Computer's Certificate Examination - May 1973

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.)

1.   Use contracted method to evaluate any one of the following,
correct to 4 places of decimal:

(a)   31.2032457 x 21.4078

(b)   0.80765 ÷ 0.72034   (4)

2.   Evaluate any three of the following with the help of suitable
formulae :

i) $(53497)^2 - (53487)^2$

ii) $(0.4 + .02)(0.16 + .0004 - 0.4 \times .02)$

iii) $(1999)^2$

iv) $\dfrac{(-3.22)(-3.22)(-3.22) + (5.72)^3}{5.72 \times 5.72 + (3.22) \times (3.22) + 3.22 \times 5.72}$

v) $(19 + \frac{1}{19})(19 + \frac{1}{19}) - (19 - \frac{1}{19})(19 - \frac{1}{19})$ (2x3) = 6

(No credit will be given for working by routine process only)

3. (a) i) Round off the following numbers to three places of decimal :

60.34019,   0.1258

ii) Find also the relative and percentage errors due to rounding
in each of the above cases.

(b)   Express the numbers in (a)(i) above, correct to three significant
digits.

(c)   The diameter of a 2-inch steel shaft is measured to the nearest
thousandth of an inch, while a one-mile railroad track is measured
to the nearest foot.

Which of the two measurements is more accurate and why?
                                              (2+4+2+6) = 14

[P.T.O]

4.   Attempt (i) and either (ii) or (iii)

        (Use of logarithmic tables is not permitted for this question)

    i) Solve the equation :

        $2^x \cdot 3^{2x} = 100$,   given $\log 2 = .3010300$

                                    $\log 3 = .4771213$

        Give the result correct to 2 places of decimal.

    ii) Find the value of

        $\sqrt[5]{35.28}$, given $\log 2 = .3010$

                                $\log 3 = .4771$

                                $\log 7 = .8451$

                                and $\log 203.9 = 2.3095$

    iii) Find the value of the expression :

        $$\log \left\{ \frac{(7.2)^3 \times (.016)^4}{\left(\frac{6}{5}\right)^{15}} \right\},$$

        given $\log 2 = .3010300$, $\log 3 = .4771213$

                                                        $(4+6)= 10$

5.   Using the logarithmic table, find the following correct to
        four places of decimal :

        (i) $\log_2 0.0576982$ (ii) antilog (-2.73)
                                        when the base is $e = 2.71728...$

                                                        $4+4=(8$

6.   Attempt any one of the following :

    (a) Calculate, correct to 5 places of decimal, the value of

        $$1 + \left(\frac{1}{3}\right) + \left(\frac{1}{3}\right)^2 + \left(\frac{1}{3}\right)^3 + \ldots + \left(\frac{1}{3}\right)^{10}$$

    (b) Find, correct to 5 places of decimal, the value of

        $$\frac{1}{1 \times 5} + \frac{1}{3 \times 5^3} + \frac{1}{5 \times 5^5} + \frac{1}{7 \times 5^7}$$

GROUP B

(Attempt questions 7 and 8 and any other two from this group)

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

x	f(x)
33	9.7361
34	9.7476
35	9.7589
36	9.7692
37	9.7795

Find by linear interpolation

i) The value of f(x) for x = 34.75

ii) The value of x for which f(x) = 9.775   (3+4)=7

8. 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	30.4	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.   (7+2+6)=15

9. Solve graphically :

i) $2x + 3y = 14$
   $4x - y = 7$

ii) $\tan x = \frac{1}{2}$ between x = 0 and x = $\frac{\pi}{2}$ (6+7)=13

10. The following table shows the index number of industrial production for two different groups of industries:

industry group	year							
	1962	1963	1964	1965	1966	1967	1968	1969
I. Capital-goods industries	153.0	170.0	206.1	244.2	210.1	205.3	(-)	213.2
II. Consumer-goods industries	108.0	110.4	(-)	127.5	131.3	125.7	131.9	144.6

(a) Plot the index numbers of industrial production for different groups of industries against time and draw smooth free hand curves through the points.

(b) Read from these curves the probable values of the two missing (-) figures.   (7+4+2)=13

11.   Draw the graphs of :

                  (i) $2y = x^2$

                  (ii) $y = 8$

      and (iii) $x = -6$

      on the same graph paper and using the same set of axis and units.
      Find graphically the area bounded by these graphs.   (8+5)=13

12.   Draw the graph of the function $y = x^4 - 6x^3 + 9x^2 - 5x - 13$
      plotting the points for $x = 2, 3, 4, 5$ and 6.

      Find from the graph, the value of x at which $y = 10$.
                                                               (10+3)=13

      NEATNESS (Groups A and B)   (4)

—————————

(M1)

INDIAN STATISTICAL INSTITUTE.

Computers' Certificate Examination - May 1973.

Paper II - Compilation and Presentation of Statistics (Practical)

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)

Q. 1. Prepare a complete table (with suitable title, row and column headings etc.)
showing the detailed Bastee Survey data relating to the Kidderpur-Chetla
area of Block 'P' of Corporation Ward Nos. 71 - 75.

The total number of families living either independently in a hut
or sharing a hut jointly with one or more families, is 26,522. Out
of this, 249 families are living independently in separate huts,
and they account for 0.94% of the total number of families. The
number of families sharing a hut in groups of 2,3 or 4 families is
shown to be 466, 876 and 1176 respectively and the corresponding
percentages are 1.76, 3.30 and 4.43 for these groups. There are
1480 families each sharing a hut with four other families. The last
group in which six or more families share one hut shows the per-
centage as high as 83.09   (8)

Q. 2. Scrutinise the information given in the following table and re-write it
after making necessary corrections and removing any other irregulari-
ties as may appear to you.

TABLE 'A': Distribution of huts by covered space and kind of
structure in certain wards of the Calcutta Corporation area.

Sl No.	Covered space (Sq.ft)	Mainly pucca		Mainly kutcha		Kind of struc- ture not record- ed		Total.	
		No.	%	No.	%	No.	%	No.	%
0	1	2	3	4	5	6	7	8	9
I	600 & less	55	3.84	99	6.08	154	5.02	154	5.02
II	601 - 1000	162	11.31	202	12.40	-	-	364	11.86
III	1001 —2000	302	41.10	734	45.06	4	57.14	1370	44.61
IV	2001 - 3000	632	25.26	399	23.88	-	-	751	24.47
V	3001 & above	215	15.00	201	12.34	1	14.29	417	13.59
VI	Not recorded.	7	0.49	4	9.24	2	28.57	13	0.42
	TOTAL	1433	100.00	1629	100.00	7	100.00	3069	100.00

(8)

Please Turn Over.

(5)

: 2 :

Q.3. Prepare a blank tabular layout with a suitable caption showing the distribution of total number of West Bengal Government employees as on 31st March 1970, by offices, i.e., Secretariat, High Court and offices (other than Secretariat and High Court), classified separately for the categories - Gazetted, Non-Gazetted (Superior) and Non-Gazetted (Inferior). Each category of staff is also to be shown on the basis of tenure of service indicated as Permanent, Temporary and Others.

Also show the percentage column of each type of employee to the total number of employees.   (11)

Q.4. Name the official publications which provide current statistics, for any three of the following:

(a) Quantity of wheat arrived from villages in certain selected markets during different periods of a year, in major wheat producing States of India.

(b) Gross monthly Union Excise Duties collected from tyres and tubes in India.

(c) Number of coal mines classified according to their monthly raisings during any month, in each State of India.

(d) Monthly production of commercial plywood in different States of India.

(e) Monthly consumption of raw jute (in 000 bales).

Also mention the name of agency issuing the publication and the periodicity of the publication in each case.   (3 x 3) = 9

Q.5. From the official publications supplied on the table collect for any recent year or month (the year or month to be specified) the required information for any three of the following:-

(a) Actual and normal rainfall (in millimetres) in any rainfall region of India, of any two consecutive months of a particular year.

(b) Number of marriages in Japan, Canada and Chile, for any recent year.

(c) Quantity of coal and coke exported from Bihar to West Bengal for twelve months ending in March, of any particular year.

(d) Number of printing presses at work and number of newspapers and periodicals published in any State of India for a particular year.

(e) Number of cholera patients treated in hospitals and dispensaries, for any State for a particular year.

Candidates must provide with their answers a complete reference to the publication consulted (name, period of publication and page number in the publication consulted).   (4 x 3) = 12.

_____

Group - B

(Attempt all questions from this Group)

Q. 6 During crop-cutting experiment on wheat, a small area, selected inside a field growing the crop, is harvested and the weight of the crop thus harvested is recorded. The following table gives the weights of crop from 110 experimental cuts :-

Cut number	Weight of crop. (grams)	Cut number	Weight of crop. (grams)	Cut number	Weight of crop (grams)
1	680	41	625	81	425
2	1950	42	2781	82	940
3	700	43	1300	83	1160
4	1150	44	1980	84	870
5	2250	45	525	85	1750
6	780	46	250	86	780
7	250	47	1060	87	250
8	2010	48	1790	88	2100
9	500	49	650	89	670
10	1540	50	450	90	850
11	960	51	2075	91	1550
12	1850	52	400	92	540
13	790	53	1590	93	460
14	450	54	480	94	1625
15	1250	55	260	95	310
16	300	56	1090	96	2560
17	100	57	750	97	525
18	150	58	1875	98	1080
19	350	59	550	99	1170
20	100	60	2900	100	460
21	325	61	470	101	1500
22	120	62	1200	102	800
23	1680	63	430	103	450
24	540	64	350	104	1020
25	1080	65	385	105	20
26	630	66	2470	106	90
27	2310	67	940	107	1410
28	60	68	660	108	500
29	950	69	1625	109	1260
30	210	70	210	110	2500
31	1140	71	650		
32	750	72	1100		
33	1450	73	80		
34	460	74	1980		
35	140	75	375		
36	530	76	375		
37	1350	77	1360		
38	1200	78	500		
39	280	79	860		
40	1760	80	1475		

Form a frequency distribution of weight of crop from the data using appropriate class intervals. Also draw the cumulative frequency curve (of less than type).

(10 + 6) = 16.

Q.7. The table below gives the average per capita daily consumption (in ounces) of different items for three classes of persons as obtained in a survey. Represent the data in a suitable diagrammatic form.

Economic status	Average per capita consumption per day (Oz.)					
	rice	dal;	fish & meat	eggs	vegeta-bles.	oil
Poor	21.3	2.0	0.19	0.03	0.73	0.26
Lower middle class	21.9	2.0	0.37	0.04	1.13	0.37
Upper middle class	20.0	2.0	0.38	0.06	2.40	0.49

(11)

Q.8. The number of tourists arriving in a certain country by air, sea and land in different years are given below.   Give a suitable graphical representation of the data.

Year	Number of tourists		
	air	sea	land
1965	4029	1159	303
1966	7369	3640	641
1967	11065	2100	127
1968	13096	1691	1033
1969	17003	2004	1387
1970	19576	2002	1323
1971	20526	2699	1857

(11)

Q.9. Draw a suitable diagram to represent the following data relating to incidence of cancer as given below.

Percentage incidence of cancer among men.

Mouth	..	29.9
Skin	..	1.1
Respiratory tract	..	21.0
Digestive tract	..	25.4
Urinary Organs	..	1.7
Genital organs	..	5.9
Leucaemia	..	7.5
Other cancers	..	7.5

(10)

NEATNESS (Groups 'A' & 'B')   (4)

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

(Attempt all questions from this group)

1. Complete the following table :

x	f	fx	fx^2	fx^3	fx^4	$f(x+1)^4$
(1)	(2)	(3)	(4)	(5)	(6)	(7)
- 6	1					
- 4	3					
- 2	24					
0	58					
1	60					
3	27					
5	2					

Total:

Hence check the total of col.(7) with the help of totals
of columns (2) to (6).   (9+3)=12

2. Using a suitable interpolation formula, find the value of
log 2.35095 from the following values :

$\log 2.350 = 0.3710879$

$\log 2.351 = 0.3712526$

$\log 2.352 = 0.3714373$

$\log 2.353 = 0.3716219$

$\log 2.354 = 0.3718065$

Compare the value obtained by you with that obtained by
linear interpolation.   (9+3)=12

3. Find by Lagrange's formula the value of U_8, given the following
values

x	U_x
0	17.378
5	15.094
10	14.270
15	12.412

(12)

Please turn over

4.   Apply Simpson's one-third rule (using 7 ordinates) to find the

     value of $\displaystyle\int_{0}^{3} \frac{dx}{1+x^2}$ correct to 5 places of decimal.   (12)

GROUP B

(Attempt any three questions from this group)

5. $x^3 - 2x - 5 = 0$ has a root in the interval $(2,3)$. Find the value
     of the root correct to three places of decimal using any
     numerical method.

     $\sqrt{}$The procedure adopted by you should be clear from your
     work-sheet.$\underline{}$ (16)

6.   Solve the equations given below graphically to one place of
     decimal :

          i) $2x^2 - y = 0$
          ii) $x + 3y - 7 = 1.25$ (16)

7.   Given the following set of equations, solve for p, q, r and s.

          i) $p + 2q - r + 3s + 9 = 0$
          ii) $3p - 5q - 3r + 9s + 16 = 0$
          iii) $7p - 5q + r - 3s - 20 = 0$
          iv) $4p + q - 2r + s + 3 = 0$ (16)

8.(a) Evaluate the determinant by the method of pivotal condensation:

$$D = \begin{vmatrix} 2 & 5 & 3 & -1 \\ 4 & 1 & -2 & 3 \\ 2 & 6 & 1 & -3 \\ 3 & 1 & 2 & 4 \end{vmatrix}$$

   (b) Write down the minor of the element in the third row and the
        second column. $(14+2)=16$

NEATNESS (Group A and Group B)   (4)

Computer's Certificate Examination – May 1973

Paper IV (Practical) : Descriptive Statistics

Time: 5 hours   Full marks : 100

(a) Those who have already passed according to
old rules in Part IB Section A only and have
accordingly been specifically excepted from
answering GROUP A, will be required to answer
the questions in GROUP B only in time not
exceeding 3 hours. The time should be
recorded on the top sheet of the script.

(b) Figures in the margin indicate full marks.

(c) Use of calculating machines is permitted.

GROUP A

(Attempt all questions from this group)

1.   EITHER

Compute mean, mode and standard deviation of the following
frequency distribution.

Frequency distribution of I.Q. of
304 six-year old children:

I.Q.	Frequency	I.Q.	Frequency
60 – 69	3	110 – 119	70
70 – 79	5	120 – 129	37
80 – 99	17	130 – 139	19
90 – 99	65	140 – 149	7
100 – 109	69	150 – 159	3
		Total	304

(5+3+8)=16

OR

(a) The following table gives the frequency distribution of scores
in English obtained by students who passed in the subject in a
School Leaving Certificate (SLC) examination.

Frequency distribution of scores in English

Score	Frequency	Score	Frequency
36 – 40	441	61 – 65	30
41 – 45	397	66 – 70	12
46 – 50	333	71 – 75	4
51 – 55	186	76 – 80	2
56 – 60	107	Total	1522

Compute the first, the second and the third quartiles of the
distribution.

(b) A motor car travelled three consecutive miles, the first at the
speed of $x_1 = 35$ miles per hour, the second at $x_2 = 48$ miles per
hour and the third at $x_3 = 40$ miles per hour. Find the average
speed of the car in miles per hour.   (12+4)=16

(211)

2.   The following table gives the stature and weight of 20 school boys

Stature(x) in cm.	Weight (y) in lbs.	Stature(x) in cm.	Weight (y) in lbs.
(1)	(2)	(1)	(2)
159	92	144	62
138	68	145	80
148	74	163	86
146	70	155	98
155	88	172	154
145	62	156	86
138	62	164	102
146	70	166	116
150	106	160	102
168	88	153	82

(a)   Find the product-moment correlation coefficient between x and y.

(b)   Find the linear regression of x on y.

(c)   Using the regression equation in (b), find the expected stature of a person whose weight is 100 lbs.

$$(5+4+4+3)=16$$

3.   Below are given the prices of some staple food articles in the rural areas of Northern India during the year 1951 and during the month of September 1954, along with the corresponding averages of monthly expenditure per household in 1951. Compute the weighted average of price relatives with average expenditures as the weights to show the changes in food prices between the year 1951 and the month of September 1954.

Commodities	Average expenditure per household in 1951 (Rs.)	Prices per seer in rupees	
		1951	September 1954
(1)	(2)	(3)	(4)
Food grains	53.27	.40	.45
Pulses	7.11	.43	.38
Edible oils	4.07	2.12	1.50
Vegetables	2.19	.44	.42
Milk	4.80	.75	.62
Meat and fish	1.41	1.50	1.62
Fruits	.34	1.60	1.50
Salt	.56	.07	.07
Spices	2.23	2.40	2.00
Sugar	4.46	.70	.75

Compute also the simple geometric mean of the price relatives of all the commodities, excluding food grains. $(10+6)=16$

GROUP B

(Attempt all questions from this group)

4. The following shows the means, standard deviations and correlation-coefficients of scores obtained on three tests :

tests	mean score	s.d.	correlation coefficients
1	39.46	6.2	$r_{12} = 0.29$
2	52.31	9.4	$r_{13} = 0.38$
3	45.26	8.7	$r_{23} = 0.43$

i) Obtain the multiple regression equation of the 3rd test score on the remaining two scores.

ii) Compute the multiple correlation coefficient $R_{3.12}$ (12+4)=16

5. Fit a curve of the type $y = AB^x$ to the following data and find the expected values of y when $x = 1$ and $x = 4$.

x	1	2	3	4	5
y	1.6	4.5	13.8	40.2	125.0

(12+4)=

6. EITHER

Determine the trend of the following series using 4-year centered moving averages. Plot the original series and the trend values on the same graph paper.

year	tea production (suitable units)	year	tea production (suitable units)
(1)	(2)	(1)	(2)
1939	41.7	1947	55.7
1940	43.0	1948	57.1
1941	46.4	1949	59.6
1942	51.5	1950	61.2
1943	51.8	1951	64.7
1944	46.7	1952	64.5
1945	50.2	1953	60.8
1946	54.0	1954	64.4

(10+6)=16

OR

The following table shows the quarterly receipts of State Governments in India. Obtain indices of seasonal variation using the method of moving averages.

Total receipts of State Governments in India (R.Crore)

year	quarter			
	April-June	July-Sept.	Oct.-Dec.	Jan.-March
1955-56	46.69	53.27	53.11	143.50
1956-57	46.93	56.40	59.57	129.61
1957-58	55.18	60.67	77.82	197.19
1958-59	65.23	98.68	101.49	255.10

(16)

NEATNESS (Group A and Group B)   (4)

Time : 5 hours.   Full Marks : 100

(a) Those who have already passed according to the old rules
    in Part IB Section II or in Part IC Section I, will be
    exempted from answering Group A or B respectively. They
    should however answer questions from the other two groups
    (i.e.from B and C or from A and C as the case may be)
    in time not exceeding 3 hours. Answer time to be recorded on script.

(b) Figures in the margin indicate full marks.

(c) Use of calculating machines is permitted.

G R O U P - A

(Attempt all questions from this group)

1.   EITHER

From records of 10 Prussian Army Corps kept over 20 years, the following
data were obtained showing the number of deaths caused by horsekicks.
Determine the average number of deaths per army corps per annum,' from this.
Calculate the theoretical Poisson frequencies and test the goodness of fit.

Number of deaths per army corps per annum	0	1	2	3	4	Total
Frequency of occurrence	109	65	22	3	1	200

(3+8+7) = 13.

OR

The following data shows the results of throwing 12 dies 4096 times; a
throw of 4, 5 or 6 being called success.

No. of successes.	frequency.	No. of successes.	frequency.
0	-	7	847
1	7	8	536
2	60	9	257
3	198	10	71
4	430	11	11
5	731	12	-
6	948		

Total : 4096

Fit a Binomial distribution to the data and test the   (4+8+6) = 18.
goodness of fit.

2.   Attempt any two from a , b , c in this question.

(a) The following figures give the percentage extension under a given
    load of two independently drawn random samples of yarn, the first
    sample being taken before washing and the second after six washings :

    Before washing   :   12.3, 13.7, 10.4, 11.4, 14.9, 12.6

    After six washings :   15.7, 10.3, 12.6, 14.5, 12.5, 13.9, 11.9

    Is there any evidence that the average extensibility is affected
    by washing ?

2. **(b).**
/contd./

In an experiment with a certain type of yarn, six lengths of yarn were selected at random and each length was cut into two halves. One of the halves was tested for examination without washing and the other half after six washings. The following percentage extensions were obtained :

Length	:	1	2	3	4	5	6
Before washing	:	13.9	12.5	11.0	11.8	10.8	14.6
After six washings	:	14.7	12.1	13.2	13.6	11.5	15.4

Can it be said on the basis of the above evidence, that washing affects extensibility ?

(c) A manufacturer of gun powders has developed a new powder which is designed to produce a muzzle velocity equal to 3000 ft./sec. Eight Colls are loaded with the charge and the muzzle velocity measured. The resulting velocities are shown below :

Muzzle Velocity : 3005, 2925, 2935, 2965,
(in feet per second) 2895, 3005, 2935, 2905.

Do the data present sufficient evidence to indicate that the average velocity differs from 3000 ft./sec. ?

$(10 + 10) = 20$

3. **EITHER**

(a) The following shows the distributions of two groups of persons according to their blood-groups :

		Blood-group				
		0	A	B	AB	Total
Army cadets	:	56	60	18	6	140
Others	:	120	122	42	11	295

Examine whether the distributions for the two groups are significantly different.   10

OR

(b) In a series of 1250 consecutive live births occurring in a hospital, 672 were found to be males. Test whether male and female births occur with equal frequency in the long run.

4.

G R O U P - B.

(Attempt all questions from this group)

4.   Attempt any two from a b e in the following question.

(a) Draw a random sample of 5 words without replacement, from the following passage indicating the procedure and giving reference to the table used :

" He who knows not and knows not he knows not,
Is fool; shun him.

He who knows not and knows he knows not,
Is simple; teach him.

He who knows and knows not he knows,
Is asleep; awake him.

He who knows and knows he knows,
Is wise; follow him. "

Work out the mean and median word-length(i.e., the number of letters in a word)for your sample.

$$(5 + 2) = 7.$$

(b) Select two lines from the passage quoted in Q.4(a) at random without replacement and with probability proportional to length of line (i.e. the number of words occurring in a line) clearly indicating the procedure. Obtain the average word-length for your sample .

$$(5 + 2) = 7.$$

(c) The error in repeated measurements with a given yardstick is known to be normally distributed, with mean - 0.5 inches and s.d 0.18 inches.

Obtain a random sample of 5 measurements with this yardstick, given that the true length is 7 inches.

$$(7)$$

5. The following is the record of number of defectives in 16 lots of 650 pins each, taken successively from a continuous production process.

16, 19, 9, 14, 23, 18, 21, 39

10, 21, 18, 22, 20, 14, 8, 17.

Draw a control chart for fraction defective and comment on the state of control of the process.

$$(12 + 2) = 14.$$

6.   EITHER

(a) Below are given the birth-weights (in lbs.) of babies classified according to order of birth :

Order of birth.

1	2	3	4	5 & above.
4.8	5.2	5.9	6.0	6.0
5.0	5.3	6.2	6.5	6.0
5.1	5.3	5.8	6.1	5.8
5.1	5.5	5.5	6.0	5.5
4.9	5.0	5.9	5.8	5.5
5.0			6.2	

Carry out an analysis of variance to test if the effect of birth-order on average birth-weight is significant. Also compare the average birth-weights of birth-orders 1 and 4 by a suitable test. $(15 + 5)=20$

CC(M73)-V(4).

OR

(b) (1) obtain the layout of a randomised block design, with 5 treatments and 4 blocks, indicating the procedure you adopt.

(ii) An experiment was conducted in a 4 X 4 Latin Square, to test the effect of four spacings A, B, C and D on the yield of a type of millet. The plan and yields (in suitable units) are given below :

Rows	Columns			
	1	2	3	4
1	A 231	B 280	C 295	D 234
2	B 284	A 246	D 293	C 271
3	C 275	D 292	A 268	B 258
4	D 259	C 271	B 209	A 275

Analyse the data to test if the different spacings are equally effective as far as mean yield is concerned. Compare also spacings B and C in this respect.

Neatness /Groups A and B/ :

$\dfrac{(5+12+3)}{1} = \dfrac{20}{4}$

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.   Use contracted method to evaluate any one of the following, correct
     to 4 places of decimal:

     (a) 5947.183×0.093187 (b) $1.34768 \div 3.278$ (.')

2.   Evaluate any three of the following with the help of suitable for... · ·

     i) $64^2 - 36^2$

     ii) 998^2

     iii) $(3.56)^3 + (6.44)^3 + 30 \times 3.56 \times 6.44$

     iv) $(0.8 - 0.03)(0.64 + 0.8 \times .03 + .0009)$

     [No credit will be given for working by routine process only] (2.7).'

3.   Attempt any two of the following :

     i)   Round off the following numbers to 4 places of decimal :

               80.127792,   0.136629

          Find also the relative and percentage errors due to rounding off
          in each of the above cases.

     ii) Find the maximum relative error in the sum of two approximate
          numbers 5.29 and 0.374, both numbers being correct to the last digit
          retained. Find the number of significant digits in the sum.

     iii) Express (a) 9 yds. 1 ft. 9 inches to the nearest foot and

                    (b) R.15-30 paise to the nearest rupee.
          Calculate the relative and percentage errors due to rounding off
          in each of the above cases.   (4+4)

4.   Attempt any one of the following :

     a) Calculate, correct to 5 places of decimal the value of :

         $$\frac{1}{2 \times 5} + \frac{2}{2^2 \times 5^3} + \frac{3}{2^3 \times 5^5} + \frac{4}{2^4 \times 5^7}$$

     b) Find, correct to 4 places of decimal the value of :

         $$\frac{1}{9} + \frac{1}{99} + \frac{1}{999} + \frac{1}{9999} + \frac{1}{99999} + \frac{1}{999999}$$ (6)

5. a) Given that
    i) $\log_{10} 0.001106 = \bar{3}.1541195$
    ii) $\log_{10} 4 = 0.6020600$
    iii) $\log_{10} 0.2022751 = \bar{1}.3059426$

    find the value of:

    $$\frac{(14.26)^{\frac{1}{3}} \times (25.6)^{\frac{1}{4}}}{(142.6)^{\frac{1}{5}}}$$

    correct to 4 significant digits.

   b) Find to two places of decimal the value of x from the

       equation $6^{3-4x} \times 4^{x+5} = 8$, given log 2 = .3010300, log 3 = .4771213

       $(8+4)=12$

       /Note: Only the information given to you should be used and it
       should be clearly indicated how these have been used./

6. a) Using the logarithmic table, find the following correct to
       4 places of decimal :

       i) $\log 2 = 87.548$

       ii) anti-log (3.02702) when the base is $e = 2.71728$

   b) Calculate, using the logarithmic table, the value of
       i) $\overline{\cdots\cdots\cdots R}$ $\dfrac{3.79 \times .032 \times 109.2 \times 19.895}{.00079 \times 981}$

       ii) $\overline{\text{Or}}$ $\dfrac{\sqrt[5]{2.415}}{(0.831)^4}$

       $(8+4)=12$

GROUP B

(Attempt all questions from this group)

7.   EITHER

     Below are given five pairs of values of x and y :

x	y
20	46802
22	57913
24	62400
26	79135
28	80246

     Find by linear interpolation, the value of y when x = 22.43 and
     the value of x when y = 78212. $(4+5)=9$

     OR

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

x y	20	22	24
11	0.0414	0.0453	0.0492
12	0.0732	0.0838	0.0864
1.	0.1139	0.1173	0.1206

     Find by linear interpolation the value of $f(21.85, 12.26)$ (9)

                                        Please turn over

8. a) Draw the graphs of the equations

(i) $2x + y = 3$,   (ii) $x - 2y = 4$.

In each case find the intercepts on the x-axis and on the y-axis.

b) Solve graphically : $2 \cos \theta = 0.842$ between $\theta = 0$ and $\theta = \frac{\pi}{2}$

correct to 2 significant digits.   (4+6)=10

9.   EITHER
The following table gives the value of exports of a certain commodity
during 1951-55.

	year				
	1951	1952	1953	1954	1955
Value (£million)	6.0	5.2	4.9	5.1	5.6

Draw a suitable graph of the above data. From the same, estimate
the approximate value for the year 1956.   (7+3)=10

OR
The average weight of boys of different ages is given in the
following table.

Age (years) :	11	12	13	14	15
Weight (Kg.) :	30	32	37	42	47

(a) Draw a graph to show the variation in weight with age.

(b) From the graph, find -

   i) obtain probable average weight of a boy of $12\frac{1}{2}$ years

   ii) find to what extent a boy of $13\frac{1}{2}$ years weighing 38 Kg,
       is below the average for his age.   (6+2+2)=10

10.   EITHER
Draw the graph of $y = x^2 - 6x + 5$ and hence find the minimum value of y
and the corresponding value of x. From the graph also obtain the
value of x, when

            (i) $x^2 - 6x + 5 = 0$ (ii) $x^2 - 6x + 5 = 6$ (5+2x3)=11
Or
Draw the graph of $y = x^2 - 9x + 15$ and obtain (graphically) the area
enclosed by this graph and the x-axis.   (5+6)=11

11.   Two trains A and B start from a place P and move towards a place Q
along the same straight line. Train A leaves at 6 a.m. and moves
at the rate of 30 km. per hour, while train B leaves at 9 a.m.
and moves at 60 km. per hour.

Find graphically :

i) the time at which the trains A and B meet each other.

ii) the distance between the starting point P and the point where the
    two trains meet.   (8)

SUITABLE (Groups A and B)   (4)

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. The special returns showing advances to agriculture, small-scale
    sector (comprising small-scale industries, transport operators and
    industrial estates) and export-promotion sector made by scheduled
    commercial banks were collected by the Reserve Bank of India for the
    period June 1969 and March 1970. The scheduled commercial banks
    were classified as Public Sector banks and other scheduled banks.
    The Public Sector banks comprised of (i) SBI and subsidiaries and ·
    (ii) 14 nationalised banks. The scheduled commercial banks'
    advances to agriculture rose from 108.41 in June 1969 to 206.98 in
    March 1970. The advances made by SBI and subsidiaries, 14 nationalised
    banks and other scheduled banks in June 1969 were 97.91, 82.42 and
    28.08 respectively. Similar advances by them in March 1970 were
    125.31, 124.29 and 36.54 respectively. As regards advances to small
    scale sector scheduled commercial banks' advances rose from 291.19 in
    June 1969 to 418.59 in March 1970. The advances for this sector by
    SBI and subsidiaries, 14 nationalised banks and other scheduled banks
    were recorded as 155.22, 214.86 and 48.51 respectively in March 1970
    as against 103..1, 153.79 and 37.39 respectively in June 1969. Banks
    have also stepped up assistance to export sector and the amount of
    credit for exports increased from 283.43 in June 1969 to 314.98 in
    March 1970. The three categories of banks as described earlier,
    contributed to the export promotion sector 79.72, 123.97 and 68.74
    respectively in June 1969 and 94.99, 147.77 and 72.31 respectively
    in March 1970.

    $\sqrt{}$ All the figures given above are in "Rupees Crore" . $\sqrt{}$

    Present the data given above in a suitable statistical table with
    appropriate headings. Indicate also in the table the advances during
    the two periods by the "Public Sector Banks".   (8+2)=10

2. Name the official publications which provide current statistics for
    any three of the following :

    a) District-wise area and production of principal cereals in India.

    b) Installed plant capacity and production $(i.e.$ generation)of electricity
        in India.

    c) Minimum wages including dearness allowance,in cotton textile mills in
        different centres in India.

    d) Demand and time liabilities of foreign banks in India as on the
        last Friday of a month.

    e) Natural rubber production in different countries.

    Mention the name of agency issuing the publication and the periodicity
    of the publication in each case.   (3x3)=9

3. From the official publications supplied on the table, collect for
    any two consecutive recent periods (years, months or weeks as the
    case may be) the required information for any three of the following :

    a) Consumer price index number (base : 1957=100) for urban non-manual
        employees in Ahmedabad.

    b) Index number of wholesale prices (base : 1951-62=100) in India of
        (i) pulses and (ii) rice during any recent week.

    c) Total production of coal from Bokaro and Jharia in Bihar.

    d) Average spot prices of gold and silver in Bombay.

    e) Infant mortality rate for Japan.

        /You are required to quote with your answer the name, periodicity of
        publication and the page number of the publication consulted./
                                                                (3x4)=12

4. Index numbers of consumer prices (base: 196?=100) for industrial
    workers are available for one or more centres of each State in India
    during recent months. Apart from the general i.e. overall indices,
    group indices for food and clothing are also separately available.

    Prepare a blank tabular layout with suitable headings for presenting
    such indices for the twelve months of 1971, for the following centres:

    i)   Guntur and Hyderabad in Andhra Pradesh,

    ii) Digboi and Doom-Dooma in Assam

    iii) Jamshedpur and Jharia in Bihar.   (7)

5. Scrutinise the information given in the following table and re-write it
    after making necessary corrections and removing any other irregularities
    as may appear to you.

    Table C(3): Distribution of factories according to size and type
                 of ownership, for the years 1953 and 1954.

size by persons employed	type of ownership							
	proprietors				partnership			
	1953		1954		1953		1954	
	no.	%	no.	%	no.	%	no.	%
Below 20	512	44.4	540	40.1	550	24.3	550	46.2
20 - 49	613	39.3	555	43.5	1020	45.0	1125	23.3
50 - 99	159	11.5	196	14.4	504	22.2	528	21.7
100 - 249	52	3.6	56	4.2	152	6.7	168	6.9
250 - 499	11	0.8	8	0.6	25	1.1	31	1.3
above 500	2	.2	2	0.2	15	0.7	16	0.6
Total	1373	100.0	1359	100.0	2266	100.0	2437	100.0

                                                                (10)

GROUP B

(Attempt all questions from this group)

6. (a) The following data give the percentage distribution of earners by
        mother tongue for urban areas of West Bengal as obtained in a
        recent survey.

mother tongue	percentage of earners
(1)	(2)
Bengali	63.5
Oriya	2.1
Hindi	29.7
South Indian languages	1.2
others	0.5

Draw a suitable diagram to represent the above data.

Please turn over

6. (b) The following table shows the working population of West Bengal by industrial categories and sex as obtained for the Census of 1961.

		(In thousand	
category	no. of persons	male	female
(1)	(2)	(3)	(4)
1. Cultivator	4,458	3,891	567
2. Agricultural labourer	1,772	1,447	325
3. Workers in plantation, forestry, fishing livestock, hunting, mining and quarrying.	570	430	139
4. Workers in manufacturing (including household) industry	1,807	1,544	263
5. Construction workers	152	147	5
6. Workers in trade and commerce	672	636	36
7. Transport, communication and storage workers	392	387	5
8. Workers in other services	1,549	1,319	230

Present the above data in a suitable diagrammatic form.   (7·11)=18

7. The following figures relate to the number of applicants placed in employment through Employment Exchanges in India during the years 1957-1964.

Year	Central Government (including Railways)	State Governments	Other establishments (including quasi-Govt. and local bodies)
(1)	(2)	(3)	(4)
1957	5.9	1.3	11.2
1958	5.2	1.4	11.2
1959	5.6	1.8	7.1
1960	6.4	0.5	6.3
1961	6.3	1.0	12.4
1962	1.0	1.0	10.4
1963	12.9	1.8	21.0
1964	13.3	7.1	23.6

Present the above data in a suitable graphical form.   (12)

8. The following table gives the frequency distribution of wages per week of a group of labourers.

Wages per week (in rupees)	Number of labourers
(1)	(2)
35.00 - 35.49	1
35.50 - 35.99	4
36.00 - 36.49	6
36.50 - 36.99	16
37.00 - 37.49	20
37.50 - 37.99	30
38.00 - 38.49	10
38.50 - 38.99	2
39.00 - 39.49	2

Draw an 'ogive' of the 'less than' type for the above frequency distribution.   (8)

Please turn over

9. The following are the marks obtained by 60 students in English and
    Mathematics in an examination. Prepare a two-way frequency table
    from the data using suitable class-intervals. .

serial no. of student	marks in English	Mathematics	serial no. of student	marks in English	Mathematics
(1)	(2)	(3)	(1)	(2)	(3)
1	64	66	31	58	50
2	52	60	32	34	54
3	56	63	33	66	62
4	64	66	34	71	64
5	41	55	35	61	66
6	39	56	36	38	56
7	33	62	37	63	58
8	25	41	38	52	74
9	72	56	39	28	44
10	71	89	40	47	73
11	46	48	41	28	26
12	57	74	42	41	66
13	61	73	43	24	56
14	39	42	44	73	54
15	43	62	45	73	60
16	54	72	46	64	52
17	43	46	47	60	66
18	61	64	48	32	38
19	60	62	49	34	36
20	33	50	50	70	60
21	55	76	51	24	20
22	41	64	52	47	74
23	53	70	53	41	46
24	66	62	54	62	56
25	63	60	55	54	56
26	33	72	56	73	64
27	53	44	57	62	74
28	53	60	58	35	40
29	65	64	59	71	62
30	44	36	60	59	62

(12)

NEATNESS (Groups A and B)   (4)

Computer's Certificate Examination — November 1973

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

(Attempt any four questions from this group)

1. Compute, using a suitable tabular layout, the values of $f(x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4}$, for the following values of x : 0.05, 0.1, 0.15 and 0.2. Compute also the values of $g(x) = x + \frac{x^2}{2} + \frac{x^3}{3} + \frac{x^4}{4}$ for all the specified values of x.
   Find the values of $\log_e(1+x)$ for the aforementioned values of x and compare them with the corresponding values of $f(x)$ obtained by you.

   $\left[\text{All your calculations should be correct to 4 places of decimal.}\right]$ $(8+4)=12$

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

x	$f(x)$
2	170.20
3	219.24
4	221.04
5	212.04
6	230.04
7	202.68

   By using Newton's Forward Formula, obtain the values of $f(x)$ for
   (i) $x = 3.5$ and (ii) $x = 1.8$ $(4+2\times4)=12$

3. Either In the following table the values of a function $f(x)$ are given for certain values of x:

x	$f(x)$
102	2.0086
104	2.0170
108	2.0334
114	2.0569

   Find the value of $f(x)$ for $x = 106$ by using Lagrange's Interpolation Form (1

   Or   Find the approximate value of $\log_{10} 4.01$ from the following table by using Newton's Divided Difference Formula :

x	$\log_{10} x$
4.0002	0.6020017
4.0104	0.6031877
4.0203	0.6045021
4.0204	0.6052044

4. Evaluate by numerical integration the integral $\int_{0}^{12} \frac{dx}{1+3x^2}$ correct to six decimal places.

   Use (i) Simpson's one-third rule and (ii) trapezoidal rule taking seven ordinates. $(8+4)=12$

5. Find the value of the following integral $\int_{1}^{2} \frac{1}{\log_{13} x} dx$ by graphical method, plotting at least eleven points on the graph of $y = \frac{1}{\log_{13} x}$.

GROUP B

(Attempt all questions from this group)

6.   Attempt <u>any two</u> questions :

(a) Find the root of the following equation correct to 4 places of decimal by any numerical method :

$$x \log_{10} x - 4.777 = 0$$

The root lies between 6 and 7.

(b) One of the roots of the equation $x^4 - 3x^2 + 75x - 10000 = 0$, lies between 9 and 10. Find the root correct to 3 places of decimal by any numerical method stating the method you adopt.

(c) Solve graphically, correct to one place of decimal, the equations

i) $4x^2 + 9y^2 - 20x - 80y + 122.25 = 0$

ii) $4y - 2x - 11 = 0$ $(16 \times 2) = 32$

7.   Attempt EITHER (a) OR (b) of the following :

    ⎾Full credit will not be given unless some short cut method is used.⏌

(a) Evaluate the following determinant to four places of decimal.

$$\begin{vmatrix} 5.75 & -2.25 & 4.79 & -7.75 \\ 1.25 & 0.70 & 8.23 & 15.23 \\ 6.35 & 1.65 & -6.59 & 21.72 \\ 1.25 & 1.25 & -5.74 & 13.42 \end{vmatrix}$$

Also write down the minor of the element in the 1st row and the 3rd column.

(b) Solve the following set of equations correct to two places of decimal for x_1, x_2 and x_3 :

$$1.254x_1 + 0.831x_2 + 1.109x_3 = -0.411$$

$$0.532x_1 + 1.105x_2 + 0.722x_3 = 0.839$$

$$0.957x_1 + 1.342x_2 + 0.642x_3 = 1.715$$

NEATNESS (Groups A and B)

INDIAN STATISTICAL INSTITUTE

Computer's Certificate Examination - November. 1973

Group IV (Practical) : Descriptive Statistics

Time : 5 hours   Full marks :

(a) Candidates who have already passed according to old rules
in Part IB of Section I only and have accordingly been
specifically exempted from answering questions of Group A,
will however be required to answer questions of Group B,
and in time not exceeding 3 hours. The time should be
recorded on the top sheet of the script.

(b) Figures in the margin indicate full marks.

(c) Use of calculating machines is permitted.

GROUP A

(Attempt all questions from this group)

1.   EITHER

The following sample data give the frequency distribution of right-hand
grip of 345 European males.

Right-hand grip (in lbs.)	frequency
29.5 - 39.5	1
39.5 - 49.5	2
49.5 - 59.5	12
59.5 - 69.5	52
69.5 - 79.5	93
79.5 - 89.5	101
89.5 - 99.5	55
99.5 - 109.5	17
109.5 - 119.5	5
119.5 - 129.5	1
	345

Compute for this distribution the following measures :

(i)   mean
(ii)   median
and (iii)   the coefficient of variation.   (2+4+6) = 12

OR .

The following table gives the results of 280 tests made on a certain kind
of coal for ash content :

Percentage ash content	frequency
3.0 - 3.9	1
4.0 - 4.9	7
5.0 - 5.9	28
6.0 - 6.9	78
7.0 - 7.9	84
8.0 - 8.9	45
9.0 - 9.9	28
10.0 - 10.9	7
11.0 - 11.9	2
	280

Calculate the mean, standard deviation and quartile deviation for the above
distribution. Find also the percentage of observations having ash content
not more than 8.5%.   (2+4+4+2) = 12

2. Either

The mean and the variance of the scores in English of two groups of students are given below. Find the mean and the standard deviation of the scores of the two groups taken together.

group	no. of students	mean	variance	
first group	30	62.1	20.3	
second group	40	58.4	18.7	(2+4) = 6

OR

The mean and the variance of of measurements are computed as 9.36758 and 19.35396 respectively. But later on, it was discovered that one observation 2.9 was mis-read as 9.2. Find the correct value of the mean and the variance.

$(2+4) = 6$

3. The bivariate frequency table below, gives the figures of production of Pig Iron (x) and of the measure Industrial Production (y). x and y have both been expressed as percentages of the trend during 1897-1913.

Industrial production (y)	Pig Iron Production (x)								Total
	50-60	60-70	70-80	80-90	90-100	100-110	110-120	120-130	
120 - 130								15	15
110 - 120						6	34	1	41
100 - 110					5	51	6		62
90 - 100				3	33	1			37
80 - 90			2	24	3				29
70 - 80			7	2					9
60 - 70		2	1						3
50 - 60	6	2							8
Total	6	4	10	29	41	58	40	16	204

(i) Compute the correlation coefficient r_{xy}.

(ii) Obtain the linear regression of y on x

(iii) Predict the measure of Industrial Production (y) when x = 165.

$(8+4+2) = 13$

4. The following data relate to the prices of some items of consumption and the corresponding quantities consumed by an average middle class family during the years 1955 and 1960.

	Commodity	Units	Price Rs.		Quantity	
			1955	1960	1955	1960
1.	Rice	maund	20.00	25.00	1.00	1.25
2.	Salt	maund	4.00	4.75	0.10	0.12
3.	Edible oil	seer	2.25	2.75	2.25	3.00
4.	Milk	litre	0.75	1.25	15.00	20.00
5.	Cloth	yard	1.20	1.45	20.00	18.00

Calculate the index number of prices for the year 1960 with 1955 as base using
 (i) Laspeyres'
 (ii) Paasche's and
 (iii) Fisher's Ideal Index formula.

$(4 \times 3) = 12$

(Attempt all questions from this group)

5. In a study of experimental observations, correlation between three variables x_1, x_2 and x_3 were estimated as :

$$r_{12} = 0.70 \; ; \; r_{13} = 0.39 \; ; \; r_{23} = 0.49$$

(i) Calculate $r_{12.3}$, $r_{13.2}$ and $R_{1.23}$.

(ii) Calculate regression coefficient of x_2 in the multiple regression equation of x_1 on x_2 and x_3, when the following mean values and s.d's of x_1, x_2 and x_3 are given.

variate	mean	s.d.	
x_1	30.8	15.6	
x_2	46.8	32.6	
x_3	43.1	14.8	$(4 \times 3 + 4) = 16$

6. The following table shows the index of industrial production in U.S.A. during 1946-54 with 1942 as base.

year	production index
1946	112.6
1947	114.7
1948	119.9
1949	125.1
1950	123.9
1951	123.1
1952	123.6
1953	126.0
1954	124.6

Fit a second degree Polynomial trend to the data. Represent the data and the fitted trend values on a graph paper. Find also the 'expected' production index for the year 1956.

$$(9+5+2) = 16$$

7. The number of letters posted in a certain city on each day in a period of 4 consecutive weeks were as follows :

Week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1st	13	101	170	154	143	161	76
2nd	19	165	179	157	168	195	85
3rd	21	162	169	153	139	185	82
4th	24	171	182	170	162	179	95

Calculate the indices of fluctuation from day to day within the week, by the method of moving averages.

$$(16)$$

Neatness (Groups A & B) (4)

Computer's Certificate Examination — November 1973

Paper V (Practical) : Elementary Statistical Methods

Time: 5 hours

Full marks : 100

(a) Those who have already passed according to the old rules in Part IB Section II or in Part IC Section I, will be exempted from answering Group A or B respectively. They should however answer questions from the other two groups (i.e. from B and C or from A and C as the case may be) in time not exceeding 3 hours. Answer time to be recorded on script.

(b) Figures in the margin indicate full marks.

(c) Use of calculating machines is permitted.

GROUP A

(Attempt all questions from this group)

1. A total of 53680 families of size eight each were observed for the number of boys in them. The following is the resulting frequency distribution:

Number of boys	0	1	2	3	4	5	6	7	8
Number of families	215	1485	5331	10649	14959	11929	6678	2092	342

Fit a binomial distribution to the data and test the goodness of fit.
(4+4+6) = 18

2. Attempt any two questions from the following :

(a) The following table gives the yield of corn in bushels per acre on 20 experimental plots. These plots were divided into two groups at random and one group of plots was treated with phosphorus as a fertiliser while the other group did not get any fertiliser.

treated :   6.2; 5.7, 5.5, 6.0, 6.3, 5.8, 5.7, 6.0, 6.0, 5.8

untreated : 5.0, 5.0, 5.6, 5.7, 5.6, 5.7, 6.0, 5.3, 5.7, 5.5

Test whether the addition of phosphorus improved the average yield of corn per acre.
(10

(b) (i) The correlation coefficient between head length and stature for a sample of 30 members of an Indian tribe has been found to be 0.339. Test whether the correlation is statistically significant.

(ii) The correlation of standing height with chest girth (r_{12}) for a group of 25 boys of different ages was 0.836. Given that the correlations of standing height with age (r_{13}) and of chest girth with age (r_{23}) were 0.714 and 0.738 respectively, find the partial correlation between standing height and chest girth when the age effect is eliminated $(r_{12.3})$.

Test the significance of this partial correlation.
(4+6) = 10

(c) The following shows the readings (in degrees centigrade, taken by two chemists trying to estimate the melting point of a substance :

Chemist A : 39.5, 40.2, 38.7, 39.3, 40.5, 39.6

Chemist B : 39.9, 40.1, 41.4, 39.6, 39.3, 41.3, 41.2

Test from these results whether chemist B was more consistent in his readings than chemist A. (Hint: Compare the variabilities.)
(10

3. The following shows the distribution of earners interviewed in course of a sample survey, according to (i) their employment status and (ii) number of additional days per week for which they were available for work.

employment status	additional days available for work		
	0 - 1	2 - 3	4 or more
employee	175	16	14
employer	192	11	17
own-account worker	665	14	24

Is there any association between the employment status and the number of additional days available for work ?   (15)

GROUP B

(Attempt all questions from this group)

4. EITHER

Arrange 5 first year students A, B, C, D and E and 7 second year students a, b, c, d, e, f, and g randomly in a row. Clearly indicate the procedure you follow.   (6)

OR

An employee is supposed to report for duty at his office by 10.00 a.m. but he is late by 15 minutes on the average with a standard deviation of 3 minutes. Obtain 5 random readings of his arrival-time, supposing that it follows the normal distribution.   (6)

5. The following data relate to total cultivable land belonging to the 14 villages of an Anchal in the district of Hooghly :

village no. (1)	cultivable land (acres) (2)	village no. (1)	cultivable land (acres) (2)
1	630	8	617
2	201	9	40
3	97	10	110
4	1,201	11	174
5	121	12	620
6	20	13	403
7	452	14	310

It has been decided to bring 4 villages from this Anchal under extensive agricultural programme. Select 4 villages without replacement for this purpose —
(i) with equal probability of selection and
(ii) with probability of selection proportional to total cultivable land belonging to the villages.

Clearly indicate the procedure followed in each case.   (4+6)=1)

6. The record of the number of defects found in an hourly sample of 50 cm. x 55 cm. cloth, from the continuous production flow of a power loom for 20 consecutive hours is given below.

3, 1, 3, 5, 2, 2, 3, 0, 1, 4,
2, 3, 0, 1, 2, 0, 5, 2, 0, 4.

Draw a control chart for the number of defects and comment on the state of control of the process of production.   (12+2)=14

7. a) EITHER

Given below are the yields in gms per plot as obtained in an experimental comparison of three varieties of seed cotton. A completely randomized design was adopted for this experiment.

Variety I	Variety II	Variety III
77	100	40
70	138	70
63	137	71
64	70	65
65	134	61
61		40
		47
		73

i) Analyse the data to test if the varieties differ among themselves in respect of average yield.

ii) Compare varieties II and III in respect of their mean yield.

$(14+4)=18$

b) OR

The following observations were made on the speed (in words per minute) of 4 typists A, B, C and D in typing from three kinds of material namely, manuscript, typewritten non-technical text and type written mathematical matter.

typist	material		
	manuscript	typewritten non-technical text	typewritten mathematical matter
(1)	(2)	(3)	(4)
A	45	53	30
B	30	40	32
C	42	56	37
D	51	57	44

i) Analyse the data to test if the typists differ significantly in respect of average speed.

ii) Also compare the speeds of typists A and D. $(14+4)=18$

SKEWNESS (Groups A and B)   (4)