KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS & STATISTICS
DHAHRAN, SAUDI ARABIA

STAT 319: Probability & Statistics for Engineers & Scientists

Semester 142

Final Exam

Sunday May 17, 2015

8:00 – 10:30 pm

Please circle your instructor name:

Abbas Al-Sawi Malik Riaz Saleh Samuh

Name: ID #: Section #: Serial #:

Question No	Full Marks	Marks Obtained
1		
2		
3		
4		
5		
6		
Total		

Q.No.1:-

(a) In a factory, there are two machines installed for the production i.e. machine A and machine B. A lot of production is inspected and it is found that 2/3 of the products are made by machine A. It is also found that 3/5 of the products are scratch less. Moreover, 5/8 of the products have scratch(es) or they are made by machine B. What is the probability that a product selected at random from this lot is made by machine B and it has scratch?

(b) An aircraft emergency locator transmitter (ELT) is a device designed to transmit a signal in the case of a crash. The Altigauge Manufacturing Company makes 80% of the ELTs, the Bryant Company makes 15% of them, and the Chartair Company makes the other 5%. The ELTs made by Altigauge have a 4% rate of defects, the Bryant ELTs have a 6% rate of defects, and the Chartair ELTs have a 9% rate of defects.

i. If an ELT is randomly selected from the general population of all ELTs, find the probability that it is defective.
ii. If a randomly selected ELT is found to be defective, find the probability that it was made by the Altigauge Manufacturing Company.

Q.No.2:-

(a) A crate contains 50 light bulbs of which 5 are defective and 45 are not. A Quality Control Inspector randomly samples 4 bulbs without replacement. Let X = the number of defective bulbs selected. Find the probability mass function, f(x), of the discrete random variable X.

(b) A pharmaceutical company knows that approximately 5% of its pills have an ingredient that is below the minimum strength, thus rendering the pill ineffective. What is the probability that fewer than 90 in a sample of 1000 pills will be ineffective?

Q.No.3:-

(a) The Statistical Abstract of the United States published by the U.S. Census Bureau reports that the average annual consumption of fresh fruit per person is 99.9 pounds. The standard deviation of fresh fruit consumption is about 30 pounds. Suppose a researcher took a random of 38 people and had them keep a record of fresh fruit they ate for one year. What is the probability that the sample average would be between 93 and 96 pounds?

(b) A professor sees students during regular office hours. Times spent with students follow an exponential distribution with mean of 12 minutes. Find the probability that a given student spends less than 15 minutes with the professor.

Q.No.4:- A quality control engineer is interested in the mean length of sheet insulation being cut automatically by machine. The desired length of the insulation is 12 feet. It is known that the standard deviation in the cutting length is 0.15 feet. A sample of 70 cut sheets yields a mean length of 12.14 feet.

i. Obtain a 99% confidence interval for the mean length cut by machine.
ii. Using the confidence interval in part (i), can we say the machine is working properly? Why?

Q.No.5:- A market research firm is interested in determining the proportion of households that are watching a particular sporting event. To accomplish this task, it plans to use a telephone poll of randomly chosen households.

i. How large a sample is needed if the company wants to be 90 percent confident that its estimate is correct to within ±0.02?

Suppose there is a sample whose size is the answer in part (i). If 23 percent of the households in sample were watching the sporting event

ii. Using the p – value approach, do you think that the percentage of the households that are watching a particular sporting event is less than 24 percent?

Q.No.6:-

A rocket motor is manufactured by bonding together two types of propellants, an igniter and a sustainer. The shear strength of the bond Y (measured in psi) is thought to be a linear function of the age of the propellant X (measured in weeks) when the motor is cast. Twenty observations gave the following summary quantities.

$$n = 20, \quad \sum y_i = 1753.7, \quad \sum x_i = 21.5, \quad \sum y_i^2 = 3075464, \quad \sum x_i^2 = 462.25, \quad \sum x_i y_i = 37704.55$$

a) Estimate the degree of **linear correlation** between and the shear strength of the bond and the age of the propellant. **Interpret** this quantity

b) Find the estimated regression line. What are your assumptions?

c) What change in mean shear strength of the bond would be expected for a 1 week change in the age of the propellant?

d) Estimate the error variance.

e) At 5% level of significance, **test** that the higher the age of the propellant, the larger the shear strength of the bond.

f) Estimate the mean shear strength of the bond when the age of the propellant is 20 weeks, using 95% confidence level.

g) Calculate the coefficient of determination and interpret it.

With the Best Wishes