Uva Wellassa University, Sri Lanka
End Semester Examination – June 2009
SCT 203-2 Statistical Methods

Part C: Essay Questions
Answer All Questions
Time: 45 Minutes
Total Marks=40

1. A mammogram is a test used to detect Breast cancer in women. A positive result suggests a woman has breast cancer, whereas a negative result suggests she does not have breast cancer. If a woman has breast cancer, the probability that the mammogram is positive is 0.50. This is called the sensitivity of the test. If a woman does not have breast cancer, the probability that the mammogram is negative is 0.96. This is called the specificity of the test. Further, a randomly selected woman has a 0.015 probability of having breast cancer.

a) Show that the probability that a randomly selected woman has a positive mammogram is 0.0469.

b) If a randomly selected woman has a positive mammogram, what is the probability that woman has breast cancer? This value is called the predictive probability.

c) The probability that an ultrasound gives a positive reading for breast cancer in a randomly selected woman is 0.096. If the ultrasound and mammogram are independent, what is the probability they will both be positive?

d) A particular radiology department assesses its workers with a study of 1000 randomly selected mammograms. The number of positive mammograms in each study is well approximated by a Binomial distribution. Using this approximation, what are the mean and standard deviation of the number of positive tests in these studies?

(20 marks)

2. A certain pen has been designed so that true average writing lifetime under controlled conditions (involving the use of a writing machine) is at least 12 hours. Production will need to be stopped to readjust the machine that makes the pens, if there is evidence that the average writing lifetime under controlled conditions is less than 12 hours. For a random sample of 37 pens, the sample mean is 11.9 hours with sample standard deviation 0.2 hour.

   a) Find a 95% confidence interval for the average writing lifetime.

   b) Test the appropriate hypotheses and advise the company what to do. Use $\alpha = 0.01$

(10 marks)

3. Studies show that gasoline usage for small cars sold in the country A is normally distributed with a mean usage of 30.5 miles per gallon and a standard deviation of 4.5 miles per gallon.

   a) What percentages of cars obtain 35 or more miles per gallon?

   b) If a rival manufacturer in the country A wants to develop a car which outperforms 95% of the current make in fuel economy, what must be the gasoline usage rate of the new car?

(10 marks)