VIT
Vellore Institute of Technology

Final Assessment Test – June 2023

Course: **MAT2001 - Statistics for Engineers**
Class NBR(s): **4844 / 4846 / 4847**
Slot: **E2+TE2**
Time: **Three Hours**
Max. Marks: **100**

KEEPING MOBILE PHONE/SMART WATCH, EVEN IN "OFF" POSITION IS TREATED AS EXAM MALPRACTICE
General Instruction: Statistical Tables are allowed

Answer any TEN Questions
(10 X 10 = 100 Marks)

1. Two brands of air coolers are tested with the following results :

Life (in'000 hrs	No. of Air coolers	
	X	Y
10-15	1	0
15-20	22	24
20-25	64	76
25-30	10	2
30-35	3	1

(a) Which brand of air cooler has greater average life?

(b) Compare the variability and state which brand of air cooler would you use on your project of housing?

2. Let X and Y be random variables of the continuous type having the joint probability density function:

$$f(x,y) = \begin{cases} \frac{3}{32}x^3y^2 & ; \quad 0 \le x \le 2 \ , \ 0 \le y \le 2 \\ 0 & ; \quad elsewhere \end{cases}$$

(a) Are the two random variables independent? Why or why not?

(b) Determine the conditional expectations $E(Y|X = x)$ and $V(Y|X = x)$.

3. A random variable X has the following probability mass function:

$$f(x) = \frac{e^{-\theta}\theta^x}{x!} \quad ; \quad x = 0, 1, 2, 3, \dots, \infty$$

(a) Find the Moment generating function of X.

(b) Use $M_X(t)$ to find mean and variance of the random variable X.

4. Calculate the Spearman's rank correlation co-efficient for the following data and interpret the result

X	35	54	80	95	73	73	35	91	83	81
Y	40	60	75	90	70	75	38	95	75	70

5. If the two lines of regression are :

$$4x - 5y + 30 = 0 \text{ and } 20x - 9y + 107 = 0$$

(i) Which of these is the line of regression of X on Y and Y on X.

(ii) Find the correlation coefficient between X and Y.

(iii) Find the value of standard deviation of Y when $\sigma_x = 3.119$.

6. The phone lines to an airline reservation system are occupied 35% of the time. Assume that the events that the lines are occupied on successive calls are Independent. Assume that 10 calls are placed to the airline.
(i) What is the probability that for at least one call the lines are not occupied?
(ii) What is the expected number of calls in which the lines are all occupied?

7. The reaction time of a driver to visual stimulus is normally distributed with a mean of 0.4 seconds and a standard deviation of 0.051 seconds.
(i) What is the probability that a reaction requires more than 0.51 seconds?
(ii) What is the probability that a reaction requires between 0.42 and 0.52 seconds?
(iii) What is the reaction time that is exceeded 90% of the time?

8. The following table represents the data on values of a harvested crop stored in the open and inside a storage house:

	Sample size	Mean	$\sum_i (x_i - \bar{x})^2$
Outside	43	127	8698
Inside	63	142	27417

Assuming that the two samples are drawn from normal populations with equal variances, examine if the mean value of the harvested crop is affected by weather conditions. Test the claim at $\alpha = 0.05$ and 0.10.

9. Because of tourism in the state, it was proposed that public schools in Michigan begin after Labour Day. To determine whether support for this change was greater than 65%, a public poll was taken and given that 414 out of a sample of 600 favour a post-Labour Day start. Test at 5% and 1% levels of significance and then draw your conclusions.

10. One hundred music majors in a random sample were classified as follows by gender and by the kind of instrument (including voice) that they played:

	Instrument				
Gender	Flute	Tabala	Brass	String	Vocal
Male	4	11	15	6	9
Female	7	18	6	6	18

Test whether the selection of instrument is independent of the gender of the respondent.

11. A random sample is selected from each of 3 makes of ropes and their breaking strength (in certain units) are measured with the following results:

I	70, 72, 75, 80, 83
II	60, 65, 57, 84, 87, 73
III	100, 110, 108, 112, 113, 120, 107

Test whether the breaking strengths of the ropes differ significantly at 5% level.

12. The life time of a certain system component is a continuous random variable whose probability density function is :

$$f(t) = \frac{32}{(t+4)^3} \; ; \; t > 0 \text{ (in years)}$$

Find the (i) Reliability function $R(t)$. (ii) Failure rate $\lambda(t)$ and (iii) MTTF.

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