Practice Midterm 1

Name: _____

Student ID: __ __ __ __ __ __ __ __ __

Instructions:

- Do not open this exam until instructed to do so.
- You have 50 minutes to complete the exam.
- Please print your name and student ID number above.
- **You may not use calculators**, books, notes, or any other material to help you. Please make sure your **phone is silenced and stowed** where you cannot see it.
- Please write your solutions in the space below the problems. We will only grade your work within the pages that are relevant to the problems.
- Each problem is worth the same amount of points. Partial credit will be scarce, so make sure to get everything right.

Please do not write below this line.

Question	Score
1	
2	
3	
4	
5	
Total	

PROBLEM 1

Suppose A and B are events such that $P(A) = 0.3$, $P(B) = 0.5$, and $P(A \cup B) = 0.7$. Do the following:

(a) Compute $P(A \cap B)$.

(b) Compute $P(A' \cap B')$.

(a)

(b)

PROBLEM 2

An urn contains five red and three white balls.

(a) Draw two balls from the urn at random without replacement. Find the probability that the selected balls are of different color.

(b) Flip a fair coin whose faces are marked 1 and 2. If k comes up, draw k balls from the urn at random. Find the probability that all of the balls drawn are red.

If you proceed by way of counting, clearly identify the counting method you are using.

(a)

(b)

PROBLEM 3

A medical test identifies a disease in 99% of cases when the patient is actually sick but also has a 1% rate of false positives – which means that the test comes out positive when the patient is actually not sick. The disease affects roughly 1% of the population. Decide whether the test is good by computing the probability that, given that the test comes out positive on a random person, the person is actually sick.

PROBLEM 4

A random variable X has the moment generating function of the form

$$M(t) = \frac{1}{6}\big(e^{-t} + 3 + 2e^{t/2}\big),$$

Do the following:

(a) Find the value of $P(X = 0)$.

(b) Compute $\mathrm{Var}(X)$.

(a)

(b)

PROBLEM 5

The number of flaws in a roll of fiber optics cable follows Poisson distribution. Suppose you know that having two flaws is twice as likely than having one flaw. Do as follows:

(a) Find the expected value of number of flaws in a roll.

(b) Compute the probability that there are at most three flaws in a roll given that there is at least one flaw in this roll.

(a)

(b)

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