CS 361 Sample Midterm 1

NAME:

NETID:

CIRCLE YOUR DISCUSSION:

Thu 2-3 **Thu 4-5** **Fri 10-11** **Fri 11-12**

- Be sure that your exam booklet has 6 pages including this cover page
- Make sure to write your name exactly as it appears on your i-card
- Write your netid and circle your discussion section on this page
- **Show your work**
- This is a closed book exam
- You are allowed one handwritten 8.5 x 11-inch sheet of notes (both sides)
- You may **not** use a calculator or any other electronic device
- Turn off your phone and store it in your backpack
- Store away any other electronic devices including earphones and smartwatches
- Absolutely no interaction between students is allowed
- Use backs of pages for scratch work if needed
- Show your i-card when handing in your exam

Problem	1	2	3	4	5	Total
Possible	30	30	30	30	30	150
Score						

Problem 1 (30 pts)

1. (10 points) Say you score 40 points out of 50 on Homework 1. Then you score 50 out of 50 on each of the remaining 9 homework assignments. Are your homework scores symmetric, left-skewed or right-skewed? Justify your answer with calculation.

   Circle one answer: SYMMETRIC LEFT-SKEWED RIGHT-SKEWED

2. (20 points) Let $\{x\}$ be a dataset consisting of N real numbers, $x_1, \ldots, x_N$. Show that the function $f(\mu) = \sum_i (x_i - \mu)^2$ is minimized when $\mu = \text{mean}(\{x\})$.

Problem 2 (30 pts) Suppose a teacher gives a multiple choice test of 10 questions to N students. Let x_i and y_i be the number of questions that the ith student gets right and wrong, respectively.

1. (10 points) Write a formula for mean($\{y\}$) in terms of mean($\{x\}$). Draw a box around your answer.

2. (10 points) Write a formula for std($\{y\}$) in terms of std($\{x\}$). Draw a box around your answer.

3. (10 points) Show that corr($\{(x, y)\}$) $= -1$

Problem 3 (30 pts)

1. (15 points) You draw a card uniformly at random from a standard deck. Let R be the event that the card is red and let B be the event the card is black. Are R and B independent? Draw a box around your answer. Justify your answer with calculation.

2. (15 points) A student takes a multiple choice test. Each question has 4 answer choices. If the student knows the answer to a question, the student gives the right answer. Otherwise, the student guesses uniformly at random from among the answer choices. The student knows the answer to 60% of the questions. Let K be the event that student knows the answer to a question and let C be the event that the students answers that question correctly. Calculate $P(K|C)$. Draw a box around your answer.

Problem 4 (30 pts)

1. (15 points) Suppose you make a bet on the roll of a fair six-sided die. If the die comes up 6, you win \$60. Otherwise, you lose \$30. Let random variable W be your net winnings. Calculate $E[W]$. Draw a box around your answer.

2. (15 points) Suppose you make the same bet as above three times in a row. Let random variable T be your total net winnings after these three bets. Calculate $P(T \geq 0)$. You do not need to simplify your answer. Draw a box around your answer.

Problem 5 (30 pts)

1. (15 points) If I attempt 20 free throws, what is the probability that I score more than 10 points? Assume that each free throw attempt is independent. Also assume that on each free throw attempt, I earn 1 point with probability p and 0 points with probability $1 - p$. You may use choose and summation notation in your answer. Draw a box around your answer.

2. (15 points) Suppose the daily number of car accidents per mile of road is a Poisson random variable with intensity $\lambda = 0.001$. What is the probability that there are 10 accidents on 1000 miles of road in a week? You do not need to simplify your answer. Draw a box around your answer.