



Université d'Ottawa • University of Ottawa

Faculté des sciences
Mathématiques et de statistique

Faculty of Science
Mathematics and Statistics

**Mid-Term test for MAT2377
Probability and Statistics for Engineers.**

Time : 80 minutes

Name : _____

Student Number : _____

**Calculators are permitted. It is an open book exam.
There are 2 short answer questions and 7 multiple choice questions.
The exam will be marked on a total of 15 points.**

Submit your answers for the multiple choice questions in the following table.

Question	Answer
1	
2	
3	
4	
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6	
7	

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Short Answer Questions

- [4] 1. The probability distribution of X , the number of imperfections per 10 meters of a synthetic fabric is given by

x	0	1	2	3	4
$f(x)$	1/3	2/9	2/9	1/9	1/9

- (a) Is f a probability mass function? Why?
- (b) Compute the expected the number of imperfections for 10 meters of this synthetic fabric.
- (c) Compute $P(X \leq 1)$.
- (d) Compute $P(X \geq \mu)$, where μ is the mean number of imperfections for 10 meters of this synthetic fabric.

- [4] 2. Assuming that a can of beverage is underfilled, an automated weight monitor will detect it with a probability of 0.95.
- (a) We purposely submit 10 underfilled cans to the monitor. What is the probability that at least 9 will be detected by the monitor? Give the expected number of cans that the monitor will detect.
 - (b) If we submit underfilled cans to the machine one at a time. How many should we expect to submit to obtain the first underfilled can that is detected by the monitor?
 - (c) Give the probability that the 6th submitted underfilled can is the third can detected by the monitor.

Multiple Choice Questions

Submit your answers for the multiple choice questions in the table found on the front page.

- [1] 1. An electrical system consists of 4 components. A parallel system of these components works if at least one of these components work. Assume that four components work independently. The reliability (probability of working) of each components 0.80. What is the probability that the entire parallel system works?
- (A) 0.9966 (b) 0.9984 (C) 0.9887 (D) 0.9921 (E) 0.8000
- [1] 2. In an assembly plant, three machines M1, M2 and M3 make 30%, 45% and 25% of the products, respectively. It is known from the past experience that 2%, 3% and 2% of the products made by each machine, respectively, are defective. A finished product is randomly selected. What is the probability that it is defective?
- (A) 0.0145 (B) 0.0135 (C) 0.005 (D) 0.009 (E) 0.0245
- [1] 3. If $E(X^2) = E[(X - 3)^2] = 30$ for some random variable X then the standard deviation of X is
- (A) 30 (B) 25 (C) 5.27 (D) 5 (E) 27.75
- [1] 4. In answering a question on a multiple choice test, a student either knows the answer or guesses. Let $p = 0.5$ be the probability that the student knows the answer and $q = 0.5$ the probability that the student guesses. Assume that a student who guesses at the answer will be correct with probability 0.2 (there are 5 answers and one of them is correct). What is the conditional probability that a student knew the answer to a question, given that he or she answered it correctly?
- (A) $1/6$ (B) $5/8$ (C) $1/12$ (D) $5/6$ (E) $2/3$

- [1] 5. In a box of 20 light bulbs, there are 4 defective items (16 non-defective). An inspector inspects 3 bulbs selected at random. Find the probability that there are exactly 2 defective light bulbs in his sample.
- (A) $\frac{1}{2}$ (B) $\frac{3}{570}$ (C) $\frac{8}{95}$ (D) $\frac{1}{95}$ (E) $\frac{19}{95}$.
- [1] 6. Only 30% of the people in a certain city believe that its public transit system is adequate. If $n = 10$ persons are selected at random, find the probability that 2 or more will think that the system is adequate.
- (A) 0.85 (B) 0.97 (C) 0.58 (D) 0.75 (E) 0.99
- [1] 7. A consulting engineer receives, on average, 0.7 requests per week. Assume that the number of requests can be modeled as a Poisson process. Find the probability that in the next four weeks there will be no calls.
- (A) 0.4965 (B) 0.0608 (C) 0.9743 (D) 0.1225 (E) 0.2466