

Name: _____ Perm: _____

TA Name and Time: _____

PSTAT 120A - Probability and Statistics

Midterm

Fall 2022

Instructions: This exam was written, with the intention of a student using their own 8.5×11 inch note sheet and calculator. You must show your work to receive full or partial credit. You may round answers to 4 decimal places.

You have 50 minutes to complete the exam. Make sure your name, perm number, TA name and section time are on the exam. Anyone found cheating will be given an “F” for the course and reported to the Office of Student Conduct. Good Luck

- (5 points) What is the probability that people in Jane's house (either Jane or her housemates) win all of the prizes?
- (5 points) What is the probability that people in Jane's house win exactly 2 of the prizes.
- (5 points) What is the probability that people in Jane's house win exactly 1 of the prizes.
- (5 points) What is the probability that people in Jane's house win less than 2 of the prizes.

Problem 2 (20 points). Netflix product evaluation team has hired people to rate all of their movies. Out of all of the raters, 59% of the raters carefully rate movies and rate 62% of the movies as good and 38% as bad. The other 41% of the raters are lazy raters and rate 100% of the movies as good.

- a. (5 points) Let G be the event the movie is rated 'Good', and C be the event the movie was rated by a careful rater. Fill in the joint distribution table below with the appropriate joint distribution values. (You are not required to fill in the marginal distribution values, but will not be penalized if you choose to.)

	G	\bar{G}
C		
\bar{C}		

- b. (5 points) What is the probability a randomly selected movie was rated by a careful rater and rated as bad?
- c. (5 points) Assuming all raters rate the same amount of movies, what is the probability that a randomly selected movie is rated good?
- d. (5 points) Given that a movie is rated as good, what is the probability it was rated by a careful rater?

Problem 3 (20 points). The PSTAT *Undergraduate Committee* has 6 student members. Three are Statistics majors, and the others are Data Science majors. The Department Chair will select 2 members, who will be the *conference committee*, to represent the Department at an upcoming conference. In the conference committee, everyone has equal rank (so order does not matter). Let E be the event of selecting two Statistics majors for the conference committee, D be the event that at least one Data Science major is selected for the conference committee, and S be the set of all possible outcomes for the Chair's decision. (Denote the different Statistics and Data Science Majors on the Undergraduate committee by E_1, E_2, E_3 , and D_1, D_2 , and D_3 respectively.)

- a. (2 points) How many different conference committees are possible?

- b. (2 point) List the outcomes in event E

- c. (2 point) List the outcomes in event \bar{D}

- d. (2 point) List the outcomes in the union $E \cup D$

- e. (2 point) List the outcomes in the intersection $E \cap D$

- f. (2 point) List the outcomes in the intersection $E \cap \bar{D}$

- g. (5 points) Let X = the number of Statistics Majors chosen for the committee. Find the probability mass function (PMF) of X .

- h. (5 points) Find the cumulative distribution (CDF) of X , and sketch a plot of it.

Problem 4 (20 points). You and I are playing a game. We start with 11 cards, where five are red and the rest are black. You randomly select 6 cards without looking (and without replacement), and record the number of cards of each color in your selection. Let X be the number of red cards in your selection.

- a. (5 points) What is the distribution of X ? Explain your answer and include any parameter values.
- b. (5 points) What is the probability that you will select the same number of cards of each color?
- b. (4 points) What is the probability that all six of the cards you select will be red cards?
- c. (6 points) What is the probability of the majority of cards selected being red?

- (4 points) What is the distribution of X ? (Check any relevant criteria and include any parameter values.)
- (6 points) Find the probability that exactly 20 of these tickets that will be paid on-time.
- (5 points) Find the probability that all of the tickets are paid on-time.
- (5 points) Find the probability that none of the tickets are paid on-time.

Scratch Paper

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