CE 311S: Exam 2

Tuesday, October 10

11:00 AM – 12:15 PM

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.
- The number of points associated with each part of each problem is indicated.
- A table of normal distributed values (a z table) is included at the end of the exam.

Problem	Points	Possible
1		20
2		30
3		25
4		25
TOTAL		100

Problem 1. (20 points) As you likely know, the Speedway construction project will be delayed because the contractor used substandard bricks which must be replaced. Assume that the lifespans of the bricks which were installed can be approximated by independent normal distributions with a mean of 60 days and a standard deviation of 10 days.

(a) (5) What is the probability that a brick lasts less than 50 days?

(b) (5) What is the probability that a brick lasts between 40 and 60 days?

(c) (5) What is the probability that a brick lasts more than 100 days?

(d) (5) What is the 95th percentile for the lifespan of a brick?

Problem 2. (30 points) In reality, some of the bricks were sourced from a supplier which met the contract specifications, and these bricks do not need to be replaced. Unfortunately you and your friends do not realize this, and the news of the construction delays sends you into an uncontrollable frenzy. Mad with rage, you improvise tools with your engineering skills and start prying bricks out of the pavement in a blind fury, without regard to whether the bricks are good or bad. The table below shows the joint PMF for the number of good and bad bricks (denoted by the random variables X and Y):

		Bad bricks (Y)			
		1	2	3	4
Good bricks (X)	1	1/16	1/16	1/16	1/16
	2	1/16	1/16	1/16	1/16
	3	1/16	1/16	1/16	1/16
	4	1/16	1/16	1/16	1/16

(a) (5) Are X and Y independent? Explain why or why not using the pmf.

(b) (5) What is the probability that you steal two good bricks?

(c) (5) What are the average numbers of good and bad bricks that you steal?

(d) (10) What is the mean and standard deviation of the *total* number of bricks that you steal?

(e) (5) What is the correlation coefficient between the number of good and bad bricks which were stolen?

Problem 3. (25 points) In a vain attempt to halt the thefts, the administration decides to levy a fine on any student caught stealing bricks. The fine involves a fixed charge of \$100, and a surcharge of \$15 per pound of bricks stolen. Assume that the weight of the bricks students are caught with is given by a gamma distribution with a mean of 4 pounds and a variance of 4 pounds^2.

(a) (10) What is the expected fine levied by UT for a single student? What is the standard deviation?

(b) (10) This week, 100 students will be caught and fined. What is the mean and standard deviation of the average fine for these 100 students?

(c) (5) What is the probability that the average fine this week is greater than \$166?

Problem 4. (25 points) As you are prying up your last brick, you are spotted by a police officer. You know you cannot afford the fine, so in a panic you drop your bricks and make a run for it. The officer makes chase. On any given day, assume that your running speed is uniformly distributed between 10 and 15 feet per second. A given UTPD officer's speed, on the other hand, is uniformly distributed between 10 and 20 feet per second.

(a) (5) What is the joint PDF for the two running speeds?

(b) (10) What is the probability that you can run faster than the officer?

(c) (10) This particular officer has more speed than endurance, and will stop running after 1000 feet. Assuming you have a head start of 250 ft, what is the probability you successfully escape?