STAT 1 **Name (Print):** _____
Fall 2020
Midterm Exam 2 **Last 4 digits of SID:** _____

Instructions:

- The exam is open book and open notes. You may not receive assistance from other people, including through forums or question and answer sites.
- There are 90 possible points. Each question part shows how many points it is worth.
- You may work directly on this exam using a tablet or by printing it out. If that is not convenient, you are also welcome to work on a separate sheet of paper.
- **You must show your work to receive credit on this exam!** This allows me to give partial credit. Correct solutions with no work shown will receive no credit.
- You do not need to show your work when finding probabilities for the standard normal distribution, where you should use the online calculator.
- Since this exam is handwritten, please sign and date the honesty statement. If you are working on separate paper, please sign and make it clear that your signature represents your agreement to the honesty statement.

Honesty Statement and Pledge:

I have not given or received any aid or assistance from other students or online question and answer sites for the full duration of the exam. Everything I have written on this exam represents my own work and knowledge. I sign this knowing that infringements on the University's Academic Integrity policy may result in failure or expulsion.

Signature: _____ **Date:** _____

1. (20 points) Your friend is taking a multiple choice exam and has not studied at all. They know that there will be six questions and that each question will have five choices (a, b, c, d, e). They decide to guess randomly the answer to each question.

   (a) (7 points) What is the probability that the first question they get right is the sixth question?

   (b) (7 points) What is the probability that they get at least one question correct?

   (c) (6 points) When using this guessing strategy, how many questions do you *expect* your friend to answer correctly?

2. (21 points) Suppose 79% of people like cats, 83% of people like dogs, and 77% like both.

   (a) (7 points) If we know that a randomly sampled person likes dogs, what's the probability that they also like cats?

   (b) (7 points) Is liking cats independent of liking dogs? Explain.

   (c) (7 points) Fill in the following joint probability distribution:

		Likes Cats	
		Yes	No	Total
Likes Dogs	Yes			
	No			
	Total			

3. Pedro and Song both ran in a local marathon. It's common for marathon racers to placed into age groups and Pedro ran in the group *Ages: 20-24* while Song ran in the group *Ages: 30-34*. Pedro ran the marathon in 4:00:29 (14429 seconds), while Song ran it in 4:06:13 (14773 seconds). The following information may be helpful:

   - The average marathon time for *Ages: 20-24* is 4:01:55 (14515 seconds) with a standard deviation of 0:42:03 (2523 seconds).
   - The average marathon time for *Ages: 30-34* is 4:07:35 (14855 seconds) with a standard deviation of 0:47:12 (2832 seconds).
   - Marathon finishing times for both groups are well-approximated by a Normal model.

   (a) (7 points) Who did better *within their respective age groups*?

   (b) (7 points) For a random sample of 25 runners from the group *Ages: 20-24*, what is the probability that their mean marathon time is between 3:45:00 (13500 seconds) and 4:15:00 (15300 seconds)?

   (c) (7 points) The current world record for the marathon is 2:01:39, set by Kenyan athlete Eliud Kipchoge in 2018. For a randomly selected athlete from the group *Ages: 30-34*, what is the probability that their time is faster than the world record?

4. For smokers, the probability of developing a severe lung infection at some point in their lifetime is 0.3.

   (a) (7 points) Suppose we take a random sample of 20 smokers. What distribution could you use to model their probability of developing a severe lung infection? Justify your answer by checking any necessary conditions.

   (b) (7 points) Find the mean and standard deviation number of smokers (from the sample of 20) who will develop a severe lung infection during their lifetimes.

   (c) (7 points) For our 20 smokers, find the probability that all 20 develop a severe lung infection during their lifetimes.

   (d) (7 points) For a random sample of 200 smokers, find the probability that between 50 and 75 of them develop a severe lung infection during their lifetimes.

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