Practice Set – VI

Sub: Statistical Methods & Data Analysis (MA 231)

1. An Oil refinery has backup monitors to keep track of the refinery flows continuously and to prevent machine malfunctions from disrupting the process. One particular monitor has an average life of 4,300 hours and a standard deviation of 730 hours. In addition to the primary monitor, the refinery has set up two standby units, which are duplicates of the primary one. In the case of malfunction of one of the monitors, another will automatically take over in its place. The operating life of each monitor is independent of others. What is the probability that a given set of monitors will last a) at least 13,000 hours? b) at most 12,630 hours?

2. Food Place, a chain of 145 supermarkets, has been bought out by a larger nationwide supermarket chain. Before the deal is finalized, the larger chain wants to have some assurance that Food Place will be a consistent money maker. The larger chain has decided to look at the financial records for 36 of the Food Place stores. Food Place management claims that each store's profits have an approximately normal distribution with the same mean and a standard deviation of $1,200. If the Food Place management is correct, what is the probability that the sample mean for the 36 stores will fall within $200 of the actual mean?

3. A random variable X follow geometric distribution with parameter p. Find the maximum likelihood estimate of p on the basis of a sample of size n from the population of X.

4. Find the maximum likelihood estimate for the parameter μ of a Poisson distribution on the basis of a sample of size n.

5. Obtain the maximum likelihood estimate of α and β based on an independent random sample of size n from the exponential population:

$$f(x;\alpha,\beta) = ke^{-\beta(x-\alpha)},\ \alpha \le x < \infty,\ \beta > 0$$

where k is a constant.

6. The heights in inches of 8 students of a college, chosen at random, were as follows: 62.2, 62.4, 63.1, 63.2, 65.5, 66.2, 66.3, 66.5. Compute the point estimates for the mean and standard deviation of the population of heights of the students of the college, assuming it to be normal.

7. The population of scores of 10-year old children in a psychological performance (Dearnborn Formboard) test is known to have a standard deviation 5.2. If a random sample of size 20 shows a mean of 16.9, find 95% confidence limits for the mean scores of the population, assuming that the population is normal.

8. Northern Orange County has found, much to the dismay of the county commissioners, that the

population has a severe problem with dental plaque. Every year the local dental board examines a sample of patients and rates each patient's plaque buildup on a scale from 1 to 100, with 1 representing no plaque and 100 representing a great deal of plaque. This year, the board examined 21 patients and found that they had an average Plaque Rating Score (PRS) of 72 and a standard deviation of 6.2. Compute for Orange County a 98% confidence interval for the mean PRS for Northern Orange County.

9. Jon Jackobsen , an overzealous graduate student, has just completed a first draft of his 700-page dissertation. John has typed his paper himself and is interested in knowing the average number of typographical errors per page, but does not want to read the whole paper. Knowing a little bit about business statistics, John selected 40 pages at random to read and found that the average number of typos per page was 4.3 and the sample standard deviation was 1.2 typos per page. Construct for John a 90% confidence interval for the true average number of typos per page in his paper.

10. A tire manufacturer wants to estimate the average no. of miles that may be driven on a tire of a certain type before the tire wears out. A random sample of 32 tires is chosen; the tires are driven on until they wear out, and the no. of miles driven on each tire is recorded. The data, in thousands of miles, are as follows: 32, 33, 28, 37, 29, 30, 25, 27, 39, 40, 26, 26, 27, 30, 25, 30, 31, 29, 24, 36, 25, 37, 37, 20, 22, 35, 23, 28, 30, 36, 40, 41. Give a 99% confidence interval for the average no. of miles that may be driven on a tire of this kind. Also compute a 99% C.I. for the variance of the no. of miles that may be driven on a tire.