Midterm Assignment

ELEC ENG 3TQ3 – Fall 2020 Section CO2

Due Date Monday Nov 16th 8:30 a.m.

NOTE:

1. You are not allowed to discuss these problems and/or solutions with anybody else.
2. There are 8 mandatory questions and one optional question for bonus points.
3. You are supposed to work individually on these assignments without any discussion/collaboration with your fellow students and/or anybody else.
4. Use of MATLAB is allowed but the code must be included in order to receive full credit for the question.
5. A student is expected to know what constitutes academic integrity to avoid committing academic offenses and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g. plagiarism, cheating) or about “rules” for group work should seek guidance from the course professor, academic advisor or associate dean for undergraduate studies. Please check The Office of Academic Integrity web page <http://www.mcmaster.ca/academicintegrity>.
6. The midterm assignment is due on Monday, November 16th 2020, 8:30 a.m. There are no other time restrictions apart from this assignment due date/time.

Q1 (10 points): Assume there are 5 keys and only one unlocks the door in front of you but you do not know which one. You first try one key and if it does not work you put it aside and try another key. You repeat the process until the door is unlocked.

1. Find the probability that you will need more than two attempts.
2. Find the probability that you will need 5 attempts.
3. What is the probability that you unlock the door with first attempt.

Q2 (10 points): Research results indicate that among 100 000 randomly selected men and 100 000 randomly selected women there are 5% color blinded men and 25% color blinded women. If a randomly chosen person among these 200 000 people is color blinded what is the probability that that person is a man ?

Q3 (10 points): We are rolling a fair dice until we get number 6. Find the probability that we will need at least three rolls.

Q4 (10 points): Let X be uniformly distributed variable on interval [0,2] and Y uniformly distributed random variable on interval [0,4]. Find:

1. Probability that X+Y>1
2. Probability that X+Y>1 and Y>X

Q5(15 points): Two trains each of length 180m are moving along two different intersecting tracks with speed 30m/s. Assuming that time at which they enter intersection is random uniformly distributed on [9h, 9h 30 min] find the probability that collision will be avoided.

Q6 (10 points): The weight of McMaster students is Gaussian distributed with mean 86kg and standard deviation 8kg. If the number of McMaster students is 30000 estimate the number of students whose weight is at least 90kg.

Q7 (10 points): The waiting time for examination in the walk-in clinic is Gaussian distributed with expected value of 20 minutes. After analyzing the data it has been found that 21.186% of patients are waiting at least 15 minutes. Find probability that randomly chosen patient will wait at least 10 minutes.

Q8 (20 points): The Tesla CEO, Mr. Elon Musk, decides to give a talk to both Engineering and Social Sciences students. The lecture is supposed to start at 8:30 a.m. and the capacity of the hall is 200 students. The time difference between the arrival time and 8:30 a.m. for the engineering students can be modeled as the exponential random variable with expected value 5 minutes. Similarly, the time difference between the arrival time and 8:30 a.m. for the society students can be modelled as exponential random variable with expected value 10 minutes. Assuming that there are 20 seats in the front row find

1. Probability that the first student entering the lecture hall is an engineering student.
2. Probability that the number of engineering students in the first row is larger than the number of society students.
3. Probability that ALL the seats in the front row will be occupied by engineering students.

Q9(bonus 15 points): The GO transit train has n cars and there are m (m>n) passengers waiting to board. Each passenger randomly chooses the car that he will board. Find the probability that that there will be at least one passenger per car.