Duration:2hrs   Max. Marks:80

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Graph paper will be provided on request.
4. Use of calculators is allowed.

Q1 a   Explain the meaning of Correlation.   3

b   Find Karl Pearson's coefficient of correlation for the following data and   6
interpret ate the result

Income(x)	18	15	16	19	12	4	6
Expenditure(y)	14	12	18	21	13	5	9

c   The lines of regression of a bivariate population are: 7
$$8x-10y+66=0 \text{ and } 40x-18y=214$$
Find (i) The mean values of x and y; (ii) Correlation coefficient
between x and y.

<div align="center">OR</div>

QI x   What is difference between correlation and regression coefficients? Can   3
correlation coefficient be computed out of regression coefficients? If yes,
how?

y   The following data give the experience of machine operators and their   6
performance ratings as given by the number of good parts turned out per 100
pieces:

Operator	1	2	3	4	5	6	7	8
Experience (in years)(x)	16	12	18	4	3	10	5	12
Performance Ratings(y)	87	88	89	68	78	80	75	83

Calculate the regression line of performance ratings on experience and
estimate the probable performance if an operator has 7 years experience.

z   Given the following aptitude and I.Q scores for a group of students. Find the   7
coefficient of rank and comment.

Aptitude Score(x)	57	58	59	59	60	61	60	64
I.Q.Score(y)	97	108	95	106	120	126	113	110

Q2 a   Differentiate between   3
    (i)   Type I and Type II errors.
    (ii)   Critical region and Region of Acceptance.

b   Coefficient of correlation between X and Y for 20 items is 0.3; mean of X is   6
15 and that of Y is 20, standard deviations are 4 and 5 respectively. At the
time of calculations one pair (X=27, Y=30) was wrongly taken as (X=17,
Y=35).Find the correct coefficient of correlation.

c During the period of time phone-in reservations are being taken at a local university, calls come in at the rate of one every two minutes.
    a. What is the expected number of calls in one hour?
    b. What is the probability of three calls in five minutes?
    c. What is the probability of no calls in a five –minute period?
      (Given $e^{-2.5} = 0.08208$)

OR

QII x Explain Null Hypothesis and Alternative hypothesis.

  y The data about the sales and advertisement expenditure of a firm is given below:

	Sales (in crores of Rs.)	Advertisement expenditure (in crores of Rs.)
Means	40	6
Standard deviations	10	1.5

Coefficient of correlation= r =0.9
1. Estimate the likely sales for a proposed advertisement expenditure of Rs. 10 crores.
2. What should be the advertisement expenditure if the firm proposed a sales target of 60 crores of rupees?

  z The aggregate marks scored by students are normally distributed with mean 400 and standard deviation 100.What percentages of students taking this test scored:
1. Between 300 and 550
2. More than 550
3. Less than 280

[Given $P(0 < z < 1)=0.3413$, $P(0 <z < 1.2)=0.3849$, and $P(0< z < 1.5)=0.4332$; where z is standard normal variate]

Q3a What is a scatter diagram? Indicate by means of suitable scatter diagrams different types of correlation that may exist between the variables in bivariate data.

  b A factory produces electric bulbs on a large scale with average life of 1500 hrs. and standard deviation of 150 hrs. In a lot of 3000 bulbs, how many bulbs are likely to have life?
1. Of less than 1100hrs.
2. More than 1850 hrs.
3. Between 1100 hrs and 1700 hrs?

[Given $P(0 < z < 1.33)=0.4082$, $P(0< z < 2.33)=0.4901$ and $P(0 <z < 2.67)=0.4962$;where z is standard normal variate]

  c (i)A soap manufacturing company was distributing a particular brand of soap through a large number of retail shops. Before a heavy advertisement campaign, the mean sales per week per shop were 160 dozens. After the campaign, a sample of 50 shops was taken and the mean sales was found to be 167 dozens with standard deviation of 22.4.What conclusion do you draw on the impact of advertisement on sales ? Use 5% significance level.

(ii)Describe the important properties of a Good Estimator.

OR

QIIIx Distinguish between Positive and Negative Correlation. 3

y Military radar and missile detection systems are designs to warn a country 6
against enemy attacks. A reliability question is whether a detection system
will be able to identify an attack and issue a warning. Assume that a particular
detection system has a .90 probability of detecting a missile attack. Use
binomial probability distribution to answer the following questions.
1. What is the probability that a single detection system will detect an
attack?
2. If two detection systems are installed in the same area and operate
independently, what is the probability that at least one of the systems
will detect the attack?
3. If three systems are installed, what is the probability that at least one of
the systems will detect the attack?

z The operators of the threading machine in a certain factory spoil on an average 7
50 bolts per 1000 over a long period of time. In a quality control inspection
programme, a test run of 900 bolts resulted into 55 spoiled bolts. Determine at
5% level of significance whether the spoilage is higher than normal during the
last run.Also estimate the 99% confidence interval for spoiled bolts.

Q4a. Distinguish between random sampling and stratified sampling. 3

b In a class of 100 students, 42 studied statistics,68 Economics,54 Commerce,22 6
both statistics and Commerce,25 both Statistics and Economics,7 Commerce
and neither Statistics nor Economics,10 studied all the three subjects and 8 did
not take any of the three. If a student is selected at random , find
1. The probability that he takes Commerce and Economics but not
Statistics.
2. The probability that a person enrolled in Commerce takes all the three
subjects.
3. The probability that he takes Statistics only.

c The following data gives the number of defectives in 10 independent samples 7
size 50 each from a production process. Draw the control chart for fraction
defective and comment on it

Sample number	1	2	3	4	5	6	7	8	9	10
No. of defectives	4	3	2	3	4	4	4	1	3	2

OR

QIVx Explain the importance of sampling.What is the well-known methods of 3
sampling in use?

y Two cards are drawn from a pack of cards without replacement. Find the 6
probability that the cards are
1. Both kings. 2. An ace and a Queen in that order. 3. At least one king.

z The following table gives the number of defects in carpets manufactured by a   7
company. Construct the c-chart for the number of defects and comment.

Carpet serial no.	1	2	3	4	5	6	7	8	9	10
No. of defects	3	4	5	6	3	3	5	3	6	2

Q5 Explain the terms 'chance causes' and 'assignable causes' of variation as used   3
a in quality control.

B i) What is control chart? Explain the basic principle underlying the control   3
charts.
                                                                                       3

ii) Obtain control limits for the range chart for 10 samples of size 5 for the data
given below. Can the process is said to be under control with respect to mean?

Sample No.	1	2	3	4	5	6	7	8	9	10
Mean	43	49	37	44	45	37	51	46	43	47
Range	5	6	5	7	7	4	8	6	4	6

(For sample size 5, A2=0.577).

c A random variable X has the following probability distribution

X=x	-2	-1	0	1	2	3
P(x)	0.1	k	0.2	2k	0.3	k

Find the value of k and calculate mean and variance of X.

OR

QVx Explain what you understand by process control. How is it achieved?

y A machine is set to deliver packets of a given weight. 10 samples of size 5 each
were recorded. Below are given relevant data:

Sample No.	1	2	3	4	5	6	7	8	9	10
Range	7	7	4	9	8	7	12	4	11	5

Draw the R- chart and comment on the state of control.
(For sample size 5, D3=0 and D4=2.115)

z Two cards are drawn from a well shuffled deck of 52 cards. Find the probability
distribution of the number of aces.
   1. Successively with replacement
   2. Simultaneously (successively without replacement).