

CARMEL COLLEGE OF ARTS, SCIENCE AND COMMERCE FOR WOMEN, NUVEM-GOA

B.SC. CBCS Semester III Examination, January, 2022

Semester: III OF B.SC

Course name & Code: Statistical Methods (SEC 1)

Total marks: 60

Duration: 2 Hrs

Total No. of pages: 04

Instructions: 1. all questions are compulsory, however internal choice is available.
2. Figures to the right indicate maximum marks allotted to the question.

Q.1. Attempt any five of the following: (5X2mks=10mks)

- Given the two regression lines as $x-2y=3$ and $4x+2y=2$, Find the mean of x and y .
- What is a scatter plot? How can a scatter plot be used to determine the correlation between the variables?
- A random variable has the following probability distribution.

X	3	4	5	6	7	8
P(X)	0.2	3k	0.1	2k	0.05	2k

Find the value of k . Also, find the expected value of random variable.

- The ranks given by judges to 6 contestant in a beauty contest are given below. Obtain the Spearman's Rank coefficient of correlation.

Contestant Number	1	2	3	4	5	6
Rank by judge X	3	1	6	4	2	5
Rank by judge Y	2	3	5	4	1	6

- The mean and variance of a random variable following binomial distribution is 2 and $2/3$ respectively. Find $P(X > 1)$.
- State the assumptions for the study of ANOVA.
- What is the probability that a non-leap year has 53 Sundays?

Q.2. Attempt any five of the following: (5X2mks=10mks)

- Show that the Standard Normal Variate Z has mean 0 and standard deviation 1.
- If X is a Poisson variate with parameter 1, find $P(X=3)$. [Given $e^{-1} = 0.36787$]
- If A and B are independent events and $P(A)=2/3$ and $P(B)=1/2$, Find $P(A \cup B)$.

- d. Marks obtained by 100 students are assumed to be normally distributed with mean 50 and variance 36. What is the number of students who will score marks over 62?
($P(0 < Z < 2) = 0.4772$)
- e. Explain the terms
- i. Null hypothesis ii. Alternative hypothesis
- f. Find the probability distribution of the number of heads in 3 tosses of a coin.
- g. Differentiate between Parametric and Non-Parametric tests.

Q.3. Answer the following:

(2X 5mks=10mks)

a) Answer any one of the following:

(5mks)

- x) The following data gives the marks obtained by 6 students of a class in Statistics and Mathematics. Calculate the Karl Pearson's correlation coefficient and comment on the type of correlation exhibited.

Statistics	50	56	78	78	89	46
Mathematics	65	70	72	82	90	55

OR

- y) The marks secured by recruits in the selection test X and in proficiency test Y are given below. Calculate the Spearman's rank coefficient of correlation

X	10	15	22	17	13	16	24	13	22
Y	30	42	45	45	33	34	40	35	39

- b) Find the equations of regression lines and hence find the most probable value of X when Y is 17.

(5mks)

X	12	14	13	15	10	11	16
Y	30	25	28	20	15	14	23

Q.4. Answer the following:

(2X 5mks=10mks)

a) Answer any one of the following:

(5mks)

- x) Probability of a man hitting the target is $1/3$.
- i. If he fires 5 times what is the probability of his hitting the target at least twice.

- ii. How many times must he fire so that the probability of his hitting the target at least once is more than 90%.

OR

- y) A manufacturing company purchased three new machines of different makes and wishes to determine whether one of them is faster than the others in producing a certain output. Five hourly production figures are observed at random from each machine and results are given below.

Observations	A1	A2	A3
1	25	31	24
2	33	29	33
3	36	28	29
4	32	42	35
5	30	35	38

Use ANOVA and determine whether the machines are significantly different in their mean speed. (Given $F_{2,12}=3.89$ AT 5% level of significance)

(5mks)

- b) It is estimated that 50% of emails are spam emails. Some software has been applied to filter these spam emails before they reach your inbox. A certain brand of software claims that it can detect 99% of spam emails, and the probability for a false positive (a non-spam email detected as spam) is 5%. Now if an email is detected as spam, then what is the probability that it is in fact a non-spam email?

Q.5. Answer the following:

(2X 5mks=10mks)

- a) Answer any one of the following:

(5mks)

- x) A pharmaceutical company wants to estimate the mean life of a drug under typical weather conditions. For a random sample of 64 bottles of the drug, the mean life was 20 months with a standard deviation of 3 months. Find an interval estimate of the mean life of the drug with

- i) 95% confidence level ii) 99% confidence level

OR

y) Given the sample size (n), mean (μ) and standard deviation (σ), derive the 95% and 99% confidence limits of the population mean. Will these limits change with change in sample values?

(5mks)

- b) A neurologist is testing the effect of a drug on response time by injecting 100 rats with a unit dose of the drug, subjecting each to neurological stimulus and recording its response time. The neurologist knows that the mean response time for rats not injected with the drug is 1.2 seconds. The mean of 100 injected rat's response time is 1.05 seconds with a sample std. dev. of 0.5 seconds. Does the drug have an effect on response time? (Use 1% LoS)

Q.6. Answer the following:

(2x5mks=10mks)

- a) Answer any one of the following:

(5mks)

x) 10 workers are selected at random from a large number of workers in a factory. The number of goods produced by them on certain days are found to be

51, 52, 53, 55, 56, 57, 58, 59, 60, 59

Would it be appropriate to suggest that the mean number of goods produced is 58?

(Given that the variance is 9 and at 5% LoS, $t_9(0.05) = 2.262$)

OR

y) A machinist is making engine parts with axle diameter of 0.700 cm. A random sample of 10 parts shows a mean diameter of 0.742 cm with a standard deviation of 0.04 cm. Find out whether the work is meeting the diameter specification using an appropriate test statistic. (Use 1% LoS, given that $t_9(0.01) = 3.25$)

(5mks)

- b) A die is rolled 100 times with the following distribution:

Number	1	2	3	4	5	6
Observed Frequency	17	14	20	17	17	15

At 1% LoS, determine whether the die is unbiased. (Given $\chi^2_5(0.01) = 15.086$)