CE 311S: Final Exam

Tuesday, May 17

9:00 AM – 12:00 noon

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 two regular-sized sheets of notes. No additional resources are permitted.
- The number of points associated with each part of each problem is indicated.

Problem	Points	Possible
1		16
2		14
3		20
4		15
5		15
6		20
TOTAL		100

Problem 1. (16 points) Over the summer, you decide to form a club to support the turtles at the pond outside of the tower. Your club has 14 members in it; broken down by college, 4 of them are engineering students, 5 are liberal arts students, 4 are from natural sciences, and 1 is from business. You are going to select volunteers to help clean the turtle pond.

(a) (4) In how many ways can you choose a group of four volunteers, with one student representing of the colleges (engineering, liberal arts, natural sciences, business)?

(b) (4) In how many ways can you choose a group of two students, both from engineering?

(c) (4) In how many ways can you choose a group of seven students, with two being from engineering, three from liberal arts, one from natural sciences, and one from business?

(d) (4) If you can pick a group of any size (even zero), with any number of students from each college (again, including zero), how many possible groups of volunteers can be formed?

Problem 2. (14 points) To encourage students to visit the turtles, you ask a few students visiting the pond to share their GPA. If their GPA is significantly higher than the average GPA for a UT student (assume this is 3.0), you will use this in your club's promotional materials. The GPA for the students visiting the pond are:

2.9 3.2 3.3 3.1 3.0

Assume that these students form a random sample, and that their GPAs follow a normal distribution.

(a) (4) What are your null and alternative hypotheses?

(b) (5) If you conduct the test with a 5% significance, what is your rejection region for this test?

(c) (5) Does the data justify the claim that students visiting the turtle pond have higher-than-average GPAs? (Explain your answer using a hypothesis test, don't just say yes/no.)

Problem 3. (20 points) Even though they shouldn't, some people try to feed the turtles bread and crackers (assume whether a visitor does this is independent of anyone else). You set up a group of volunteers to watch out for this behavior, and stop anyone doing this. On average, you have to stop one person per hour.

(a) (5) Let A be the number of people you have to stop in a given hour. What is the probability that A is more than two?

(b) (5) Let B be the time between two successive visitors trying to feed the turtles bread and crackers. What are the mean and standard deviation of B?

(c) (5) At the end of the week (81 hours from now), you will calculate C, the *average* number of times per hour you had to stop someone feeding the turtles. What is the probabiity that C is more than 1.1?

(d) (5) Now assume that each time you stop someone feeding the turtles, there is a 20% chance they will become angry with you and insist that you don't have the right to stop them from feeding the turtles. After the third time this happens, UTPD will be called, and they will ask you to stop while they investigate the legality of your actions. Let D be the number of times you ask people to stop before UTPD arrives. What are $E[D]$ and $V[D]$?

Problem 4. (15 points) You track the number of visitors to the turtle pond on 60 different days in the semester. Let x_i denote the day of the semester the measurement was taken (1, 2, etc., up to the number of days in the semester), and let y_i be the number of students visiting the turtle pond on that day. You find that $\sum x_i = 2720$, $\sum y_i = 17.3 \times 10^3$, $\sum x_i^2 = 163 \times 10^3$, $\sum y_i^2 = 6.31 \times 10^6$, and $\sum x_i y_i = 622 \times 10^3$.

(a) (4) What is the best-fit line for predicting the number of students visiting the turtle pond each day of the semester

(b) (4) What is the R^2 value for your line?

(c) (2) What is the probability that more than 300 students will visit the pond on the 1st day of the semester?

(d) (2) What is the probability that more than 300 students will visit the pond on the 90th day of the semester?

(e) (3) Can you claim a significant relationship between these two variables with 5% significance?

Problem 5. (15 points) You try to develop promotion slogans to encourage more people to visit the turtles. After a lot of effort and asking your dad for help (after all, you are an engineer and not a marketer), you come up with the following three lines:

1 Come out of your shell and visit the turtle pond!
2 Meet UT's most famous shell-ebrities!
3 Grab your shell-phone cameras! Best turtle picture will win a prize.

You keep meticulous records of your practicing, and find that 20% of people responded favorably to your slogans, while 80% responded unfavorably. Of those who responded favorably, you used line 1 25% of the time, line 2 50% of the time, and line 3 25% of the time. Of those who responded unfavorably, you used line 1 40% of the time, line 2 50% of the time, and line 3 10% of the time.

(a) (5) For any given attempt, what is the probability that you both used line 1 and received a favorable response?

(b) (5) During your practicing, what percent of the time did you use line 1?

(c) (5) Which pickup line will maximize the probability of a positive reaction, and what is that probability?

Problem 6. (20 points) You think back over the last 6 months, and write down the number of times you visited the turtle pond each month. Within this sample, the mean is 42 and the standard deviation is 10 Assuming that the number of times per month you visit the turtles is normally distributed, answer the following questions.

(a) (5) Form an interval containing the mean number of your monthly visits to the turtle pond, with 95% confidence.

(b) (5) Form an interval containing the standard deviation, with 90% confidence

(c) (5) Form an interval containing the number of visits you make to the turtle pond next month, with 95% confidence.

(d) (5) Form an interval containing the numbers of visits you make to the turtle pond for each of *the next five months* (i.e., all five of these numbers), with 95% confidence.