KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS AND STATISTICS
Term 111

STAT 319: PROBABILITY & STATISTICS FOR ENGINEERS & SCIENTISTS

Second Major Exam Monday November 28, 2011

Please check/circle your instructor's name

□ Anabosi □ Joarder □ Muttlak

□ Riaz □ Alsawi □ Al-Sabah.

Name: _____ ID #: _____

☺ Important Note:

Show all your work including formulas, intermediate steps and final answer.

Question No	Full Marks	Marks Obtained
1	4	
2	13	
3	7	
4	6	
5	10	
Total	40	

1) The random variable *X* has the following probability distribution:

x	-2	-1	0	1	2
P (*x*)	0.1	0.25	0.15	0.1	0.4

i) What percentage of *X* values are negative? *(1 pt.)*

ii) Find the mean and variance of *X*. *(3 pts.)*

2) Weekly demand for Pepsi, in thousands of liters, is a continuous random variable with the following function

$$f(x) = \begin{cases} \frac{x}{2} & for \quad 0 \le x \le 2 \\ 0 & otherwise \end{cases}$$

i) Is this a probability density function? Explain. *(2 pts.)*

ii) Find the probability that weekly demand is less than 1.5 *(1 pt.)*

iii) Find the median weekly demand. *(2 pts.)*

iv) Find the mean and the standard deviation of the weekly demand. *(3 pts.)*

v) The demand is observed for 36 randomly selected weeks. What is the probability that the average weekly demand is less than 1.5? Did you use any "result" to arrive at your solution? *(3 pts.)*

vi) Compare the results in ii) and v) and explain. *(2 pts.)*

3) The failure time of the light bulbs is exponentially distributed with an average of 5 years.
   i) What is the probability that a bulb survives more than four years? *(3 pts.)*

   ii) Find the 90^{th} percentile, and explain its meaning in terms of failure time. *(4 pts.)*

4) An electronic system has five identical components, each with probability 0.35 of failure. The system will operate if any three of the five components are operating.
   i) Find the probability that the system fails. *(3 pts.)*

   ii) Find the mean number of components that will fail. *(1 pt.)*

   iii) In a quality control check of the components sequentially, what is the probability that the first component to fail is the third? *(1 pt.)*

   iv) What assumptions did you make to solve the previous 3 parts? *(1 pt.)*

5) Chalks manufactured at a factory are known to have length that is normally distributed with mean 100mm and a standard deviation 3mm. The specifications are that it must have a length of between 95mm and 106mm.

   i) What percentage of chalk would be within specifications? *(4 pts.)*

   ii) Find the cut off length for the shortest 10% of the chalk produced. *(3 pts.)*

   iii) A sample of size 16 is selected what is the probability that the sample mean will be more than 102mm? *(3 pts.)*