CE 311S: Exam 2

Friday, March 28

9:00 – 9:50 AM

Name _____

Instructions:

- **SHOW ALL WORK** unless instructed otherwise. No shown work means no 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.
- The number of points associated with each part of each problem is indicated.

Problem	Points	Possible
1		30
2		30
3		40
TOTAL		100

Problem 1. (30 points). As you recall from the last exam, you and your friends (including Robin, a shady acquaintance from high school) were on a spring break camping trip when Robin went missing. You are searching for clues for where Robin may have gone. Let the random variable X represent the number of minutes you spend searching the car for clues, and Y the number of minutes you spend searching the tent. The mean and standard deviation of X are 10 minutes and 3 minutes, respectively; the mean and standard deviation of Y are 20 minutes and 4 minutes, respectively.

(a) (5) Assuming that X has a normal distribution, what is the probability you spend more than 13 minutes searching the car?

(b) (5) What is the expected amount of time you spend searching these two places in total?

(c) (10) Assuming X and Y are independent, what is the standard deviation of the total time you spend searching these places?

(d) (10) Repeat part (b) if X and Y are not independent, but instead have a correlation coefficient of $-3/8$.

Problem 2. (30 points). The clues you gather suggest that Robin may have snuck away on one of the trails to have a secret rendezvous with some unknown party. It's dark, but you don't want to wait until morning, so you get ready to set out on a hike. You aren't sure how long you will search, so you check your backpack to see how many extra flashlight batteries you packed (call this A), and the number of snacks you have (call this B). These discrete random variables have the following joint distribution:

		B			
		0	1	2	3
	1	1/16	1/16	0	0
A	2	1/8	1/4	p	1/8
	3	0	0	1/16	1/16

(a) (5) What is the missing value p?

(b) (10) What is the expected number of snacks you pack?

(c) (15) What is $\rho_{A,B}$?

Problem 3. (40 points). After searching for an hour, you finally see footprints in the mud that look like Robin's — this must be the right trail. It turns out you are right, and Robin did go down this trail. But there is also a snake on this trail, and having watched too many Indiana Jones movies as a child, you will run back to the campsite screaming if you encounter the snake. So even though you chose the right trail, it's possible that you don't find Robin if you find the snake first.

The trail is exactly one mile long. Let U denote where Robin is located on the trail, with $U = 0$ being the start point and $U = 1$ being the end point a mile away. Similarly, let V denote where the snake is located on the trail; V is also between 0 and 1. These are both continuous random variables; U has the density function $k_1 u$ for $0 \leq u \leq 1$, and 0 otherwise; V has the density function $k_2 v^2$ for $0 \leq v \leq 1$, and 0 otherwise.

(a) (10) What are the constants k_1 and k_2?

(b) (7) What is the mean of U?

(c) (8) What is the 25th percentile of U?

(d) (5) If U and V are independent, what is the joint probability density function $f_{UV}(u, v)$?

(e) (10) What is the probability that you actually find Robin?

Luckily, you find Robin before the snake shows up, and sure enough Robin is meeting with a cloaked figure who runs off into the night as you approach. You confront Robin, and find a backpack full of exams from Dr. Boyles' CE 311S class! What's going on here? Stay tuned to the final examination for the thrilling conclusion...