

Final Assessment Test (FAT) - APRIL/MAY 2023

Programme	B.Tech	Semester	Winter Semester 2022-23
Course Title	PROBABILITY AND STATISTICS	Course Code	BMAT202L
Faculty Name	Prof. Dhivya P	Slot	AT1A1
		Class Nbr	CH2022235000987
Time	3 Hours	Max. Marks	100

Non-Programmable calculator and statistical tables are permitted

Section-A (10 X 10 Marks)

Answer any 10 questions

01. Find the mode and quartile deviation of the following data [10]

125-175	175-225	225-275	275-325	325-375	375-425	425-475	475-525	525-575
2	22	19	14	3	4	6	1	1

02. (i) For a group of 200 candidates, the mean and standard deviation of scores were found to be 40 and 15 respectively. Later on, it was discovered that the scores 43 and 35 were misread as 34 and 53 respectively. Find the corrected standard deviation. [10]

(ii) Six dice are thrown 729 times. How many times do you expect at least three dice to show a 5 or 6.

03. Let (X, Y) be a bivariate random variable with probability density function $f(x, y)$ as [10]

$$f(x, y) = \begin{cases} a(x + y) & \text{if } 0 < x + y < 1, x \geq 0, y \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

Then evaluate the followings.

(i) The value of a , (ii) $P(0 < Y < \frac{1}{2})$ and (iii) the marginal density function of X .

04. (i) A random variable X has the following probability mass function [10]

X	0	1	2	3	4	5	6	7
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$$P(X = x) = 0, k, 2k, 2k, 3k, k^2, 2k^2, 7k^2 + k$$

Here, find the value of k and $P(X < 4)$.

(ii) The equation of two regression lines of a given dataset are $7X - 16Y + 9 = 0$ and $5Y - 4X - 3 = 0$. Find the correlation coefficient and means of X and Y .

05. In a trivariate distribution, $\sigma_1 = 3, \sigma_2 = \sigma_3 = 3, r_{12} = 0.6, r_{23} = r_{31} = 0.6$. Then find [10]

(i) $r_{23.1}$ and $R_{1.23}$

(ii) $b_{12.3}$ and $\sigma_{1.23}$

06. (i) If a random variable X follows Poisson distribution such that $P(1) = P(2)$, then find the mean of this distribution, $P(4)$, $P(X \geq 1)$ and $P(1 < X < 4)$. [10]

(ii) A sample of 900 members has a mean 3.4 cm and standard deviation 2.61 cm. Is it the sample drawn from a large population of mean 3.25 cm and standard deviation 2.61 cm, given 5% level of significance?

07. (i) For some computers, the time period between charges of the battery is normally distributed with a mean of 50 hours and a standard deviation of 15 hours. Rohan has one of these computers and needs to know the probability that the time period will be between 50 and 70 hours. [10]

(ii) In a survey of buying habits, 400 women shoppers are chosen at random in super market A located in a certain section of the city. Their average weekly food expenditure is Rs. 250 with a standard deviation of Rs. 40. For 400 women shoppers chosen at random in super market B in another section of the city, the average weekly food expenditure is Rs. 220 with a standard deviation of Rs. 55. Test at 1% level of significance whether the average weekly food expenditure of the two populations of shoppers are equal.

08. Before an increase in excise duty on tea, 800 people out of a sample of 1000 people were found to be tea drinkers. After an increase in duty, 800 people were tea drinkers in a sample of 1200 people. Using standard error of proportion, state whether there is a significant decrease in the consumption of tea after the increase in excise duty. [10]
09. The nine items of a sample had the values 45, 47, 50, 52, 48, 47, 49, 53, 51. Does the mean of these nine items differ significantly from the assumed population mean of 47.5 at 5% level of significance ? [10]
10. Three different vaccines are used for a production. On the basis of the outputs, set up one-way ANOVA table and test whether the vaccines are equally effective. [10]

	Outputs	
Vaccine 1	Vaccine 2	Vaccine 3
10	9	20
15	7	16
11	5	10
10	6	14

11. Given that $R(t) = e^{-\sqrt{0.001t}}$, $t > 0$ [10]
- (i) Compute the reliability for a 50 hours mission.
- (ii) Show that the hazard rate is decreasing.
- (iii) Given a 10-hour wear-in period, compute the reliability for a 50-hour mission.
- (iv) What is the design life for a reliability of 0.95, given a 10-hour wear-in period?
12. (i) The reliability of certain brand of batteries is given by $R(t) = 0.5e^{-0.8t}$. Calculate the failure rate and find the mean time to failure. [10]
- (ii) Calculate the reliability of the system

