CE 311S: Exam 1
Friday, February 17
9:00 – 9:50 AM

Name _____

Instructions:

- **SHOW ALL WORK** unless instructed otherwise. No shown work means no partial credit!

- If you require additional space, you may use the back of each sheet and/or staple additional pages to the end of the exam.

- If you need to make any additional assumptions, state them clearly.

- You may use a calculator and one regular-sized sheet of notes. No additional resources are permitted. Please turn in this sheet with your exam.

- The number of points associated with each part of each problem is indicated.

Problem	Points	Possible
1		30
2		40
3		30
TOTAL		100

Problem 1. (30 points). The Department of Civil, Architectural, and Environmental Engineering is preparing its inaugural talent show, and you are desperate to win the top prize (a year's worth of lunches from Taco Joint). Bored during the pandemic, you learned to ride a unicycle and want to develop an act based on this new skill. You decide that ordinary unicycle riding is boring, so you start practicing three "extreme" versions of the sport: mountain unicycling, underwater unicycling, and blindfolded upside-down unicycling.

On any given day, there is a 20% probability that you are practicing mountain unicycling; a 30% probability that you practice underwater unicycling, and a 50% probability of practicing blindfolded upside-down unicycling. As these are "extreme" sports, you also have an extremely large chance of injury. Whenever you mountain unicycle, there is a 20% probability of injury; for underwater and blindfolded upside-down unicycling, these probabilities are 60% and 80%, respectively.

(a) For a specific day, what is the probability that you practice underwater unicycling and are injured?

(b) What is the probability that you are injured on any given day?

(c) If you are injured, what is the probability that this happened while blindfolded upside-down unicycling?

Problem 2. (40 points). After a particularly unfortunate injury you decide to try a different act. You and two friends decide to try a juggling act. After a (very late night) brainstorming, you identify five possible objects to juggle that would impress the CAEE judges the most: (1) reinforced concrete samples; (2) raw eggs; (3) a surveying level from CE 301; (4) trophies from the Concrete Canoe competition; and (5) flaming bowling balls. All three of you independently choose one of these five objects to juggle (so it is possible the same object may be chosen more than once.

(a) (10) What is the probability all three of you choose to juggle reinforced concrete?

(b) (10) What is the probability that all of you choose the same item?

(c) (10) If X represents how many of you choose to juggle reinforced concrete, what is $E[X]$?

(d) (10) What is the probability that you and exactly one of your friends chooses to juggle reinforced concrete?

Problem 3. (30 points). You find it difficult to juggle the objects you chose, so as a last resort you try to form a whistling quartet.

(a) (10) You need to recruit three friends in order to form this group, and each friend that you ask will agree to participate with probability 1/4. What is the probability that you have to ask exactly five friends to form the group?

(b) (10) As your act you plan to whistle "Texas Fight," "Deep in the Heart of Texas," and "March Grandioso." Despite all of your practicing, the probability that you successfully perform each piece is only 30% (independent of any other). What is the expected number of pieces you successfully perform? What is the standard deviation?

(c) (10) Unfortunately, you have stage fright which sometimes causes you to twitch awkwardly while whistling (this happens randomly, but on average once every three minutes). What is the probability that this happens more than once during your 6-minute performance?