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

STAT 319: Probability & Statistics for Engineers & Scientists
Semester 141
Final Exam
Thursday January 1, 2015
8:00 – 10:30 am

Please circle your instructor name:

Abbas   Al-Sabah   Al-Sawi

Anabosi   Malik

Saleh

Name: ID #:   Section #:   Serial #:

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

Q1. (marks) A manufacturer of automobiles conducted a market survey. Eighty percent of the customers want better fuel efficiency, while 55% want a vehicle navigation system and 45% percent want both features.

a. Find the probability that a person wants either better fuel efficiency or a vehicle navigation system.
b. Find the probability that a person wants better fuel efficiency but not a vehicle navigation system.
c. Find the probability that a person wants a vehicle navigation system but not better fuel efficiency.
d. Find the probability that a person wants a vehicle navigation system given that he also wants a better fuel efficiency.

e. let the event A: the customers want better fuel efficiency, B: the customers want a vehicle navigation system, are the two events independent? Explain using probability.

Q2. (marks) In a semiconductor manufacturing process, three wafers from a lot are tested. Each wafer is classified as pass or fail. Assume that the probability that a wafer passes the test is 0.8 and that wafers are independent. Determine the probability distribution function of the number of wafers from a lot that pass the test.

Q3. (marks) The following data are the temperature of effluent at discharge from a sewage treatment facility on consecutive days

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36   43   44   44   45   45   46   46
47   48   48   49   49   49   49   50
50   50   50   51   51   51   52   52
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a. Find the mean, the median, the standard deviation. Comment on the shape.
b. Is the first condition of the empirical rule satisfied? Explain.
c. Using the z – score, is there any outliers?
d. Construct a box plot, comment on the shape.

Q4. (marks) The life of automobile voltage regulators has an exponential distribution with mean life of six years. You purchase an automobile that is six years old, with working voltage regulator, and plan to own it for six years.
a. What is the probability that the voltage regulator fails during your ownership?
b. If the regulator fails three years after you own the automobile, and it is replaced, what is the mean time until the next failure?

Q5. (marks) To judge which one of two fitness training approaches is better, 50 twenty-five year old men are randomly selected. For four weeks, 25 men are trained by approach 1 while the other 25 men are trained by approach 2. The percentage improvement in fitness was measured for each man and the statistics are shown below. The percentage figures are known to be normally distributed.

Approach 1	Approach 2

$\bar{x}_1 = 27.3$	$\bar{x}_2 = 33.6$
$s_1^2 = 47.614$	$s_2^2 = 28.09$

Assuming the two population standard deviations are unequal, do these results allow us to conclude that approach 2 is superior? Use the p-value approach.

Q6. (marks) A soft-drink machine is regulated so that the amount of drink dispensed is approximately normally distributed with a mean of 200 milliliters and a standard deviation of 15 milliliters. The machine is checked periodically by taking a sample of 9 drinks and computing the average content. If the average content of the 9 drinks falls in the interval (191 , 209), the machine is thought to be operating satisfactorily; otherwise, we conclude that $\mu \neq 200$ milliliters.

   a. Compute the value of the significance level.
   b. Compute the probability of committing a type II error when μ = 215 milliliters.

Q7. (marks) A chemical reaction is run 12 times, and the temperature (x) (in C^o) and the yield y (in percent of a theoretical maximum) are recorded each time. The following summary statistics are recorded:

$$\bar{x} = 65, \quad \bar{y} = 29.05, \quad \sum_0^{12}(x - \bar{x})^2 = 6032, \quad \sum_0^{12}(y - \bar{y})^2 = 835.42, \quad \sum_0^{12}(x - \bar{x})(y - \bar{y}) = 1988.4$$

   a. Compute the least square estimate and interpret the coefficients.
   b. Compute the error variance estimate.
   c. Find a 95% confidence interval the slope.
   d. A chemical engineer claims that the yield increases by more than 0.5 for each one C^o increase in temperature. Do the data provide sufficient evidence for you to conclude that this claim is false?

With the Best Wishes