



Université d'Ottawa • University of Ottawa

Faculté des sciences
Mathématiques et de statistique

Faculty of Science
Mathematics and Statistics

Mid-Term test for MAT2377, Fall 2014. Probability and Statistics for Engineers.

Time : 80 minutes

Name : _____

Student Number : _____

Calculators are permitted. This is an open book exam.
There are 2 short answer questions and 8 multiple choice questions.
The exam will be marked on a total of 22 points.

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

Question	Answer
1	
2	
3	
4	
5	
6	
7	
8	

585, av. King-Edward
Ottawa (Ontario) K1N 6N5 Canada

585 King Edward Avenue
Ottawa, Ontario K1N 6N5 Canada

(613) 562-5864 • Téléc./Fax (613) 562-5776
Courriel/Email: uomaths@science.uottawa.ca

Short Answer Questions

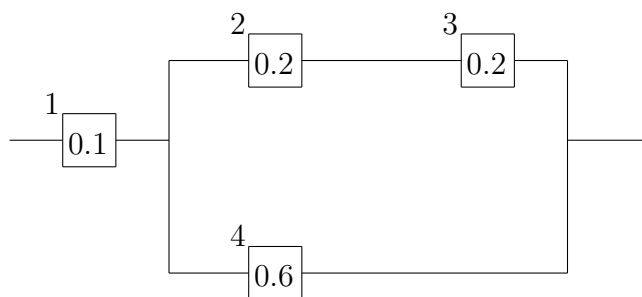
- [4] 1. The percentage of an additive in a certain type of food, X , has the following density function

$$f(x) = \begin{cases} 6x(1-x) & \text{if } 0 \leq x \leq 1 \\ 0 & \text{otherwise.} \end{cases}$$

- (i) Find $\mu = \mathbb{E}(X)$ and $\sigma^2 = \text{Var}(X)$.

- (ii) Find $\mathbb{P}(0.5 < X < 1)$.

- [2] 2. Consider the following circuit with four components. We say that it is functional if there is a path of functional components from left to right. The probability that the component is **NOT** functional is indicated. Suppose that the components are independent. What is the probability that the circuit is working?



Multiple Choice Questions

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

- [2] 1. An insurance company believes that people can be divided into two classes. Those that are accident prone and those that are not. Their statistics show that an accident prone person will have an accident at sometime within a fixed 1-year period with probability 0.5, whereas this probability decreases to 0.1 for a non-accident-prone person. Assume that 20% of the population is accident prone. An accident has occurred. What is the probability that the person involved is an accident prone individual.
- (a) $5/9$
 - (b) $4/9$
 - (c) $2/9$
 - (d) $1/9$
 - (e) $10/29$
- [2] 2. Each sample of air has a 10% chance of containing a particular molecule. Find the probability that, in a collection of 20 independent samples, at least one sample contains the rare molecule.
- (a) 0.555
 - (b) 0.440
 - (c) 0.878
 - (d) 0.265
 - (e) 0.098
- [2] 3. Two events A , B have probabilities $\mathbb{P}[A] = 0.6$ and $\mathbb{P}[B] = 0.55$. Are A and B mutually exclusive? (i.e. does $\mathbb{P}[A \cap B] = 0$)
- (a) Yes.
 - (b) No.
 - (c) Insufficient information.
- [2] 4. A shipment of 30 textbooks to a bookstore contains 7 books with printing errors. If 12 of the 30 books are bought at random (and none are returned), what is the probability that exactly 3 books with printing errors are bought?

- (a) 0.674
- (b) 0.192
- (c) 0.256
- (d) 0.312
- (e) 0.331

- [2] 5. 1000 students were polled about car ownership and living location. The results were :

	Owns car	Does not own car
Lives on campus	32	340
Does not live on campus	406	222

A student among these one thousand is selected at random. What is the probability that the student owns a car, given that the student lives on campus?

- (a) $\frac{27}{241}$
- (b) $\frac{93}{250}$
- (c) $\frac{39}{432}$
- (d) $\frac{8}{93}$
- (e) $\frac{20367}{125000}$

- [2] 6. A random variable X has cumulative distribution function ZZX :

$$F(x) = \begin{cases} 0 & \text{if } x < 0 \\ 0.12 & \text{if } 0 \leq x < 2 \\ 0.37 & \text{if } 2 \leq x < 3 \\ 0.42 & \text{if } 3 \leq x < 4 \\ 1 & \text{if } x \geq 4 \end{cases}$$

What is $\mathbb{P}[1 \leq X \leq 3]$?

- (a) 0.30
- (b) 0.42
- (c) 0.25
- (d) 0.37
- (e) 0.88

- [2] 7. The number of customers calling a certain internet service provider's customer support number per minute is observed to follow a Poisson

distribution, with rate 8 customers per minute. Compute the probability that the number of calls X in a give 30-second period satisfies $X \leq 3$.

- (a) 0.629
- (b) 0.018
- (c) 0.433
- (d) 0.092
- (e) 0.238

- [2] 8. 30 percent of new workers at a mine take an optional safety course. Among those who take the course, it is know that 0.5 percent are involved in an accident within their first year of employment. Among those who do not take the course, it is known that 1.8 percent are involve in an accident within their first year of employment. A new employee is selected an random. What is the probability that the student is involved in an accident within their first year of employment ?

- (a) 0.0043
- (b) 0.0141
- (c) 0.0115
- (d) 0.0225
- (e) 0.0126