STAT 319 Statistics for Engineers and Scientists

Final Exam   Monday May 26, 2014

Please check/circle your instructor's name

☐ Anabosi   ☐ Jabbar   ☐ Malik   ☐ Al-Sabah   ☐ Saleh

Name: _____   ID #: _____Section# _____

☺Important Notes:

➢ Show all your work including formulas, intermediate steps and final answer.
➢ In hypothesis testing problems, write the hypotheses, the test statistics, the rejection region, the decision and the conclusion.
➢ Unless otherwise specified, in testing problems use a significance level of 5%

Question No	Full Marks	Marks Obtained
1	8	
2	4	
3	2	
4	4	
5	5	
6	7	
7	20	
Total	50	

1) A lot of 50 washers contains 30 washers that are thicker than the target dimension.
   a) Suppose that three washers selected at random without replacement from the lot
      i) Find the probability that all three washers are thicker than the target. *(2 pts)*

      ii) Find the probability that only the third washer is thicker than the target. *(2 pts)*

   b) Suppose that three washers selected at random with replacement from the lot
      i) Find the probability that all three washers are thicker than the target. *(2 pts)*

      ii) Find the probability that only the third washer is thicker than the target. *(2 pts)*

2) The resistance of 1 meter of copper cable at a certain temperature is normally distributed with mean 23.8 and standard deviation of 1.28.
   a) What is the 75th percentile of the resistance levels? *(3 pts)*

   b) Interpret it in context. *(1 pt)*

3) The density function of the random variable X, the total number of hours, in units of 100 hours, that a family runs a vacuum cleaner over a period of one year is

$$f(x) = \begin{cases} x & 0 < x < 1 \\ 2 - x & 1 \le x < 2 \\ 0 & otherwise \end{cases}$$

Find the average number of hours per year that families run their vacuum cleaners. *(2 pts)*

4) In an experiment to measure the weight of 36 rats under specified conditions, it was found that 12 are underweight. Calculate a 95% confidence interval on the true proportion of rats that are underweight, and interpret it. *(4 pts)*

5) A sample of 19 resistors yielded the following resistances (ohms):

28	34	34	35	35	35	38	41	43	44
45	45	45	45	47	47	47	50	55	

Construct a frequency histogram, starting with the interval (27, 33], and comment on its shape.

(5 pts)

6) The amount of residual gas saturation from 18 cores from oil-wet carbonate reservoirs gave a mean of 38.6 and a standard deviation of 8.5
   a) Find a 99% confidence interval for the true amount of residual gas saturation.   *(3 pts)*

   b) What assumptions, if any, you needed to solve part a)?   *(1 pt)*

   c) Based on the interval in a), do you think, at the 1% significance level, that the true amount of residual gas saturation is different from 44? Justify your answer.   *(3 pts)*

7) A chemical company, wishing to study the effect of extraction time. x, on the efficiency, y, of an extraction operation, obtained the data shown in the following table;

Extraction time (minutes)	15	19	19	27	31	35	39	41	45	49
Extraction efficiency (%)	57	46	52	57	68	62	72	80	64	77

$$Use \qquad S_{xx} = 1250 \qquad S_{yy} = 1072.5 \qquad S_{xy} = 955$$

a) Calculate the best fit (regression) equation to regress the extraction efficiency on the extraction Time. *(3 pts)*

b) Interpret the Least Squares Estimators in the context of this problem. *(2 pts)*

c) What is the *percentage* of the variation in the efficiency that is explained by the variation in the extraction time? *(3 pts)*

d) Calculate the mean squared error of the regression model. *(2 pts)*

e) Predict the efficiency for an extraction time of 31 minutes. *(1 pt)*

f) Calculate the error in estimating the efficiency for an extraction time of 31 minutes. *(1 pt)*

g) Construct a 95% confidence interval for extraction efficiency given that its extraction time is 31 minutes. *(3 pts)*

h) Do you think that there is a significant positive linear relationship between the extraction efficiency and the extraction time? *(5 pts)*