide information on the following items. Also mention in each case, the name of the agency issuing the publication, together with the periodicity of the publication.
Attempt any four of the following :
- a) Total number of Sugarcane Crusher in rural and urban areas of India for a certain year.
 - b) Daily rate of Agricultural wages in certain selected villages of India classified according to operation.
 - c) Monthly rate of total man-shift per tonne of coal production in different coal producing areas of different States of India.
 - d) Monthly figures in respect of estimated employment in major industries and services in India under private sector.
 - e) Total number of passengers carried on the railways (India Govt.) classified according to suburban and non-suburban lines.
 - f) Amount of fixed capital employed in Tobacco manufacturing industries in different States of India in a particular year.
 - g) Gross income assessed by Income-tax deptt. for the salary group employees of India for any recent year as per demand.
 - h) Total number of pupils in all educational institutions in India for any recent year. (3X4)=12
5. Prepare a blank tabular layout with an appropriate heading for presenting the distribution of earners according to major group of occupations in West Bengal during 1992-63.
The earners are to be classified by language viz. Bengalee and Non-Bengalee and average monthly income (in Rs.) is also to be shown corresponding to each group under Major-group of occupation.
Provision of sub-totals for some major groups of occupations viz. A, B, C, etc. and groups viz. 1, 2, 3, etc. under each major group should be kept together with the grand total of all occupations. (2)

Please turn over

GROUP B

(Answer all questions from this group)

6. The following table gives the age distribution of UP (Males) according to 1951 Census.

Draw the Histogram and the "less than type" ogive.

<u>age last birthday (yrs.)</u>	<u>male population (00)</u>
0 - 4	42,684
5 - 9	41,985
10 - 14	37,571
15 - 19	33,009
20 - 24	29,412
25 - 29	25,203
30 - 34	23,793
35 - 39	21,802
40 - 44	19,649
45 - 49	15,634
50 - 54	12,907
55 - 59	9,870
60 - 64	3,873
65 - 69	4,549
70 - 79	5,739

Total 3,30,099 (545)-10

7. The percentage distribution of number of married couples by the number of children per married couple, as obtained from a survey in the rural areas of Country, is given below:

<u>number of children per married couple</u>	<u>percentage of married couples</u>	<u>number of children per married couple</u>	<u>percentage of married couples</u>
(1)	(2)	(3)	(4)
0	27.8	7	4.7
1	14.2	8	3.8
2	11.7	9	1.5
3	13.5	10	2.8
4	9.9	11	2.8
5	8.1	12 and above	3.2
6	6.3		

Draw the frequency polygon to represent the above data. (6)

8. The average annual expenditure (in rupees) per agricultural labour household on some important items of consumption, as obtained from an Agricultural Labour Enquiry, are given below.

<u>Items of consumption</u>	<u>Expenditure (in Rs.)</u>
1. Cereals	329.72
2. Pulses	23.55
3. Edible oils	13.36
4. Sugar, salt, spices etc.	21.71
5. Fish, meat, egg	15.78
6. Milk, and milk products	14.33
7. Vegetables	17.31
8. Fruits & nuts	3.24
9. Beverage, refreshments etc.	15.38

Represent the data in a suitable chart. (10)

Please turn over

9. A person Z was tasked to draw 50 straight lines, each two inches in length, with an ungraduated straight edge. The lines drawn were then measured to the nearest $1/10$ mm. independently by two other persons X and Y. The results are given below.

sr. no.	length in (cm) measured by		sr. no.	length in (cm) measured by	
	X	Y		X	Y
1	5.425	5.450	20	4.450	4.425
2	4.950	4.930	27	4.925	4.900
3	4.850	4.830	28	4.350	4.375
4	5.225	5.200	29	4.500	4.550
5	5.500	5.475	30	4.800	4.850
6	4.800	4.850	31	4.075	4.900
7	5.375	5.350	32	5.000	5.000
8	5.500	5.500	33	4.750	4.750
9	5.350	5.450	34	5.775	5.750
10	4.925	4.975	35	4.850	4.825
11	4.900	4.900	36	4.850	4.775
12	4.850	4.950	37	4.675	5.200
13	5.175	5.150	38	5.325	5.425
14	4.850	4.825	39	5.550	5.550
15	4.925	4.950	40	5.275	5.250
16	5.725	5.700	41	5.450	5.500
17	5.825	5.600	42	5.050	5.325
18	4.875	4.850	43	5.105	5.150
19	5.325	5.250	44	5.100	5.125
20	4.025	4.875	45	5.350	5.325
21	4.800	4.050	46	4.800	4.775
22	5.025	5.550	47	5.450	5.450
23	5.375	5.350	48	5.300	5.700
24	4.850	4.830	49	5.225	5.250
25	4.925	4.800	50	4.000	4.875

- (a) Prepare a two-way frequency table using suitable class intervals for measurements by X and Y.
 (b) Draw the scatter-diagram. (12+8)=20

NEATNESS (Groups A and B)

(4)

INDIAN STATISTICAL INSTITUTE
Computer's Certificate Examination - November 1976

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. Evaluate correct to 5 places of decimal $\log_2 2$ by using the series :

$$\log_2 \left(\frac{1^{p+1}}{p} \right) = 2 \left\{ \frac{1}{2^{p+1}} + \frac{1}{3} \frac{1}{(2^{p+1})^3} + \frac{1}{5} \frac{1}{(2^{p+1})^5} + \dots \right\} \quad (12)$$

2. Compute by Simpson's one-third rule the value of the integral

$$\int_0^1 \sqrt{(1-x^2)(2-x)} dx$$

taking 11 ordinates. Give the result upto 5 places of decimal.

(6+6)=12

3. Using the following table, find the value of y when (i) $x = .487$ and (ii) $x = .826$ by appropriate interpolation formulae :

x	y
.4	1.52334
.5	1.78744
.6	2.04421
.7	2.32753
.8	2.65138

(4+4+4)=12

4. The following table gives the steam pressures corresponding to different temperatures. Find by suitable interpolation formula the steam pressure at 370° C.

Temperature (°C)	Pressure (Cm of Hg)
351	154.2
367	167.0
378	181.0
387	212.8
393	244.2

(12)

Please turn over

GROUP B

(Answer all questions from this group)

5. Evaluate the determinant.

$$\begin{vmatrix} 7.4 & 2.2 & -3.1 & 0.7 \\ 1.0 & 4.8 & -8.5 & 4.5 \\ 4.7 & 7.3 & -0.2 & 3.8 \\ 6.9 & 2.7 & 4.9 & -5.3 \end{vmatrix} \quad (15)$$

6. Solve the equation
- $x \log_{10} x = 1$
- graphically, correct to two places of decimal. (15)

7. Solve the equations for positive values :

$$\begin{aligned} x^2 + y^2 &= 1 \\ \text{and } x^3 - y &= 0 \end{aligned}$$

correct to 3 decimal places.
You may start with an initial solution (0.9, 0.5). (18)

ENDNESS3 (for Groups A & B) (4)

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination - November 1978

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 income distribution for a certain low-income group of people.

<u>Income (Rs.)</u>	<u>Frequency</u>	<u>Income (Rs.)</u>	<u>Frequency</u>
0 - 5.5	4	40.5 - 60.5	25
5.5 - 13.5	20	60.5 - 80.5	25
13.5 - 25.5	32	80.5 - 100.5	15
25.5 - 40.5	45	100.5 - 125.5	2

Compute the

- (i) arithmetic mean, (ii) median, and (iii) the coefficient of variation of the above distribution. (3+3+5)=11

2. Draw the concentration curve (Lorenz Curve) for the income distribution given below:

<u>Monthly income (Rs.)</u>	<u>Frequency</u>	<u>Monthly income (Rs.)</u>	<u>Frequency</u>
0 - 50	33	200 - 250	203
50 - 100	75	250 - 300	84
100 - 150	101	300 - 350	43
150 - 200	123	350 - 400	15

Estimate the coefficient of concentration graphically. (3+2)=5

3. The arithmetic mean and geometric mean of a set of three values are 20 and 18 respectively. If one of the values be 13, find the Harmonic mean of all the three values. (6)
4. The bivariate frequency distribution of the weight of green jute plant (x), and the weight of dry jute fibre (y) for 418 plants is given below:

<u>x (gms)</u>	<u>10.0-15.0</u>		<u>15.0-20.0</u>		<u>20.0-25.0</u>		<u>25.0-30.0</u>		<u>30.0-35.0</u>		<u>35.0-40.0</u>	
<u>y (gms)</u>												
31.5 - 33.0		4		6		15		20				
33.0 - 34.5				8		11		22				
34.5 - 36.0				12		15		25		32		
36.0 - 37.5						20		32		34		40
37.5 - 39.0								35		41		45

EITHER

Compute the linear regression equation of y on x and estimate the error due to regression. (3+4+2)=9

OR

Compute the correlation ratio of y on x . (5+5)=10

Please turn over

5. The table below gives the Interim Index of Industrial Production for some selected groups for the months June 1937 and June 1963 with June 1966 as base.

No.	Group	Weight	Group Index	
			June '37	June '63
1	China & Earthenware	5	123	150
2	Bricks, Cement etc.	25	139	132
3	Metal ferrous	30	111	121
4	Metal Non-ferrous	18	121	116
5	Precision instruments	8	127	122
6	Leather goods etc.	6	95	98
7	Glass	7	112	127
8	Manufacture of wood & cork	25	134	133
9	Paper and printing	32	117	136
10	Other manufacturing industries	10	130	152

- (a) Calculate the Interim Index of Industrial Production for the 10 groups taken together for June '37 and for June '63.
- (b) There are 25 groups for the complete index with total weight 1000, of which only 10 groups are listed above.
- If the complete index for June '37 was 114, what was the index for the same month for the remaining 15 groups taken together.
 - If the index for the remaining 15 groups in June '63 was 123.2 what was the index for the same month for all the 25 groups taken together. $(343+23)=17$

GROUP B

(Answer all questions from this group)

6. The values of a variable y corresponding to some values of another variable x , are given below:

x :	0	2	4	6	8	10	12
y :	114.5	132.1	150.1	171.0	196.7	225.2	257.9

- Fit a curve of the form $y = Ax^2$.
 - Find also the expected values of y for the given values of x .
 - Plot both the observed and the expected values of y on the same graph paper. $(10+5+5)=18$
7. The means and the product moment correlation coefficients of three variables, x_1 , x_2 and x_3 are as follows :

$\bar{x}_1 = 34.0$	$r_{12} = 0.5911$	$r_{13} = 0.4108$
$\bar{x}_2 = 42.3$		$r_{23} = 0.6703$
$\bar{x}_3 = 27.4$		

- Compute the (i) partial correlation coefficient $r_{32.1}$
 (ii) multiple correlation coefficient $R_{3.21}^2$ $(7+7)=14$
- The quarterly outputs (thousand unit) of a certain commodity for five successive years are given below:

year	1930	1931	1932	1933	1934
quarter					
I	31	42	49	47	51
II	39	44	53	51	54
III	45	57	55	52	53
IV	33	45	57	57	59

Compute the indices of seasonal variation by any suitable method.

NEATNESS (for Groups A & B)

(14)
(14)

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination - November 1973

Paper V (Practical) : Elementary Statistical Methods

Time : 5 hours

Full Marks :

(a) Figures in the margin indicate full marks.

(b) Use of calculating machines is permitted.

GROUP A

(Answer question No.1 and any three of the rest from this GROUP)

1. The following table shows the number of days in a fifty day period during which 0, 1, 2, 3, 4 automobile accidents occurred in a city.

Fit a Poisson distribution to the given data, calculate the expected frequencies, and test the goodness of fit.

number of accidents	0	1	2	3	4
number of days	21	18	6	4	1

(4+4+4)=12

2. The observations on a certain characteristic are taken for two independent random samples are given below :
- Sample 1 : 8, 15, 9, 5, 6, 11, 13, 13, 7, 10
- Sample 2 : 4, 12, 7, 8, 9, 5, 13, 13, 15, 4, 3, 8, 13.
- Test whether the variances of the two samples differ significantly from one another. (12)

3. Some of the results obtained from the analysis of the scores in English (x_1), History (x_2) and Political Science (x_3) of 27 students, are given below :

$$r_{23} = 0.58; \quad R_{1,23} = 0.52$$

Test the significance of these two correlations. (12)

4. 1072 school boys were classified according to their economic condition, and intelligence quotient ($I.Q.$). The table thus obtained is given below :

economic condition	r_{12}			
	high	fair	moderate	low
poor	81	165	160	82
well off	43	190	131	103

Test whether there is any association between the two attributes.

5. The yield (in suitable units) of a crop on 10 experimental plots with 2 sub-plots in each are given below. One of the two sub-plots in each plot was treated with a certain manure, while the other was left untreated.

	Yield									
Sub-plot treated	8.3	5.8	6.3	6.2	6.6	6.3	5.7	5.7	5.2	5.8
Sub-plot untreated	5.8	5.5	5.7	5.7	6.6	5.5	6.2	5.9	5.6	5.7

Test whether treating a plot with the said manure improves the average yield of the crop. (12)

Please turn over

GROUP B

(Answer all questions from this group)

6. (a) A region is bounded by the circle $x^2 + y^2 = 1$, and the co-ordinate axes. Select 5 points at random from this region, mentioning the co-ordinates of the chosen points, correct to two decimal places.
- (b) Draw a random sample of size 5 without replacement from a population of 121 bryans.
- (c) Obtain a random sample of size 5 from a normal population with mean 23, and S.D. 4. In each of the above three cases, state briefly the procedure of selection followed by you.
7. Example (3x3+3x2)=15

An experiment was conducted to study the effect of glass type (I, II) and of phosphor type (A, B, C) on the brightness of a television tube screen. The variable measured in this case was the current in microamperes necessary to produce a certain brightness of the tube screen, the larger the current the poorer the tube-screen quality. Based on the data given below, make an analysis of variance and comment on the effects of different factors.

Current (in microamp) to produce a certain brightness in the Television Tube Screen

Glass type	Phosphor type		
	A	B	C
I	230	240	270
	290	210	235
	205	255	290
II	230	230	220
	235	240	225
	240	235	230

00231

(8+2+2)=12

CR

A 4x4 Latin-square experiment was conducted to compare the effects of four spacings A, B, C, D on the yield of millet. The plan and yields (in suitable unit) are given below :

A	B	C	D
23	28	29	28
B	A	D	C
28	25	28	27
C	D	A	B
27	28	25	20
D	C	B	A
26	27	20	23

Test whether the different spacings are equally effective, in case they are not so, find the best spacing. (8+2+2)=12

Please turn over

8. Construct the layout of a randomized block design with 5 treatments and 2 replications. State also the procedure followed by you. $(5 \times 2) = 7$
9. The following table gives the results of daily inspection of dowl pin plates for picking up plates with surface defects. Construct the control chart for fraction defective and comment on the state of control.

Date of inspection	Number of plates inspected	Number of plates found defective
October 2	532	18
4	533	13
5	488	13
6	510	15
7	540	21
8	520	17
9	583	28
11	479	13
12	570	20
13	520	10
14	510	15
15	538	22

 $(12 \times 2) = 14$

NEATNESS (for Groups A and B)

(4)