Final Assessment Test – November 2019

VIT
Vellore Institute of Technology

Course: MAT2001 - Statistics for Engineers
Class NBR(s): 0367 / 0368 / 0369 / 0370 / 0371 / 0539 / 6579   Slot: B2+TB2

Time: Three Hours   Max. Marks: 100

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

Statistical tables are permitted

Answer any **FIVE** Questions

(5 X 20 = 100 Marks)

1. Lives of two models of refrigerators turned in for new models in a recent survey are given below. Using coefficient of variation comment on which model has more uniformity. **[20]**

Life (No. of years)	Model A	Model B
0-2	5	2
2-4	16	7
4-6	13	12
6-8	7	19
8-10	5	9
10-12	4	1

2. a) A delivery truck travels from point A to point B and back using the same route each day. There are 4 traffic lights on the route. Let X_1 denote the number of red lights the truck encounters going from A to B. Let X_2 denote the number encountered on the return trip. Data collected over a long period suggest that the joint probability distribution for (X_1, X_2) is given by: **[10]**

X_1 \ X_2	0	1	2	3	4
0	0.01	0.01	0.03	0.07	0.01
1	0.03	0.05	0.08	0.03	0.02
2	0.03	0.11	0.15	0.01	0.01
3	0.02	0.07	0.10	0.03	0.01
4	0.01	0.06	0.03	0.01	0.01

I. Find the marginal distributions

II. Find the conditional distribution of X_1 given $X_2=3$.

III. Expectations of X_1

IV. $E[X_1/X_2 = 3]$.

b) The length of time in minutes for an airplane to obtain clearance for take-off at a certain airport is a random variable Y=3X-2 where X has the density function. **[10]**

$$f(x) = \begin{cases} \dfrac{1}{4}e^{-x/4} & x > 0 \\ 0 & otherwise \end{cases}$$

Find the mean and variance of the random variable Y.

3. The expected remaining life of an electronic part is believed to be related to the age of the part. The ages of 10 of these parts that were in use on a certain date were recorded in operating hours. When each part burned out, the elapsed time was recorded. The results were as follows: **[20]**

Age of the part(in hrs)	40	65	90	5	30	10	80	85	70	25
Remaining life (in hrs)	30	20	10	80	40	65	15	15	20	50

Determine the coefficient of correlation and regression lines.

SEARCH VIT QUESTION PAPERS
ON TELEGRAM TO JOIN

4. a) The probability that a patient recovers from a rare blood disease is 0.4. If five people are known to have contracted this disease, what is the probability that i) atleast 10 survive ii) from 3 to 8 survive iii) exactly five survive. [10]

   b) The location authorities in a certain city install 10,000 electric lamps in the streets of the city. If these lamps have an average life of 1000 burning hours with a standard deviation of 200 hours, assuming normality, find the number of lamps might expected to fail (i) in the first 800 burning hours. (ii) between 800 to 1200 burning hours. Also find, after what period of burning hours would you expect that 10% of the lamps would fail? [10]

5. a) In a survey of buying habits, 400 women shoppers are chosen at random in super market A located in a certain section of a city. Their average weekly food expenditure is Rs. 250 with a standard deviation 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 standard deviation of Rs. 55. Test at 1% level of significance whether the average weekly food expenditure of the two populations of the shopper are equal. [10]

   b) Two horses Ebony and Onyx were tested according to the time (in seconds) to run a particular track with the following results: [10]

Horse Ebony	28	30	32	33	33	29	34
Horse Onyx	29	30	30	24	27	29	

   Test whether the two horses have the same running capacity at 5% level of significance.

6. a) Two researchers adopted different sampling techniques while investigating the same group of students to find the number of students falling into different intelligence level. The results are as follows: [10]

Researchers	Below Average	Average	Above average	Genius
Tony	86	60	44	10
Richard	40	33	25	2

   Would you say that the sampling techniques adopted by the two researchers are significantly different at 5% level of significance.

   b) A textile company weaves a certain fabric on a large number of looms. Test the significant variation in strength at 5%, among the looms. The determination of the strength of the fabric in pounds per square inch for four randomly selected looms are as given below: [10]

Loom			
1	2	3	4
99	97	94	93
97	96	95	94
97	92	90	90
96	98	92	92

7. a) A household appliance is advertised as having more than 10-year life. If its probability density function is given by $f(t) = 0.1(1 + 0.05t)^{-3}$; $t \geq 0$. Determine its reliability for next 10 years, if it has survived a one year warranty period. What is its MTTF before the warranty period? What is its MTTF after the warranty period assuming that it has still survived? [12]

   b) Six identical components with constant failure rates are connected in high level redundancy with three components in each subsystem. Determine MTTF to provide a system reliability of 0.90 after 100 hours of operation. [8]

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