Final Assessment Test – November 2019

VIT
Vellore Institute of Technology

Course: MAT2001 - Statistics for Engineers
Class NBR(s): 0375 / 0376 / 0377 / 2881
Slot: D2+TD2
Time: Three Hours
Max. Marks: 100

KEEPING MOBILE PHONE/SMART WATCH, EVEN IN 'OFF' POSITION, IS EXAM MALPRACTICE

Use of statistical table is permitted

Answer any FIVE Questions

(5 X 20 = 100 Marks)

1. a) Find the Median and Mode for the following data. [10]

Wages (Rs)	Number of Workers
0 – 10	4
10 – 20	16
20 – 30	60
30 – 40	100
40 – 50	40
50 – 60	6
60 – 70	4

b) From the prices of shares of 'X' and 'Y' given below, find out which is more stable in value. [10]

X	35	54	52	53	56	58	52	50	51	49
Y	108	107	105	105	106	107	104	103	104	101

2. a) If the probability mass function of a random variable X is given by $P(X = r) = kr^3, r = 1,2,3,4$ find [10]
a) the value k
b) $P(\frac{1}{2} < X < \frac{5}{2} / X > 1)$
c) the mean and variance of X
d) the distribution function of X

b) The joint probability density function of two random variables X and Y is given by [10]

$$f(x,y) = \begin{cases} xye^{\frac{-(x^2+y^2)}{2}}, x \geq 0, y \geq 0 \\ 0, \ otherwise \end{cases}$$

Find the marginal probability density function of X and Y. Are X and Y independent?

3. a) Ten competitors in a musical test were ranked by three judges A, B and C in the following order: [10]

A	1	6	5	10	3	2	4	9	7	8
B	3	5	8	4	7	10	2	1	6	9
C	6	4	9	8	1	2	3	10	5	7

Using rank correlation method, discuss which pair of judges has the nearest approach to the common likings in music.

b) The academic achievement, anxiety level and intelligence level of 10 students are given below. Estimate the correlation between the academic achievement with anxiety level and intelligence level. [10]

Student number	Academic achievement	Anxiety level	Intelligence level
1	15	6	25
2	18	3	29
3	13	8	27
4	14	6	24
5	19	2	30
6	11	3	21
7	17	4	26
8	20	4	31
9	10	5	20
10	16	7	25

4. a) After correcting 50 pages, the proof reader finds that there are on the average of 2 errors per 5 pages. How many pages could one expect with 0 error, 1 error and at least 3 errors in 1000 pages of the first print of the book? [10]

b) If the life X (in years) of a certain type of car has a Weibull distribution with the parameter $\beta = 2$. Find the value of the parameter α, given that probability that the life of the car exceeds 5 years is $e^{-0.25}$. For these values of α and β, find the mean and variance of X. [10]

5. a) A company has a head office at Kolkata and a branch at Mumbai. The personnel director wanted to know if the workers at the two places would like the introduction of a new plan of work and a survey was conducted for this purpose. Out of a sample of 500 workers at Kolkata, 62% favoured the new plan. At Mumbai, out of a sample of 400 workers, 41% were against the new plan. Is there any significant difference between the two groups in their attitude towards the new plan at 5% LOS? [10]

b) In a survey of buying habits, 400 women shoppers are chosen at random in super market 'A' located in a certain region of the city. Their average weekly food expenditure is Rs.250 with the standard deviation of Rs.40. For 400 women shoppers chosen at random in super market 'B' located in another region of the city, the average weekly food expenditure is Rs.220 with the standard deviation of Rs.55. Test at 1% LOS, whether the average weekly food expenditure of the two populations of shoppers are equal. [10]

6. a) Pumpkins were grown under two experimental conditions. Two random samples of 11 and 9 pumpkins show the sample standard deviation of their weights are 0.8 and 0.5 respectively. Assuming that the weight distributions are normal, test the hypothesis that the true variances are equal or not at 10% LOS. [10]

b) A completely randomized design experiments with 10 plots and 3 treatments gave the following results. [10]

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

Analyse the results for treatment effects.

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

i. What is the reliability if the power unit must operate continuously for 50 hrs?
ii. Determine the design life if a reliability of 0.90 is desired.
iii. Compute the Mean Time to Failure (MTTF).
iv. Given that the unit has operated for 50 hours, what is the probability that it will survive a second 50 hours of operation?

b) The time to repair a power generator is best described by its Probability Density Function given by [10]

$$m(t) = \frac{t^2}{333}, 1 \leq t \leq 10 \text{ hours}$$

i. Find the probability that a repair will be completed in 6 hours.
ii. Find the Mean Time to Repair (MTTR).
iii. Find the repair rate.