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Student Number:	

STAT 2593 - Practice Midterm Assessment**Assessment Instructions:**

The following are practice questions which cover the concepts that are covered on the midterm examination. Note, these are provided in addition to the practice problems on the course website. **The true midterm assessment may not resemble these questions exactly. Please ensure that all material, including those from the practice problems, are fully understood in order to succeed on the midterm assessment.**

Solutions will **not** be provided for these questions. However, you are free to come to my office hours (or email me) with your specific questions, and your attempts to solve them, and I will happily go over the material with you.

QUESTION 1. A group of researchers are interested in studying smoking in the population of young adults in Canada (individuals under the age of 25). They are interested in the health impacts of smoking on this population, the social determinants of smoking behaviours, the network effects of smoking, and so forth. In order to do so, the researchers commence a cross-country study, drawing on individuals from every province with a representative demographic make-up. The researchers end up sampling 5000 people from across the country in this regard.

One important consideration that the researchers make is in determining the number of peers that an individual has who smoke, and the number of friends that an individual has who smoke. These values are considered based on the smoking status of the individuals broadly.

True or False: The average number of friends who smoke that person who smokes has in Canada is a parameter, and the average number of peers who smoke that a person who does not smoke has from the representative sample is a statistic.

QUESTION 2. A study is being conducted to investigate the best material to be used for building a new structure.

- a) What type of variable is cost measured in dollars?
- b) What type of variable is the ease with which the material can be worked with (recorded as easy, moderate, or challenging)?

QUESTION 3. Let $F(x)$ represent the CDF of a random variable X . Assume that $F(0) = 0$. **True or False:** $E[X]$ is a positive value.

QUESTION 4. You design a system with two components, such that both components must work in order for the system to be functional. The probability that the components work is independent of one another. If the first component fails with probability 0.03 and the second component works with probability 0.98, what is the probability that the system is functional?

QUESTION 5. You wish to compare the fatigue resistance of aluminum and a composite material for the use of manufacturing aircraft fuselage. For a random sample of 50 aircraft of each type, you record the presence and severity of any micro-cracks found in the fuselage structure at the first major maintenance visit and compare your results between the two materials. Is this an observational study or designed experiment? Why?

QUESTION 6. Suppose that a study is run in which University of New Brunswick students are selected at random from the whole university population. For each of the follow random variables, indicate what distribution the quantity will follow.

- a) Let X represent the the total number of non-engineering students selected before the 10th engineering student is selected.
- b) Let Y represent the count of Saint John students in a sample of size 50.

QUESTION 7. The following data represent the weight in kilograms for a sample of $n = 7$ packages carried by Canada Post. The data have been ordered for convenience, however, some package weights are missing.

x	0.60	0.80	z	1.80	2.30	2.95
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Suppose that the median package weight is 1.7, and the mean is 1.5.

- What are the values of x and z ?
- What are the values of Q1 and Q3?
- What is the IQR?

QUESTION 8. A student is enrolled in 5 different classes. Over the course of the weekend, each class has an assignment to be completed, but the student can only complete a total of 3.

- How many possible ways are there for the student to complete these assignments?
- If one assignment will be complete on Saturday morning, one on Sunday morning, and one on Sunday evening, how many possible ways are there these assignments?

QUESTION 9. Suppose that the number of times an on call engineer is required to come to work after hours to handle an emergency in a given month has the following PMF

$$p(x) = \begin{cases} 0.2 & x = 0 \\ 0.4 & x = 1 \\ 0.4 & x = 2 \\ 0 & \text{otherwise} \end{cases} .$$

- What is the average number of times an on call engineer is required to come to work after hours to handle an emergency, in a given month?
- If $E[X^2] = 2$, what is the variance of the number of times that an on call engineer is required to come to work after hours to handle an emergency?

QUESTION 10. Suppose at a factory there are 10 machines and it is known that the probability that any one machine does not require require service in a given week is 80%. Let X represent the count of machines that require service in a given week. Note, you may assume that the requirement for one machine to be serviced in a given week is independent of the need for service for any other machine. What is the probability in a given week that at least 2 machines require service?

QUESTION 11. A manufacturing process of TVs, the probability a TV has a cosmetic defect is 0.15, the probability a TV has a functional defect is 0.10 and the probability that a TV has a cosmetic defect given that it has a functional defect is 0.5.

- a) For a randomly selected TV, what is the probability that is has both a cosmetic and functional defect?
- b) For a randomly selected TV, what is the probability that is has any defect?
- c) Are the events having a cosmetic defect and having a function defect mutually exclusive? Why?
- d) Are the events having a cosmetic defect and having a function defect mutually independent? Why?

QUESTION 12. a) In how many ways can 7 people be seated around a round table, if the seats are indistinguishable from one another?

- b) What if there are 2 particular people who must not sit next to each other?