Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

SEMESTER– 3 EXAMINATION – WINTER 2012

Subject code: 630003 **Date: 02/01/2013**

Subject Name: Statistical Methods

Time:10:30 – 13:00 **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 are applications of statistics in Business and Economics? **03**

(b) Define Expected value of $\bar{x}$, Standard Variation of $\bar{x}$ for finite and infinite population. **03**

(c) Consider a binomial experiment with $n = 20$ and $p = 0.70$. Compute $f(12)$, $P(x \geq 16)$, $E(x)$ and $Var(x)$. **04**

(d) Define and Differentiate **04**

(i) Type-I and Type-II errors

(ii) Tow-tailed and One-tailed tests

Q.2 **(a)** (i) Consider the following data: **03**

8.9	10.2	11.5	7.8	10.0	12.2	13.5	14.1	10.0	12.2
6.8	9.5	11.5	11.2	14.9	7.5	10.0	6.0	15.8	11.5

Construct a dot plot, a frequency distribution, a percent frequency distribution.

(ii) Consider a sample with data values 27, 25, 20, 15, 30, 34, 28 and 25. Compute the range, interquartile range, variance and standard deviation. **04**

(b) For two events A and B, with $P(A) = 0.50$, $P(B) = 0.60$ and $P(A \cap B) = 0.40$. **07**

(i) Find $P(A \mid B)$.

(ii) Find $P(B \mid A)$.

(iii) Are A and B independent? Why or Why not?

OR

(b) Airline passengers arrive randomly and independently at the passenger-screening facility at a major international airport. The mean arrival rate is 10 passengers per minute. **07**

(i) Compute the probability of no arrivals in a 1-minute period.

(ii) Compute the probability that three or fewer passengers arrive in a 1-minute period.

(iii) Compute the probability of no arrivals in a 15-second period.

(iv) Compute the probability of at least one arrival in a 15-second period.

Q.3 **(a)** A person must score in the upper 2% of the population on an IQ test to qualify for membership in GTU-IQ-Club. If IQ scores are normally distributed with a mean of 100 and a standard deviation of 15, what score must a person have to qualify for GTU-IQ-Club? **07**

(b) (i) The following data are from a simple random sample: **03**

5	8	10	7	10	14

What are point estimates of the population mean and standard deviation?

(ii) Assume the population standard deviation is 25. Compute the standard error of the mean, for sample sizes of 50, 100 and 200. **04**

What can you say about the size of standard error of the mean as the sample size is increased?

OR

Q.3 **(a)** The lifetime (hours) of an electronic device is a random variable with the following exponential probability density function. **07**

$$f(x) = \frac{1}{20} e^{-x/20} \text{ for } x \geq 0$$

(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?

(iii) What is the probability that the device will operate 100 or more hours before failure?

(b) A simple random sample of 50 items from a population with $\sigma = 6$ resulted in a sample mean of 32. Provide a 90%, 95% and 99% confidence intervals for the population mean. **07**

Q.4 **(a)** According to BSNL, 71% of internet users connect their computers to the internet by normal telephone lines. Assume a population proportion $p = 0.71$. **07**

(i) What is the probability that a sample proportion from a simple random sample of 350 internet users will within ± 0.5 of the population proportion?

(ii) What is the probability that a sample proportion from a simple random sample of 350 internet users will be 0.75 or greater?

(b) A factory is producing 50000 pairs of shoes daily. From a sample of 500 pairs, 2% were found to be of sub-standard quality. Estimate the number of pairs that can be reasonably expected to be spoiled in the daily production and assign limits at 95% level of confidence. **07**

OR

Q.4 **(a)** Audience profile data collected at the SAB TV Survey showed that 26% users were women. Assume that this percentage was based on a sample of 400 users. **07**

(i) At 95% confidence, what is the margin of error associated with the estimated proportion of users who are women?

(ii) What is the 95% confidence interval for the population proportion of SAB TV users are women?

(iii) How large a sample should be taken if the desired margin of error is 0.3?

(b) A sample analysis of examination results of 500 students was made. It was found that 220 students had failed, 170 had secured a third class, 90 were placed in second class and 20 got a first class. Are these figures commensurate with the general examination result which is the ratio of 4 : 3 : 2 : 1 for the various categories respectively? **07**

Q.5 **(a)** In a random sample of 500 persons belonging to urban area 200 are found to be commuters of public transport. In another sample of 400 persons belonging to rural area 200 are found to be commuters of public transport. Discuss whether the data reveal a significant difference between urban and rural area so far as the proportion of commuters of public transport is concerned at 1% level of significance. **07**

(b) **07**

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

The estimated regression equation for these data is $\hat{y} = 0.20 + 2.60x$. Compute SSE, SST, SSR, coefficient of determination and sample correlation coefficient.

OR

Q.5 **(a)** A set of 5 coins is tossed 3200 times and the number of heads appearing each time is noted. The results are given below: **07**

No. of heads	0	1	2	3	4	5
Frequency	80	570	1100	900	50	50

Test the hypothesis that the coins are unbiased.

(b) For the data given in Q-5 (b) above **07**

Estimate the standard deviation of $\hat{y}_p$ when $x = 4$.

Develop a 95% confidence interval for the expected value of y when $x = 4$.

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