CS556 Fall 2022 Test 2

Name:

Closed book: no textbook, no electronic devices, one sheet of paper with handwritten notes. *Read carefully before answering!* Write your answers on this test paper. Also hand in your note sheet, with your name on it.

Question 1 *(5 points)* Suppose an individual is randomly selected from the population of all adult males living in the United States. Let A be the event that the selected individual is over 6 ft in height, and let B be the event that the selected individual is a professional basketball player. Which do you think is larger, $P(A|B)$ or $P(B|A)$? Why?

Question 2 *(20 points)* The accompanying table gives information on the type of coffee selected by someone purchasing a single cup at a particular airport kiosk. Consider randomly selecting such a coffee purchaser.

	Small	**Medium**	**Large**
Regular	14%	20%	26%
Decaf	20%	10%	10%

- What is the probability that the individual purchased a small cup?

- If we learn that the selected individual purchased a small cup, what now is the probability that he/she chose decaf coffee?

- If we learn that the selected individual purchased decaf, what now is the probability that a small size was selected?

Question 3 *(15 points)* Owners of a car rental company have determined that if they charge customers p dollars per day to rent a car, where $60 \leq p \leq 150$, the number of cars n they rent per day can be modeled by the linear function $n(p) = 750 - 5p$. If they charge $60 per day or less, they will rent all their cars. If they charge $150 per day or more, they will not rent any cars. Assuming the owners plan to charge customers between $60 per day and $150 per day to rent a car, how much should they charge to maximize their revenue?

Question 4 *(10 points)* Compute the derivative of $f(x) = (4 - x^2)^3$.

Question 5 *(10 points)* Compute the gradient of $f(x, y) = (y + 2) + xysin(x)$ at $(0, 1)$.

Question 6 *(10 points)* This question considers the wind speeds of Hurricane Katrina, which affected New Orleans, Louisiana, in August 2005.

Hours after Midnight, August 26	1	5	11	29	49	58	73	81	85	107
Wind Speed (mph)	45	75	100	115	145	175	155	125	95	35

Using the table above, estimate the derivative of the wind speed at hour 83 using the forward, backward and central difference methods.

Question 7 *(10 points)* The concentration of a substance is normally distributed with $\mu = 0.3$ and $\sigma = 0.06$. (Round up to two decimal points. For example you should round 2.176 to 2.18).

1. What is the probability that the concentration is at most 0.10?

2. What is the probability that the concentration exceeds 0.25?

3. How would you characterize the largest 5% of all concentration values?

Question 8 *(20 points)* Given $f(x) = \sqrt{\frac{(x-1)(x-2)}{(x-3)(x-4)(x-5)}}$, find the derivative $f'(x)$ using logarithmic differentiation.

Question 9 *(5 points)* **BONUS** Complete the sentence. Be creative.
    In the rest of the semester, I am hoping for ...