

**BMAS 0106: STATISTICS AND COMPLEX ANALYSIS****Assignment-I****Module-I**

Q. 1. The first four moments about mean of a frequency distribution are 0, 60, -50 and 8020 respectively. Discuss the kurtosis of the distribution.

**Ans.**  $\beta_2 = 2.2278$ , Platykurtic

Q. 2. Find the measures of skewness and kurtosis on the basis of moments for the following distribution:

$x$	1	3	5	7	9
$f$	1	4	6	4	1

**Ans.**  $\gamma_1 = 0, \beta_2 = 2.5$ .

Q. 3. Prove that the distribution curve of the following frequency distribution is leptokurtic

Class	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55
Frequency	1	4	8	19	35	20	7	51	

**Ans.** Show that  $\beta_2 > 3$ .

Q. 4. A computer while calculating correlation coefficient between two variables  $X$  and  $Y$  from 25 pairs of observations obtained the following results:

$$n = 25, \quad \sum X = 125, \quad \sum X^2 = 650,$$

$$\sum Y = 100, \quad \sum Y^2 = 460, \quad \sum XY = 508.$$

It was, however, later discovered at the time of checking that he had copied down two pair as

$X$	$Y$
6	14
8	6

While the correct values were

$X$	$Y$
8	12
6	8

Obtain the correct value of correlation coefficient.

**Ans.**  $r = 0.67$ .

Q. 5. Two judges in a music competition rank the 12 candidates as follows:

$x$	1	2	3	4	5	6	7	8	9	10	11	12
$y$	12	9	6	10	3	5	4	7	8	2	11	1

What degree of agreement is there between the judgement of two judges?

**Ans.** -0.454

Q. 6. Calculate the coefficient of correlation between the marks obtained by 8 students in Mathematics and Statistics:

Students	A	B	C	D	E	F	G	H
Mathematics	25	30	32	35	37	40	42	45
Statistics	08	10	15	17	20	23	24	25

**Ans.** 0.9804

Q. 7. In a partially destroyed laboratory record of an analysis of a correlation data, the following results only are legible:

Variance of  $x = 9$ ,

Regression equations:  $8x - 10y + 66 = 0$ ,  $40x - 18y = 214$ .

What were (a) the mean values of  $x$  and  $y$  (b) the standard deviation of  $y$  and the coefficient of correlation between  $x$  and  $y$ .

**Ans.** (a)  $\bar{x} = 13$ ,  $\bar{y} = 17$ ,  $\sigma_y = 4$ .

**Q. 8.** A panel of two judges, A and B, graded seven T.V. serial performances by awarding marks independently as shown in the following table:

Performance	1	2	3	4	5	6	7
Marks by A	46	42	44	40	43	41	45
Marks By B	40	38	36	35	39	37	41

The eighth T.V. performance which judge B could not attend, was awarded 37 marks by judge A. If the judge B had also been present, how many marks would be expected to have been awarded by him to the eighth T.V. performance?

Use regression analysis to answer this question.

**Ans.** 33.5

Q. 9. An analyst for a company was studying travelling expenses ( $y$ ) in INR and duration ( $x$ ) of these trips for 102 sales trip. He has found relation between  $x$  and  $y$  linear and data as follows:

$$\sum x = 510, \sum y = 7140, \sum x^2 = 4150, \sum xy = 54900, \sum y^2 = 740200$$

Calculate (a) Two regression lines

(b) A given trip has to take 7 days. How much money should be allowed so that they will not run out of money.

**Ans.** (a)  $y = 12x + 10$ ,  $x = 0.07986y - 0.59068$ .

Q. 10. Assuming that we conduct an experiment with 8 fields planted with corn, four fields having no nitrogen fertiliser and four fields having 80 kgs of nitrogen fertiliser. The resulting corn yields are shown in table in bushels per acre:

field	1	2	3	4	5	6	7	8
Nitrogen(kgs) $x$	0	0	0	0	80	80	80	80
Corn yield(acre) $y$	120	360	60	180	1280	1120	1120	760

(a) Compute a linear regression equation of  $y$  on  $x$ .

(b) Predict corn yield for a field treated with 60 kgs of fertiliser.

**Ans.** (a)  $y = 11.125x + 180$  (b) 847.5 acres

Q. 11. Can  $y = 5 + 2.8x$  and  $x = 3 - 0.5y$  be the estimated regression equations of  $y$  on  $x$  and  $x$  on  $y$  respectively? Explain your answer with suitable theoretical arguments.

**Ans.** No.

Q. 12. If  $F$  is the pull required to lift a load  $W$  by means of a pulley block, fit a linear law of the form  $F = mW + c$  connecting  $F$  and  $W$ , using the data

$W$	50	70	100	120
$F$	12	15	21	25

where  $F$  and  $W$  are in kg wt. Compute  $F$  when  $W = 150$  kg wt.

**Ans.**  $F = 0.18793W + 2.27595$ ;  $F = 30.4654$  kg wt.

Q. 13. The following results were obtained from marks in applied Mechanics and Engineering Mathematics in an examination:

	Applied Mechanics ( $x$ )	Engineering Mathematics ( $y$ )
Mean	47.5	39.5
Standard Deviation	16.8	10.8

$$r = 0.95.$$

Find both the regression equations. Also estimate the value of  $y$  for  $x = 30$ .

**Ans.**  $y = 0.6107x + 10.49$ ,  $x = 1.477y - 10.8415$ ,  $y = 28.81$

Q. 14. There are four fused bulbs in a lot of 10 good bulbs. If three bulbs are drawn at random with replacement, find the probability of distribution of the number of fused bulbs drawn.

**Ans:**

$x$	0	1	2	3
$P(x)$	125/343	150/343	60/343	8/343

Q. 15. If  $X$  is binomially distributed with 6 trials and a probability of success equal to  $\frac{1}{4}$  at each attempt, what is the probability of: (a) exactly 4 successes (b) at least one success?

**Ans:** (a) 0.033, (b) 0.822

Q. 16. On average, every one out of 10 telephones is found busy. Six telephone numbers are selected at random. Find the probability that four of them will be busy.

Ans: 0.001215

Q. 17. A Council is considering whether to base a recovery vehicle on a stretch of road to help clear incidents as quickly as possible. The road concerned carries over 5000 vehicles during the peak rush hour period. Records show that, on average, the number of incidents during the morning rush hour is 5. The Council won't base a vehicle on the road if the probability of having more than 5 incidents in any one morning is less than 30%. Based on this information should the Council provide a vehicle?

Ans: The probability of more than 5 incidents is  $P(X > 5) = 1 - P(X \leq 5) = 0.38403$ , which is 38.4%. So the Council should provide a vehicle

Q. 18. Suppose it has been observed that, on average, 180 cars per hour pass a specified point on a particular road in the morning rush hour. Due to impending road works it is estimated that congestion will occur closer to the city centre if more than 5 cars pass the point in any one minute. What is the probability of congestion occurring?

Ans:  $P(\text{more than } 5) = 0.0839$

Q. 19. Suppose that a book of 600 pages contains 40 printing mistakes. Assume that these errors are randomly distributed throughout the book and  $x$ , the number of errors per page has a Poisson distribution. What is the probability that 10 pages selected at random will be free of errors?

Ans:  $P(0) = 0.51$

Q. 20. Fit a Poisson distribution to the following data and calculate theoretical frequencies:

Deaths:	0	1	2	3	4
Frequencies:	122	260	15	2	1

Q. 21. Six dice are thrown 729 times. How many times do you expect at least three dice show a 2 or 3.

Ans: 233

Q. 22. In a discrete series of 20 terms, the sum of the terms is 300, the sum of their squares of the terms is 5000 and the median is 15. Find the Karl Pearson's coefficient of skewness.

Ans: 0

Q. 23. 500 students at school were graded according to their intelligences and economic conditions of their homes. Examine whether there is any association between economic condition and intelligences, from the following data:

Economic	Intelligence
----------	--------------

conditions	Good	Bed
Rich	85	75
Poor	165	175

Given that values of  $\chi^2$ -for 1 degree of freedom are 3.841 at 0.05 significance level.

Ans: No

Q. 24. A survey of 320 families with 5 children shows the following data:

No. of boys & girls:	5 boys & 0 girls	5 boys & 0 girls	5 boys & 0 girls	5 boys & 0 girls	5 boys & 0 girls	5 boys & 0 girls	Total
No. of families	18	56	110	88	40	8	320

Given that values of  $\chi^2$ -for 5 degree of freedom are 11.1 at 0.05 significance level, test that the hypothesis that male and female birth are equally probable.

Ans:  $H_0$  is rejected.

Q.25. A chemical extraction plant processes sea water to collect sodium chloride and magnesium. It is known that sea water contains sodium chloride, magnesium and other elements in the ratio of 62 : 4:34. A sample of 200 tonnes of sea water has resulted in 130 tonnes of sodium chloride and 6 tonnes of magnesium. Apply Chi-Square test and check whether these data is consistent with the known composition of sea water at 5% level of significance.

Given that values of  $\chi^2$ -for 2 degree of freedom are 5.991 at 0.05 significance level.

Ans:  $\chi^2 = 1.025$ , Yes