King Fahd University of Petroleum and Minerals

Department of Mathematics and Statistics

Stat 319: Probability and Statistics for Engineers and Scientists
Major Exam 1 – Spring 2013 (T122)
Monday, March 4, 2013
Allowed Time: 75 minutes, from 6:00-7:15pm

Instructors: (Circle One)

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M. Malik **M. Saleh** **W. Sharabati (coordinator)**

Name: _____ ID #: _____

Section #: _____ Serial Number: _____

Instructions:

1. **Show all your work and write clearly**. No points for answers without justification!
2. **Only basic calculators are allowed.**
3. **Turn off your cell-phone and put it away.**

Question	Score	Points
1		15
2		10
3		10
4		10
5		5
6		5
7		5
8		15
Total:		75

1. Motor vehicles sold to individuals are classified as either cars or light trucks and as either US or non-US. In a recent year, 69% of vehicles sold were light trucks, 78% were US, and 55% were US light trucks. Let A be the event that a vehicle is a car and B the event that it is non-US.

   (a) Find the probability that the vehicle is a non-US car.

   (b) Given that a vehicle is non-US, what is the probability it is a light truck?

   (c) Are the events "vehicle is a light truck" and "vehicle is non-US" independent? Justify your answer.

2. A smoke detector system uses two devices A and B. If smoke is present, the probability that it will be detected by device A is 0.95; by device B is 0.98 and by both devices is 0.94.

   (a) If smoke is present, find the probability that the smoke will be detected by device A or device B.

   (b) Find the probability that smoke will not be detected.

3. A researcher receives 87 containers of oxygen. Of those containers, twenty of them have oxygen that is not ionized and the rest are ionized. Two samples are randomly selected, without replacement, from the lot.

   (a) What is the probability that the first one selected is not ionized?

   (b) What is the probability that the second one selected is not ionized given that the first one was ionized?

4. A manufacturer knows that on the average 20% of the electric toasters which he makes will require repairs within 1 year after they are sold.

   (a) When 20 toasters are randomly selected, find the appropriate number x such that the probability at least x of them will require repairs is less than 0.5.

   (b) When the toasters are selected one by one, what is the probability that the first toaster, that required repairs within 1 year, is the 5^{th} one?

5. Three microprocessors are installed and the system is designed so that it operates as long as one microprocessor is still functional. Suppose that the probability that a microprocessor is still active after t seconds is $p = e^{-\lambda t}$. If it is known that one microprocessor is still functional, what is the probability that two microprocessors are functional?

6. 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

$$f(x) = \begin{cases} x, & 0 \leq x \leq 1 \\ 2 - x, & 1 \leq x \leq 2 \\ 0, & \text{otherwise} \end{cases}$$

Find the mean and median number of hours per year families run their vacuum cleaners.

7. Hits to a high-volume Web site are assumed to follow a Poisson distribution with mean of 10,000 per day. Approximate the probability that more than 20,000 hits in a day.

8. The fill volume of an automated filling machine used for filling cans of carbonated beverage is normally distributed with a mean of 3.7 *cc* and standard deviation of 5 *cc*.

   (a) If all cans less than 365 or greater than 375 *cc* are scrapped, what is the proportion of scrapped cans?

   (b) Determine specifications that are symmetric about the mean include 99% of all cans.

   (c) If 10 cans are selected at random, what is the probability that at most 7 cans are not scrapped?

Good Luck! ☺