BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI, DUBAI CAMPUS

DUBAI INTERNATIONAL ACADEMIC CITY, DUBAI
SECOND SEMESTER 2024 – 2025
DEPARTMENT OF COMPUTER SCIENCE

#Questions: 5
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COURSE : Foundation of Data Science (CS F320)	
COMPONENT : Midsem exam (Closed Book)	**WEIGHTAGE :** 30% (30 Marks)
DATE : 21-10-2024, Monday	**DURATION :** 90 mins (8:30 am – 10:00 am)

Note:
  a. Calculator is allowed to be brought in the exam room.
  b. Make suitable assumptions wherever required.

Q.1: Answer the followings: [4+3=7]
  a) Explain Gaussian distribution with the help of its formula and curve. Also, mention at least 3 characteristics of this distribution.
  b) Distinguish between convex and non-convex functions using their graphical representations. Can convex functions have saddle points?

Q.2: Write the equations for beta distribution and B function. The duration of study time is a random variable X (in hour) of a student follows beta distribution. It has $\alpha=3$ and $\beta=2$. Perform the followings. **[3+3=6]**
  a) What is the chance that his study time will be between 1/3 to 1/2 of the day.
  b) For the range $R=2X^2+10X-3$. Find the expected value of X.

Q.3: A new medical test has been developed to detect a certain disease. The test is 95% accurate, meaning that it correctly identifies 95% of people who have the disease and 95% of people who do not have the disease. It is known that 1% of the population has the disease. If a person tests positive for the disease, what is the probability that they actually have the disease? **[3]**

Q. 4: A function $f(x)=13x\cos(x) - 11\sin(x) + 21x$ to be optimized in the interval between -5 to 5 with $\alpha=0.2$ and $\beta=0.8$. There are two methods to update the x values using gradient descent method. **[6]**
Method I: x_next = x - $\alpha \times f'(x)$
Method II: x_next = $\beta \times x - (1-\beta) \times f'(x)$

Initial value of x is set as 1.0. Determine the first order derivative for f(x) (i.e., f '(x)). Compute the values for f '(x) and x_next using both above methods for 3 iterations.

[Hint: f '(sin(x))=cos(x) and f '(cos(x))=-sin(x)]

Q. 5: A computer vendor, in UAE, prepares quotation for two types of order: type A and type B. The order includes monitors and cabinets (consisting of CPU unit, RAM, etc.). In the order A, customer requires 5 units of monitor and 11 units of cabinet, and in the order B, customer requires 16 units of monitor and 22 units of cabinet. The profit earned for A is 3300 AED and for B is 4130 AED. The vendor has 81 units of monitor and 110 units of cabinets. He wants to maximize the profit. Attempt the followings: (use the roundoff value for the fractional orders)

[2+3+3=8]

  a) Assign the variables and formulate this optimization problem, write the objective function and constraints.
  b) Using the graphical and linear programming methods solve the optimization problem and how many numbers of type A and B orders should be made?
  c) How much maximum profit earned by him?

********** ALL THE BEST ********