

GUJARAT TECHNOLOGICAL UNIVERSITY
MBA - SEMESTER-I • EXAMINATION – WINTER 2013

Subject Code: 2810007**Date: 30-12-2013****Subject Name: Quantitative Analysis - I****Time: 10.30 am – 01.30 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) What is a Box plot? Explain the construction of a Box plot. **07**

(b) A production department uses a sampling procedure to test the quality of newly produced items. The department employs the following decision rule at an inspection plan: If a sample of 14 items has a variance of more than 0.005, the production line must be shut down for repair. The following data have just been collected: 3.43, 3.45, 3.43, 3.48, 3.52, 3.50, 3.39, 3.48, 3.41, 3.38, 3.49, 3.45, 3.51, and 3.50. **07**

- 1) Should the production line be shut down? Why or why not?
- 2) Find the Pearson's measure of skewness and comment on the nature of the distribution.

Q.2 (a) The following information is available about the production and wages of the workers of a large manufacturing company during a certain month. **07**

	Production (No. of items)	Wages (Rs)
Total	38,000	3,20,000
SD	76	512
No. of Workers	100	100

Why SD or variance is not a suitable measure of variability in this case. Suggest a suitable measure of variability and find which of the two has greater variability?

(b) State the following: **07**

- 1) Addition rule for any two events A and B. What happens if the events A and B are mutually exclusive?
- 2) Multiplication rule for any two events A and B. What happens if the events A and B are independent?
- 3) Empirical rule for normally distributed data
- 4) Chebychev's Theorem

OR

(b) An insurance company believes that people can be divided into two classes-those who are prone to have accidents and those who are not. The data indicate that an accident-prone person will have an accident in a one-year period with probability 0.1 and probability for all others is 0.05. Suppose that the probability that a new policy holder is accident prone is 0.2. Find the probability that he/she is accident prone **07**

given that a new policy holder has an accident in the first year. Also find the probability that a new policy holder has an accident in the first year. Define clearly your events of interest.

- Q.3 (a)** The proportion of defective components produced by a company is 0.6%. The components are sold in boxes of 250 and the company guarantees to replace any box containing more than three defectives. The cost of each replacement box is Rs 400. The company is thinking about introducing a more comprehensive inspection scheme that would cost Rs 20 per component box but would eliminate all defective. Use the Poisson approximation to the binomial to decide whether this inspection scheme is worthwhile. **07**

- (b)** The percentage of people (to the nearest 10) responding to an advertisement is a random variable denoted by X with the following distribution. **07**

X (%)	0	10	20	30	40	50
$p(x)$	0.1	0.2	0.35	0.2	0.1	0.05

- 1) What is the expected percentage of people responding to an advertisement?
- 2) What is the SD of percentage of people responding to an advertisement?
- 3) Find the probability that more than 20% will respond to the advertisement.

OR

- Q.3 (a)** In preparation of an international sports event, the civic authorities in a city install 6000 electric lamps on the roads. These lamps have normally distributed burning life with an average of 1200 hours with a standard deviation of 150 hours. **07**

- 1) What is the number of lamps that might be expected to fail in the first 900 burning hours?
- 2) What is the number of lamps that might be expected to have life between 1000 and 1400 hours?
- 3) What is the number of lamps that might be expected to have life more than 1400 hours?
- 4) After how many hours would you expect that 10% of the lamps would fail?

- (b)** The lives of a certain brand of batteries are known to be normally distributed with mean 415 hours and SD 20 hours. A random sample of 100 batteries were selected, what is the probability that the batteries will have a mean life of at least 412 hours? If sample size is reduced to 50, what happens to the above probability? **07**

- Q.4 (a)** A random sample of twelve 750 ml bottles of a certain brand of soft drink is taken and examined to see the exact quantity of soft drink in **07**

them. The following data represent the quantity of soft drink in ml: 746, 757, 752, 742, 748, 741, 754, 750, 758, 751, 744, and 751. Assuming the volume of soft drink in a bottle has normal distribution; obtain a 95% confidence interval for the mean volume.

- (b) Explain the large sample test procedure for testing the difference of population means when the samples are independent and the population standard deviations are known. **07**

OR

- Q.4** (a) A suit has been filed against a large company charging it with gender discrimination stating that its female employees are paid less than male employees for the same type of work. The legal officer of the company selects independent random samples of male and female employees with same job classification and obtain information on the hourly wages paid to them with the following results **07**

	Females	Males
Sample Size	17	12
Mean wage	Rs. 18.40	Rs. 22.20
SD wage	Rs. 2.20	Rs. 2.80

State the null and alternative hypothesis. Test your null hypothesis at $\alpha = 0.01$ and draw your conclusion.

- (b) A research firm provides monthly mean apartment rental costs for a city. Assume the population standard deviation is \$220 and the desired margin of error is \$50. Find the recommended sample sizes in the following cases: **07**

- 1) 90% confidence interval estimate of the population rental cost
- 2) 95% confidence interval estimate of the population rental cost
- 3) 99% confidence interval estimate of the population rental cost
- 4) If the desired margin of error is fixed, what happens to the sample size as the confidence level increases?

- Q.5** (a) 1) List the assumptions used in a simple linear regression model **07**
2) List the assumptions used in one way ANOVA model

- (b) To test the mean time required to mix a batch of materials is the same for machines produced by three manufactures, the Jacobs Chemical Company collected a sample of 15 observations on the time in minutes needed to mix the material and conducted an ANOVA. A partially incomplete ANOVA table is given below. **07**

Source	of	SS	df	MSS	F-ratio
Variation					

Between Groups (Treatments)	*	*	510	13.36
Within Groups (Error)	*	*	*	
Total	1478	*		

Complete the ANOVA table and test the hypothesis stated in the question at $\alpha = 0.05$.

OR

- Q.5 (a)** The number of accidents of workers in an assembly plant on each day is observed for a 50 day period and is assumed to have a Poisson distribution. Use $\alpha = 0.01$ to test the assumption that the accidents follow a Poisson distribution. The following data is observed. **07**

No. of accidents	0	1	2	3	4	5
No. of days	25	15	8	0	1	1

- (b)** To investigate the relationship between the level of advertising (in thousands of rupees) in local newspapers and the level of sales (in lakhs of rupees), the marketing manager of a firm in consumer products applies different amounts of advertising in 10 randomly selected comparable geographic area. The manager conducted a linear regression analysis and a partial Excel output of the same is given below. You may assume $\alpha = 0.05$. **07**

Summary Output

Regression Statistics			
Multiple R	0.91		
R Square	0.83		
Adjusted R Square	0.80		
Standard Error	14.59		
Observations	10		
	Coefficients	Standard Error	t-stat
Intercept	78.74	15.42	5.11
X variable 1	1.02	0.17	6.18

- 1) Write down the estimated regression line
- 2) Estimate the level of sales for an area in which Rs. 100,000 is spent on advertising.
- 3) How much variation in sales is explained by level of advertising?
- 4) Find the correlation between the sales and level of advertising?
- 5) Test the hypothesis $H_0 : \beta_1 = 0$ against $H_1 : \beta_1 \neq 0$
