Dawson College

Mathematics Department

FINAL EXAMINATION

Probability and Statistics for Social Science

201-MA4-DW section 00001

May 21 , 2025

Student Name:_____

Student I.D#:_____

Instructor: Oxana Cerba

Time: 14:00 - 17:00

Instructions:

- Print your name and student ID number in the space provided on the Cover Sheet.
- All questions are to be answered directly on the examination paper in the space provided. Show your complete work and give explanations.
- ONLY SHARP EL-531*** are permitted.

This examination consists of 16 **questions. Please ensure that you have a complete examination.**

This examination must be returned intact.

Question #1. [3 points]

Backgammon is a board game for two players in which the playing pieces are moved according to the roll of two dice. Players win by removing all of their pieces from the board, so it is usually good to roll high numbers. You are playing backgammon with a friend and you roll two 6s in your first roll and two 6s in your second roll. Your friend rolls two 3s in his first roll and again in his second row. Your friend claims that you are cheating, because rolling double 6s twice in a row is very unlikely. Using probability (table or tree), show that your rolls were just as likely as his.

Question #2. [2+2+2+2 points]

Events A and B are such that P(A)= 0.2 and P(B)= 0.5. Are the following statements true or false? Justify your choice.

(a) If A and B are mutually exclusive, then $P(A \cap B) = 0.6$.

(b) If A and B are mutually exclusive, then $P(A \cup B) = 0.1$.

(c) If A and B are independent, then $P(A \cap B) = 0.1$.

(d) If A and B are independent, then $P(A \cup B) = 0.6$.

Question #3. [3+3 points]

Find the number of distinct license plates that are composed of a 3-capital letter sequence followed by a 3-digit sequence assuming:

(a) repetitions of letters and digits are allowed.

(b) repetitions of letters and digits are not allowed.

Question #4. [2+2+2+2 points]

The following table shows a random sample of 108 musicians and how they learned to play their instruments.

Gender	Self-Taught	Studied in School	Private Instruction	Total
Female	12	38	22	
Male	19	2	15	
Total				

(a) Find P(female musician).

(b) Find P(male musician AND had private instruction).

(c) Find P(female musician OR is self taught).

(d) Are the events 'being a female musician' and 'learning music in school' mutually exclusive events?

Question #5. [5 points]

Suppose 36% of families own a dog, 30% of families own a cat, and 22% of the families that have a dog also have a cat. A family is chosen at random and found to have a cat. What is the probability they also own a dog?

Question #6. [2+2+3 points]

The number of miles driven by a truck driver per day falls between 300 and 700, and follows a uniform distribution.

(a) Find the probability that the truck driver goes more than 650 miles in a day.

(b) Find the probability that the truck driver goes between 400 and 650 miles in a day.

(c) At least how many miles does the truck driver travel on the 10 percent of days with the highest mileage?

Question #7. [4+3 points]

Suppose that you are offered the following deal: You roll a die. If you roll a six, you win $10. If you roll a four or five, you win $5. If you roll a one, two, or three, you pay $6.

(a) Construct a distribution table.

(b) Over the long run of playing this game, what are your expected average winnings per game? should you take the deal?

Question #8**. [5 points]**

In a room of 29 students what is the probability that some (at least 2 of them) share a birthday? (Hint: Find the probability of the complement event)

Question #9. [2+3+3 points]

According to a study done by De Anza students, the height for Asian adult males is normally distributed with an average of 66 inches and a standard deviation of 2.5 inches. Suppose one Asian adult male is randomly chosen. Let X = height of the individual.

(a) Find the probability that the person is between 65 and 69 inches.

(b) Would you expect to meet many Asian adult males taller than 72 inches? Explain why or why not, and numerically justify your answer.

(c) The middle 40 percent of heights fall between what two values? Sketch the graph, and write the probability statement.

Question #10**. [4+4 points]**

Adverse growing conditions have caused 5% of grapefruit grown in a certain region to be of inferior quality. Grapefruit are sold by a box of 15.

(a) Find the average number of inferior quality grapefruit per box.

(b) A box that contains two or more grapefruit of inferior quality will cause a strong adverse customer reaction. Find the probability that a box of grapefruit will contain two or more grapefruit of inferior quality.

Question #11. [3+2 points]

A store randomly samples 603 shoppers over the course of a year and finds that 142 of them made their visit because of a coupon they'd received in the mail.

(a) Construct a 95% confidence interval for the fraction of all shoppers during the year whose visit was because of a coupon they'd received in the mail.

(b) Interpret it in this context.

Question #12**. [3+2 points]**

A consumer group took a sample of 51 grocery stores in Montreal and found that the average price of Tasty Flakes cereal in that sample was \$4.47 with a standard deviation of \$0.37. This consumer group is interested in a making a 98% confidence interval for the price of Tasty Flakes at all grocery stores in Montreal.

(a) Construct the 98% confidence interval.

(b) Interpret it in this context.

Question #13. **[4+2 points]**

The cost of a daily newspaper varies from city to city. A study was done to test the claim that the mean cost of a daily newspaper is \$1.00. Twelve costs yield a mean cost of 95¢ with a standard deviation of 18¢.

(a) Do the data support the claim at the 10 percent significance level?

(b) Compute the observed significance of the test (approximately).

Question #14. [4+2 points]

According to an article in a local poll, a city found that 14 percent of its residents walk for exercise. Suppose that a survey is conducted to determine this year's rate. Nine out of 70 randomly chosen city residents replied that they walk for exercise. Conduct a hypothesis test to determine if the rate is still 14 percent or if it has decreased.

(a) Conduct a hypothesis test to determine if the rate is still 14 percent or if it has decreased at the 1% level of significance.

(b) Compute the observed significance of the test.

Question #15. [4+3 points]

A sample of six persons admitted driving under the influence of alcohol. The court asked all to attend a series of counselling sessions. The following table gives the number of times these six persons drove under the influence of alcohol one month before and one month after attending the counselling sessions.

Before	11	8	13	6	4	12
After	7	9	8	3	4	8
Difference						

Let the paired difference be the number of times a person drives under the influence of alcohol during the one month period before attending the counselling sessions minus the number of times a person drives under the influence of alcohol during the one month period after attending the counselling sessions. Test at the 1% significance level whether attending the counselling sessions decreases the mean number of times all persons drive under the influence of alcohol.

Question #16. **[6 points]**

Describe Will Rogers' paradox with a supporting numerical example.

ANSWERS

Question #1.$P((6,6) \cap (6,6)) = P((3,3) \cap (3,3)) = \frac{1}{36*36} = 0.00077$

Question #2.(a) False,(b) False, (c)True, (d) True.

Question #3. $(a) 26^3 * 10^3 = 17576000, (b) 26 * 25 * 24 * 10 * 9 * 8 = 11232000$

Question #4. (a)0.6667 (b)0.1388 (c)70.8426 (d) No

Question #5. $P(D|C) = 0.264$

Question #6. (a)0.1272 (b) 0.6234 (c) 660

Question #7. (b)0.3333

Question #8. 68.097%

Question #9.(a) 0.5403 (b) 0.0082, (c) [64.7, 67.3]

Question #10.(a) 0.75 (b) 0.171

Question #11. [0.206, 0.274]

Question #12. [4.35, 4.59]

Question #13. (a) $-1.796 < -0.96$ (b)$0.15 > 0.10$

Question #14. (a) $-2.325 < -0.275$ (b)$0.3897 > 0.01$

Question #15. $\bar{d}$=2.5 , s=2.249 2.521 < 3.365 fail to reject

Question #16.