

GUJARAT TECHNOLOGICAL UNIVERSITY**SEMESTER– 1 EXAMINATION – WINTER 2012****Subject code: 2810007****Date: 07/01/2013****Subject Name: Quantitative Analysis - I****Time:14:30 – 17:30****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) You are required to undertake a study about consumption pattern of 'Below Poverty Line' families in our country. Which method of sampling would you recommend for such a study? Why? Explain that sampling method. **03**

(b) What are non-probabilistic methods of sampling? Explain in brief any three of them. **03**

(c) If the data set has extreme values, then which central tendency measure is expected to offer a better measure? Explain giving example. **03**

(d) Define briefly the following: **05**

- I. Mode
- II. Histogram
- III. Conditional Probability
- IV. Type I and Type II Error
- V. Mutually Exclusive Events

Q.2 (a) Compute the mean, mode, variance, and standard deviation of the following sample data: **07**

Class Interval	Frequency
10-15	6
15-20	22
20-25	35
25-30	29
30-35	16
35-40	8
40-45	4
45-50	2

(b) Big Bazaar has been the target of many shoplifters during the past month, but owing to increased security precautions, 250 shoplifters have been caught. Each shoplifter's sex is noted; also noted is whether the perpetrator was a first-time or repeat offender. The data are summarized in the table: **07**

Sex	First-time offender	Repeat Offender
Male	60	70
Female	70	50

Assuming that an apprehended shoplifter is chosen at random, find:

- I. The probability that the shoplifter is male

- II. The probability that the shoplifter is female
- III. The probability that the shoplifter is both female and a first-time offender
- IV. The probability that the shoplifter is a first-time offender, given that the shoplifter is male
- V. The probability that the shoplifter is female, given that the shoplifter is a repeat offender
- VI. The probability that the shoplifter is female, given that the shoplifter is a first-time offender
- VII. The probability that the shoplifter is both male and a repeat offender.

OR

- (b)** A company uses three methods to encourage collection of delinquent accounts. From past collection records, it learns that 70% of the accounts are called on personally, 20% are phoned, and 10% are sent a letter. The probabilities of collecting an overdue amount from an account with the three methods are 0.75, 0.60, and 0.65 respectively. The company has just received payment from a past-due account. What is the probability that this account:
- I. Was called on personally?
 - II. Received a phone call?
 - III. Received a letter?

- Q.3 (a)** John, who frequently invests in the stock market, carefully studies any potential investment. He is currently examining the possibility of investing in the Trinity Power Company. Through studying past performance, John has broken the potential results of the investment into five possible outcomes with accompanying probabilities. The outcomes are annual rates of return on a single share of stock that currently costs Rs.150. Find the expected value of the return for investing in a single share of Trinity Power. If John purchases stock whenever the expected rate of return exceeds 10 percent will he purchase the stock, according to these data?

Return on investment (Rs.)	0.00	10.00	15.00	25.00	50.00
Probability	0.20	0.25	0.30	0.15	0.10

- (b)** Harry is the mayor of a large city. Lately, he has become concerned about the possibility that large numbers of people who are drawing unemployment cheques are secretly employed. His assistants estimate that 40 percent of unemployment beneficiaries fall into this category, but he is not convinced. He asks one of the aides to conduct a quiet investigation of 10 randomly selected unemployment beneficiaries.
- I. If the mayor's assistants are correct, what is the probability that more than eight of the individuals investigated have jobs?
 - II. If the mayor's assistants are correct, what is the probability that only three of the investigated individuals have jobs?
- (c)** A supervisor for a hydraulic dam knows that the dam's turbines generate electricity at the peak rate only when at least 1000000 gallons of water pass through the dam each day. He also knows, from experience, that the daily flow is normally distributed, with the mean equal to the previous day's flow and a standard deviation of 200000 gallons. Yesterday, 850000

gallons flowed through the dam. What is the probability that the turbines will generate at peak rate today?

OR

- Q.3 (a)** Jason has just bought a VCR from Jim's Videotape Service at a cost of Rs.300. He now has the option of buying an extended service warranty offering 5 years of coverage for Rs.100. After talking to friends and reading reports, Jason believes the following maintenance expenses could be incurred during the next five years. Find the expected value of the anticipated maintenance costs. Should Jason pay Rs.100 for the warranty? **04**

Expense	0	50	100	150	200	250	300
Probability	0.35	0.25	0.15	0.10	0.08	0.05	0.02

- (b)** A company CEO is worried about an elderly employee's ability to keep up the minimum work pace. In addition to the normal daily breaks, this employee stops for short rest periods an average of 4.1 times per hour. The rest period is a fairly consistent 3 minutes each time. He decided that if the probability of the employee resting for 12 minutes (not including normal breaks) or more per hour is greater than 0.5, he will move the employee to a different job. Should he do so? **05**
- (c)** ABC Medical Company is developing a compact kidney dialysis machine, but its chief engineer is having trouble controlling the variability of the rate at which fluid moves through the device. Medical standards require that the hourly flow be 4 liters, plus or minus 0.1 liter, 80 percent of the time. The chief engineer, in testing the prototype, has found that 68 percent of the time, the hourly flow is within 0.08 liter of 4.02 liters. Does the prototype satisfy the medical standards? **05**
- Q.4 (a)** The retail price of a medium sized box of a well-known brand of cornflakes ranges from \$2.80 to \$3.14. Assume these prices are uniformly distributed. What are the average price and standard deviation of prices in the distribution? If a price is randomly selected from this list, what is the probability that it will be between \$3.00 and \$3.10? **04**

- (b)** In an automotive safety test conducted by the Ahmedabad Highway Safety Research Centre, the average tire pressure in a sample of 62 tires was found to be 24 pounds per square inch, and the standard deviation was 2.1 pounds per square inch. **05**

- I. What is the estimated population standard deviation for this population? (There are about a million cars registered in Ahmedabad).
- II. Calculate the estimated standard error of the mean.
- III. Construct a 95 percent confidence interval for the population mean.

- (c)** Before the 1973 oil embargo and subsequent increases in the price of crude oil, gasoline usage in the US had grown at a seasonally adjusted rate of 0.57 percent per month, with s. d. of 0.10 percent per month. In 15 randomly chosen months between 1975 and 1985, gasoline usage grew at an average rate of only 0.33 percent per month. At a 0.01 level of significance, can you conclude that the growth in the use of gasoline had decreased as a result of the embargo and its consequence? **05**

OR

Q.4 (a) Suppose 18 major computer companies operate in the country and that 12 are located in Bangalore. If three computer companies are selected randomly from the entire list, what is the probability that one or more of the selected companies are located in the Bangalore city? **04**

Q.4 (b) The City Police Chief has recently instituted a crackdown on drug dealers. Since the crackdown began, 750 of the 12,368 drug dealers in the city have been caught. The mean value of drugs found on these 750 dealers is Rs.250000. The standard deviation of the value of drugs for these 750 dealers is Rs.41000. Construct for the Chief a 90 percent confidence interval for the mean value of drugs possessed by city's drug dealers. **05**

(c) In response to criticism concerning lost mail, the Indian Postal Service initiated new procedures to alleviate this problem. The postmaster general had been assured that this change would reduce losses to below the historic loss rate of 0.3 percent. After the new procedures had been in effect for 2 months, the IPS sponsored an investigation in which a total of 8000 pieces of mail were mailed from various parts of the country. Eighteen of the test pieces failed to reach their destinations. At a significance level of 0.10, can the PMG conclude that the new procedures achieved their goal? **05**

Q.5 (a) A credit insurance organization has developed a new high-tech method of training new sales personnel. The company sampled 16 employees who were trained the original way and found average daily sales to be Rs.688 and the sample standard deviation was Rs.32.63. They also sampled 11 employees who were trained using the new method and found average daily sales to be Rs.706 and the sample standard deviation was Rs.24.84. At $\alpha = 0.05$, can the company conclude that average daily sales have increased under the new plan? **04**

(b) A study compared the effects of four 1-month point-of-purchase promotions on sales. The unit sales for five stores using all four promotions in different months follow: **05**

Free sample	78	87	81	89	85
One-pack gift	94	91	87	90	88
Cents off	73	78	69	83	76
Refund by mail	79	83	78	99	81

- I. Compute the mean unit sales for each promotion and then determine the grand mean.
- II. Estimate the population variance using the between-column variance
- III. Estimate the population variance using the within-column variance computed from the variance within the samples.
- IV. Calculate the F ratio. At the 0.01 level of significance, do the promotions produce different effects on the sales?

(c) A Corporation owns several companies. The strategic planner for the corporation believes dollars spent on advertising can to some extent be a predictor of total sales dollars. As an aid in long-term planning, she gathers the following sales and advertising information from several of the companies for 2008 (\$ million). **05**

Advertising	12.5	3.7	21.6	60.0	37.6	6.1	16.8	41.2
Sales	148	55	338	994	541	89	126	379

Develop the equation of the simple regression line to predict sales from advertising expenditures using these data.

OR

Q.5 (a) To celebrate their first-anniversary, Paul decided to buy a pair of diamond earrings for his wife. He was shown nine pairs with marquise gems weighing approximately 2 carats per pair. Because of differences in the colours and qualities of the stones, the prices varied from set to set. The average price was Rs.2990, and the sample standard deviation was Rs.370. He also looked at six pairs with pear-shaped stones of the same 2 carat approximate weight. These earrings had an average price of Rs.3065, and the sample standard deviation was Rs.805. On the basis of this evidence, can Paul conclude (at a significance level of 0.05) that pear-shaped diamonds cost more, on average than marquise diamonds? **04**

(b) The following data show the number of claims processed per day for a group of four insurance company employees observed for a number of days. Test the hypothesis that the employees' mean claims per day are all the same. Use the 0.05 level of significance. **05**

Employee 1	15	17	14	12		
Employee 2	12	10	13	17		
Employee 3	11	14	13	15	12	
Employee 4	13	12	12	14	10	9

(c) Use a chi-square goodness-of-fit test to determine whether the observed frequencies are distributed the same as the expected frequencies ($\alpha = 0.05$). **05**

Category	1	2	3	4	5	6
f_o	53	37	32	28	18	15
f_c	68	42	33	22	10	8
