CE 311S: Final Exam

Monday, May 16 2:00 – 5:00 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 one regular-sized sheet of notes; please turn in the notes with your exam. No additional resources are permitted.
- The number of points associated with each part of each problem is indicated.
- All necessary tables are attached.

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

Problem 1. (20 points). Over the summer, you decide to form a club to support the turtles at the pond outside of the tower. As a starting point, you collect data on how many people stop to watch the turtles each day. You collect the following data:

 $97 \quad 102 \quad 88 \quad 125 \quad 85 \quad 90 \\$

For each of the following, find *two-sided intervals* which you are 95% sure contain the requested values. Assume that the number of visitors to the turtle pond each days follows a normal distribution.

- (a) (5) The number of visitors on any given day.
- (b) (5) The mean number of visitors per day.
- (c) (5) The standard deviation of the number of visitors per day.
- (d) (5) The number of visitors showing up in 99% of the days.

Problem 2. (20 points). Even though they shouldn't, some people try to feed the turtles bread and crackers. You set up a group of volunteers to watch out for this behavior, and stop anyone doing this. Your volunteers have to stop 3 people a day on average. In any day when more than 5 people are stopped, the Daily Texan will run an article about your vigilante force; after three such articles, UT will post signs telling people not to do this (unfortunately, this will not change people's behavior and your volunteers are still needed). For each of the following random variables, indicate the *name of the distribution family*, its *mean*, and its *variance*. If you need to make additional (reasonable) assumptions for this problem, state what they are.

- (a) (5) The number of people stopped per day.
- (b) (5) The time between people being stopped.
- (c) (5) The average number of people stopped over the next 100 days.
- (d) (5) The number of days until UT posts signs.

Problem 3. (15 points). You poll a large number of students about how many times per week they visit the turtle pond, giving the following results:

Times per week	0	1	2	3	4
Percent of responses	40	30	10	10	10

(a) (5) What is the expected number of times a student visits the turtle pond each week?

(b) (5) What is the standard deviation of the number of times a student visits the turtle pond per week?

(c) (5) Repeat parts (a) and (b), excluding students who never visit the turtles (those who answered 0).

Problem 4. (15 points). You now use the same survey data from Problem 3 to decide whether UT should build a new turtle pond outside ECJ. You find President Hartzell to be an intimidating figure, and will only ask him if you are very sure that at least 25% of students would visit the turtles frequently ("frequently" means students will visit the turtles *at least twice per week*). Assume that n = 100 for your survey.

- (a) (2) What are your null and alternative hypotheses?
- (b) (3) State what Type I and Type II errors are for this problem, without using any mathematical or statistical jargon.
- (c) (5) Do you ask Hartzell to build a new turtle pond? Use a significance level of 5% for your test.
- (d) (5) What is the smallest proportion of frequent visitors for which you would decide to ask Hartzell?

Problem 5. (15 points). As the summer goes on, you suspect there might be a relationship between the temperature (measured in Fahrenheit) and the number of daily visitors. You have collected the following data:

Temperature	85	87	91	95	114
Visitors	58	54	63	84	25

- (a) (5) What is the best-fit line relating visitors to temperature?
- (b) (5) What is the R^2 value?
- (c) (5) If it is 94 degrees, what is the probability that there are more than 60 visitors?

Problem 6. (15 points). Running the turtle club costs money, and for each month you calculate the difference between donations received, and expenses (healthy turtle food, and paying for the development of a TurtleCam app). This will give the monthly change in your club's account balance (positive means you have more money in your account than last month, negative means you have less).

The mean and standard deviation of these quantities are as follows: for donations, \$1000 and \$500; for turtle food, \$300 and \$200; and for development costs, \$800 and \$500. First assume that these three values are independent of each other.

- (a) (5) What is the expected monthly change in your account balance?
- (b) (5) What is the standard deviation of the monthly change in the account balance?
- (c) (5) Repeat parts (a) and (b) if the three quantities are no longer independent, but correlated in the following way: the correlation coefficient between donations and turtle food costs is +0.5; between donations and development costs, -0.1; and between turtle food and development costs, +0.4.