

CE 311S: Exam 1
Tuesday, February 27, 2018
8:00 – 9:15 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.
- The number of points associated with each part of each problem is indicated.

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

Problem 1. (25 points) After a few late nights having trouble finding a decent restaurant in West Campus, your friends convince you to open your own restaurant. Perhaps that Business Foundations certificate will help you sooner than you thought. You have the brilliant idea of opening SubwayBowl, a “fusion” restaurant based on your two favorite West Campus hangouts: Subway and Poke Bowl. Unfortunately, your restaurant seems to attract the bad luck of both of these. After opening your restaurant, there is a 60% chance that a drunk driver will crash into the building, requiring months of repairs.¹ Furthermore, if a drunk driver crashes into the building, the resulting media attention results in a 70% chance that your restaurant will be robbed. (Otherwise, the probability your restaurant will be robbed is only 30%).

- (a) (5) Are the possibilities of a robbery and a drunk driver crashing into the building independent? (Use the equation defining independence to answer this question.)
- (b) (5) What is the probability that your restaurant is neither robbed nor destroyed by a drunk driver?
- (c) (5) What is the probability that your restaurant is robbed?
- (d) (5) Assuming your restaurant is robbed, what is the probability that a drunk driver first crashed into the building?
- (e) (5) What is the probability that your restaurant suffers at least one of these two disasters?

¹Contrary to popular belief, such drivers can still be arrested even if they are UT students.

Problem 2. (20 points). Luckily, so far SubwayBowl has avoided any major disasters. Currently your signature menu item involves a bowl with 3 different ingredients mixed together, chosen from the following list:

Bread cubes	Salmon	Rice	American cheese
Black olives	Tuna	Secret sauce	Mayonnaise
Meatballs	Marinara	Seaweed	Wasabi

- (a) (5) How many different SubwayBowls can a customer order if they are *not* allowed to repeat ingredients in their order?
- (b) (5) How many different SubwayBowls can a customer order if they *are* allowed to repeat ingredients in their order?
- (c) (5) You want to advertise that customers can order a different SubwayBowl every day for all four years they are at UT (so, 1461 days).² What is the minimum number of ingredients you need to offer so that this is a true statement? Assume that customers are allowed to repeat ingredients when they order.
- (d) (5) Now assume that you want to keep the ingredients to the 12 listed above, but want to increase the number of ingredients that go into a SubwayBowl. What is the minimum number of ingredients per SubwayBowl so that there are more than 1461 different SubwayBowls? Assume that customers are allowed to repeat ingredients when they order.

²Your advertising conveniently ignores the fact that this includes SubwayBowls consisting only of a triple order of mayonnaise.

Problem 3. (30 points). Customers start trickling in, and SubwayBowl begins to get reviews listed on Yelp at an average rate of 3 per week. Some people were attracted by the concept, others because it was the closest restaurant nearby, and others out of morbid curiosity. The following table shows the distribution of Yelp reviews that your customers will leave:

Rating	Probability
1	0.4
2	0.2
3	0.2
4	0.1
5	0.1

- (a) (10) What are the expected value and standard deviation of the Yelp score left by a customer?
- (b) (5) What is the probability that you receive no Yelp reviews in a given week?
- (c) (10) How many Yelp reviews do you expect it will take before you receive a 5-star review? What is the variance of this number?
- (d) (5) What is the probability that at least two of the first 10 reviews will be either 4 or 5 stars?

Problem 4. (25 points). After extensive pestering, four of your friends also reluctantly open up SubwayBowl food trucks, so you now have a total of five SubwayBowl locations. Each month, there is a 25% chance that each SubwayBowl location will fail a health inspection visit (perhaps it wasn't such a good idea to use your shady brother-in-law's seafood company). Assume that these probabilities are independent across months and across all locations.

- (a) (10) What is the probability that you and two of your friends will fail health inspections during the first month?
- (b) (15) If three or more SubwayBowl locations fail health inspections in the same month, the Daily Texan will write a devastating exposé, resulting in a 15% chance that all of your locations are forced out of business. How many months do you expect it will take before all of your locations are forced to close?