

**GUJARAT TECHNOLOGICAL UNIVERSITY****MCA - SEMESTER-III • EXAMINATION – SUMMER • 2014****Subject Code: 630003****Date: 31-05-2014****Subject Name: Statistical Methods****Time: 02:30 pm - 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

**Q.1 (a) State whether the following statements are true or false. 07**

- (1) The average of marks secured by 30 students is 85 marks. So all these students must have secured marks more than 35.
- (2) The Ogives of 'less than type' and 'more than type' for a data intersect at the mean of the data.
- (3) For some events  $A$  and  $B$ , it is possible that  $p(A) = 0.22$  and  $p(A \cup B) = 0.12$
- (4) The middle 50% data lie in the inter quartile range.
- (5) If  $p(A) = 0.25$ ,  $p(B) = 0.20$ ,  $p(A \cap B) = 0.05$ , then  $A$  and  $B$  must be Independent events.
- (6) If sample correlation coefficient of two variables is 0.97, then these two variables have very weak linear relationship.
- (7) Higher confidence levels provide wider confidence intervals.

**(b)** The monthly starting salaries for a sample of 12 graduates are given as:  
2850, 2950, 3050, 2880, 2577, 2710, 2890, 3130, 2940, 3325, 2920, 2880.

- (i) Provide a Five - Number Summary. **03**
- (ii) Show a box plot. **03**
- (iii) Is there any outlier? **01**

**Q.2 (a) (1) A department of transportation study on driving speed and mileage for midsize automobiles resulted in the following data. 04**

Driving Speed	30	50	40	55	30	25	60	25	50	55
Mileage	28	25	25	23	30	32	21	35	26	25

Compute and interpret the sample correlation coefficient.

- (2) For two events  $A$  and  $B$ , given that  $p(A) = 0.50$ ,  $p(B) = 0.60$ ,  $p(A \cap B) = 0.40$ . 03**  
Find (i)  $p(A|B)$  (ii)  $p(B|A)$  and (iii)  $p(A \cup B)$ .

**(b) (1) Consider a sample with data values 20, 25, 20, 15, 30, 35, 20 and 25. 03**  
Compute coefficient of variation.

- (2) A survey found that 33% of the students have their own credit card. 04**  
(i) In a sample of six students, what is the probability that two will have their own credit card?  
(ii) In a sample of 10 students, what is the probability that none will have their own credit card?

**OR**

- (b) (1) For the following probability distribution of a random variable  $x$ , 03  
 Compute  $E(x)$  and  $Var(x)$ .

$x$	1	2	4	7	8
$f(x)$	0.1	0.2	0.3	0.3	0.1

04

- (2) Forty percent of business travelers carry either a cell phone or a laptop with them.  
 For a sample of 15 business travelers,  
 (i) Compute the probability that exactly three of the travelers carry a cell phone or a laptop.  
 (ii) Compute the probability that at least two of the travelers carry a cell Phone or a laptop.

- Q.3 (a)** (1) Airline passengers arrive randomly and independently at the passenger screening facility at an international airport. The mean arrival rate is 10 passengers per minute. 04

- (i) Compute the probability of no arrivals in a 1-minute period.  
 (ii) Compute the probability of at least one arrival in a 1-minute period.  
 (iii) Compute the probability of no arrivals in a 30-second period.  
 (iv) Compute the probability of at least one arrival in a 30-second period.

- (2) The lifetime (in hours) of an electric device is a random variable with the 03  
 Exponential probability density function,  $f(x) = \frac{1}{50} e^{-x/50}$  for  $x \geq 0$ .

- (i) What is the mean lifetime of the device?  
 (ii) What is the probability that the device will fail in the first 25 hours of operation?

- (b) (1) Write characteristics of the normal distribution. 03  
 (2) Assume that the test scores from a college admissions test are normally distributed, 04  
 with a mean of 450 and a standard deviation of 100.  
 (i) What percentage of the people taking the test score between 400 and 500?  
 (ii) If a particular university will not admit anyone scoring below 480, what percentage of the persons taking the test would be acceptable to the university?

**OR**

- Q.3 (a)** (1) A new automated production process averages 1.5 breakdowns per day. Assume that 04  
 breakdowns occur randomly, that the probability of a breakdown is the same for any two time intervals of equal length, and that breakdowns in one period are independent of breakdowns in other periods.

- (i) What is the probability of having exactly two breakdowns during a day?  
 (ii) What is the probability of having three or more breakdowns during a day?

- (2) The time between arrivals of vehicles at a particular intersection follows an 03  
 exponential probability distribution with a mean of a 12 seconds.  
 (i) What is the probability that the arrival time between vehicles is 12 seconds or less?  
 (ii) What is the probability of 30 or more seconds between vehicle arrivals?

- (b) (1) Write characteristics of a Student's  $t$  distribution. 03  
 (2) A machine fills containers with a particular product. The standard deviation of filling 04  
 weights is known from past data to be 0.6 ounce. If only 2% of the containers hold less than 18 ounces, what is the mean filling weight for the machine? Assume that the filling weights have a normal distribution.

- Q.4 (a)** (1) Describe various sampling methods. **03**  
 (2) The mean height obtained from a random sample of size 100 is 64 inches. The standard deviation of the distribution of height of the population is known to be 3 inches. Test the statement that the mean height of the population is 67 inches at 1% level of significance. **04**

- (b)** (1) A drug is given to 10 patients and the increments in their blood pressure were recorded to be 3, 6, -2, 4, -3, 4, 6, 0, 0, 2. Is it reasonable to believe at 5% level of significance, that the drug has no effect on blood pressure? **03**  
 (2) 680 heads and 520 tails are obtained in tossing a coin 1200 times. Can it be concluded that the coin is unbiased, at 5% level of significance? **04**

**OR**

- Q.4 (a)** (1) Define a point estimator. Write properties of a good estimator. **03**  
 (2) The mean life time of a sample of 400 fluorescent light bulbs, produced by a company is found to be 1570 hours with a standard deviation of 150 hours. Test the hypothesis that the mean life time of the bulbs produced by the company is greater than or equal to 1600 hours against the alternative hypothesis that it is smaller than 1600 hours at 1% level of significance. **04**

- (b)** (1) A random sample of size 16 has 53 as mean. The sum of squares of the deviations taken from mean, is 135. Can this sample be regarded, at 5% level of significance, as a sample taken from the population having 56 as mean? Also obtain 95% confidence interval of the mean of the population. **04**  
 (2) In 324 throws of a six-faced die, odd points appeared 180 times. Would you say that the die is fair at 5% level of significance? **03**

- Q.5 (a)** Given the data for two variables  $x$  and  $y$ , **07**

$x_i$	6	11	15	18	20
$y_i$	6	8	12	20	30

- (1) Develop an estimated regression equation for these data.  
 (2) Compute the residuals.  
 (3) Develop a plot of the residuals against the independent variable  $x$ .  
 (4) Do the assumptions about the error terms seem to be satisfied?  
**(b)** Using the following data, test the hypothesis, at 5% level of significance that the drug is no better than sugar pills for curing cold. **07**

	HELPED	HARMED	NO EFFECT
DRUG	50	12	18
SUGAR PILLS	40	14	26

**OR**

- Q.5 (a)** For the data given below **07**

$x_i$	1	2	3	4	5
$y_i$	3	7	5	11	14

- (1) Estimate the standard deviation of  $\hat{y}_p$ , when  $x=4$ .  
 (2) Develop a 95% confidence interval for the expected value of  $y$  when  $x=4$ .  
 (3) Estimate the standard deviation of an individual value of  $y$  when  $x=4$ .  
 (4) Develop a 95% prediction interval for  $y$  when  $x=4$ .  
**(b)** The number of defects per unit in a sample of manufactured product was found as follows: **07**

Number of defects	0	1	2	3	4
Number of units	200	90	20	8	2

Fit Poisson distribution to the data and test the goodness of the fit ( $\alpha = 0.05$ )

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