MAT2377 3X: Probability and Statistics for Engineers
Instructor: Aziz Khanchi

Midterm Test
June 2012

Surname _____ First Name _____

Student # _____

Take your time to read the entire paper before you begin to write, and read each question carefully. Make a note of the questions that you feel confident you can do, and then do those first: you do not have to proceed through the paper in the order given.

- Do **not** detach the exam booklet. You have to return the complete stapled booklet.
- You have 80 minutes to complete this exam.
- Only answers recorded in the table on the second page will be marked.
- This is an open book exam, and notes of any kind are allowed. The use of cell phones, pagers or any text storage or communication device **is not permitted.**
- Only the Faculty approved Texas Instrument and Casio calculators are allowed.
- Where it is possible to check your work, do so.

Good Luck!

Only answers recorded in the following table will be marked.

Question	Answer
1	
2	
3	
4	
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7	
8	
9	
10	
11	
12	

Question 1. A distributor of cell phones sells them in boxes of three. Let X be the number of defective cell phones in a box. Assume that X follows the following mass function

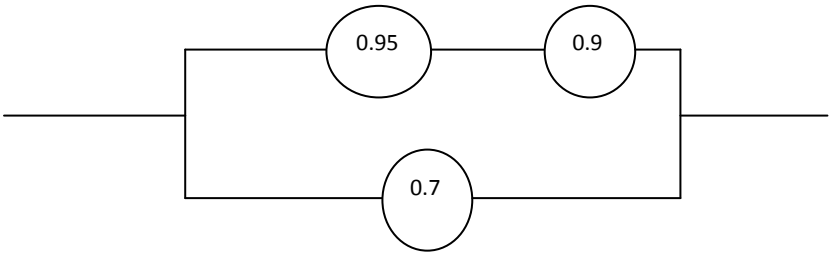
$$f(k) = c(0.9 - 0.2k).$$

Determine the value of the constant c and also determine the mean number of defective cell phones in a box.
A) $c = 0.417, \mu = 1.0842$ B) $c = 0.2321, \mu = 0.60346$ C) $c = 0.4673, \mu = 1.21498$
D) $c = 2.4, \mu = 1.2914$

Question 2. It is known that any item produced by a certain machine will be defective with probability 0.1, independently of any other item. What is the probability that in a sample of three items, at most one will be defective?
A) 0.243 B) 0.757 C) 0.972 D) 0.028.

Question 3. The number of hacker hits at a specific server follows a Poisson distribution with a rate of 5 per hour. Approximately, how long should we wait so that the probability of one or more hits exceeds 0.9?
A) 60 min. B) 27.6 min. C) 26.4 min. D) 5 min.

Question 4. The following circuit operates only if there is a path of functional devices from left to right. The probability that each device functions is shown on the graph. Assume that the devices work independently. What is the probability that the circuit operates?



A) 0.5985 B) 0.145 C) 0.4015 D) 0.9565

Question 5. It is estimated that 3.3 million Canadians have diabetes. 90% of all people with diabetes have type 2 diabetes. 90% of people with type 2 diabetes are overweight. What percentage of Canadians have type 2 diabetes and are overweight? Assume that Canada has a population of 33 million people.

A) 8.10% B) 9.45% C) 6.12% D) 4.32%

Question 6. Malware, *ISTEALYOURDATA*, has infected 17% of computers in a company. The malware's objective is to steal personal data. 86% of the infected computers have given away personal data because of this malware. On the other hand, 15% of computers have also lost personal data for reasons other than *ISTEALYOURDATA*. What is the probability that the computer is infected by *ISTEALYOURDATA*, given that some personal data is stolen from it?

A) 0.27 B) 0.41 C) 0.15 D) 0.54 E) 0.86

Question 7. The following table summarizes the opinion of 119 students regarding their preference for a multiple choice exam in a statistics course, as well as their intention of pursuing graduate studies:

Opinion	Number of students
prefer a multiple choice exam and intend to pursue graduate studies	66
prefer a multiple choice exam and do not intend to pursue graduate studies	10
do not prefer a multiple choice exam and intend to pursue graduate studies	28
do not prefer a multiple choice exam and do not intend to pursue graduate studies	15
Total	119

What is the probability that a student prefers a multiple choice exam, given that he/she intends to pursue graduate studies?

A) 0.87 B) 0.70 C) 0.50 D) 0.45

Question 8. Continuing with the previous question, is the preference for a multiple choice exam independent of the intention of pursuing graduate studies?

A) yes, these are independent events B) no, they are not independent events

C) insufficient information given.

Question 9. The probability that a packet, transmitted through a digital channel, is received in error is 0.1. Assume that the transmissions are independent events. An email message requires 10 packets and an email is corrupted if at least one of its packets is received in error. Suppose that independent emails are sent. What is the mean number of emails until receiving the first corrupted email?

A) 10 B) 0.65132 C)1.54 D) 1

Question 10. Patients arrive at a clinic according to a Possion distribution with rate 7 per day.

a) What is the probability that strictly less than 4 people arrive on a random day?

b) What is the mean number of people arriving in a single day?

A) a) 0.052, b) 1/7 B) a) 0.918, b) 7

C) a) 0.082, b) 1/7 D) a) 0.082, b) 7

Question 11. A batch contains 30 fuses. Assume that 10 of the fuses are not acceptable. Six fuses are selected at random, what is the probability that at least one of the selected fuses is not acceptable if

a) the selection is done without replacement?

b) the selection is done with replacement?

A) a) 0.935, b) 0.912 B) a) 0.912, b) 0.935

C) a) 0.066, b) 0.088 D) a) 0.088, b) 0.066

Question 12. Let X be a continuous random variable with probability density function

$$f(x) = \frac{x}{12.5} \quad \text{for} \quad 0 \leq x \leq 5.$$

Determine $P(1 < X \leq 3)$.

A) 5/12.5 B) 6/12.5 C) 7/25 D) 8/25.