


VIT

Vellore Institute of Technology

Final Assessment Test - April 2025
 Course: BMAT202L - Probability and Statistics
 Class NBR(s): 1202 / 1203 / 1204 / 1205 / 1206 / 1207 / 1208 / 1209
 Time: Three Hours

Slot: B2+TB2

Max. Marks:

- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
 ➤ DON'T WRITE ANYTHING ON THE QUESTION PAPER

General Instruction: Statistical Tables are permitted

Answer ALL Questions

(10 x 10 = 100 Marks)

1. Calculate the coefficient of mean deviation from mean, coefficient of variation [10]
 for the following data.

x	0	1	2	3	4	5	6	7	8
y	4	36	100	232	280	204	112	28	4

2. (i) A random variable X has the following probability function :

[10]

x	-2	-1	0	1	2	3
p(x)	0.1	k	0.2	2k	0.3	k

2. Find the value of k and calculate mean and variance. Also, find the cumulative density function $F(x)$.

(ii) Given the probability function :

x	0	1	2	3
p(x)	0.1	0.3	0.5	0.1

Let $Y = X^2 + 2X$. Find the probability function of Y , and the mean of Y .

3. Let X and Y have the joint probability density function,

[10]

$$f(x, y) = \begin{cases} x^2 + \frac{xy}{3}, & 0 \leq x \leq 1, 0 \leq y \leq 2 \\ 0 & \text{otherwise} \end{cases}$$

Then find, (i) $P\left(X > \frac{1}{2}\right)$, (ii) $P(Y < X)$, (iii) $P\left(Y < \frac{1}{2} / X < \frac{1}{2}\right)$

(iv) the mean of X and the mean of Y .

4. People of various heights as given below are requested to read the letters on a car at 25 yards distance. The number of letters correctly read is given below.

[10]

Heights	5.1	5.3	5.6	5.7	5.8	5.9	5.10	5.11	6.0	6.1
No. of Letters	11	17	19	14	8	15	20	6	8	12

Find the correlation between heights and visual power using Karl Pearson's method.

5. Obtain the two regression lines for the following data. Also estimate the value of $\hat{Y}$ when $X = 37$, and $\hat{X}$ when $Y = 4$. [10]

Price(X)	34	36	32	35	30	38	40
Units sold (Y)	3	7	6	5	9	2	8

6. Out of 800 families with 5 children each, find how many families would you expect to have (a) 3 boys, (b) 5 girls, (c) either 2 or 3 boys, (d) at least one boy? Assume equal probability for boys and girls. [10]

7. The hourly wages of 900 workmen are normally distributed around a mean of Rs. 71 and with a standard deviation of Rs. 6. Estimate the number of workers whose hourly wages will be: [10]

(i) Between Rs. 65 and Rs. 70, (ii) More than Rs. 74, (iii) Less than Rs. 60.

8. A sample of 100 students is taken from a large population. The mean height of the student in this sample is 160 cm. Can it be reasonably regarded that, in the population, the mean height is 165 cm, and S.D. is 10 cm? [10]

9.a) The mean lifetime of a sample of 25 bulbs is found as 1550 hours, with S.D. of 120 hours. The company, manufacturing the bulbs claims that the average life of their bulbs is 1600 hours. Is the claim acceptable at 5% level of significance? [10]

OR

9.b) A completely randomised design experiment with 10 plots and 3 treatments gave the following results: [10]

Plot No.	1	2	3	4	5	6	7	8	9	10
Treatment	A	B	C	A	C	C	A	B	A	B
Yield	5	4	3	7	5	1	3	4	1	7

Analyse the results for treatment effects.

10.a) The time to failure in operating hours of a critical solid-state power unit has the hazard rate function $\lambda(t) = 0.003\left(\frac{t}{500}\right)^{0.5}$, for $t > 0$. [10]

(i) What is the reliability if the power unit must operate continuously for 50 hours?

(ii) Determine the design life if reliability of 0.90 is desired

(iii) Compute the MMTF.

(iv) Find $P((T \geq 100 | T \geq 50))$.

OR

10.b) A cutting tool wears out with a time to failure that is normally distributed. It is known that about 34.5% of the tools fail before 9 working days and about 78.8% fail before 12 working days. [10]

(i) Compute the MTTF.

(ii) Determine its design life for a reliability of 0.99.

(iii) Determine the probability that the cutting tool will last one more day given that it has been in use for 5 days.