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GATE AIR - 13

M.Tech in Data Science From IIT Guwahati

Expertise in Machine Learning, Deep Learning, Artificial Intelligence, Probability and Statistics

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Problems of Week 4 (August)

Note : These Problems of the Day (POTD) will be the cornerstone of your entire GATE Data Science preparation. Keep in mind, that the goal is to focus on the learning experience these problems offer, rather than just finding the answers.

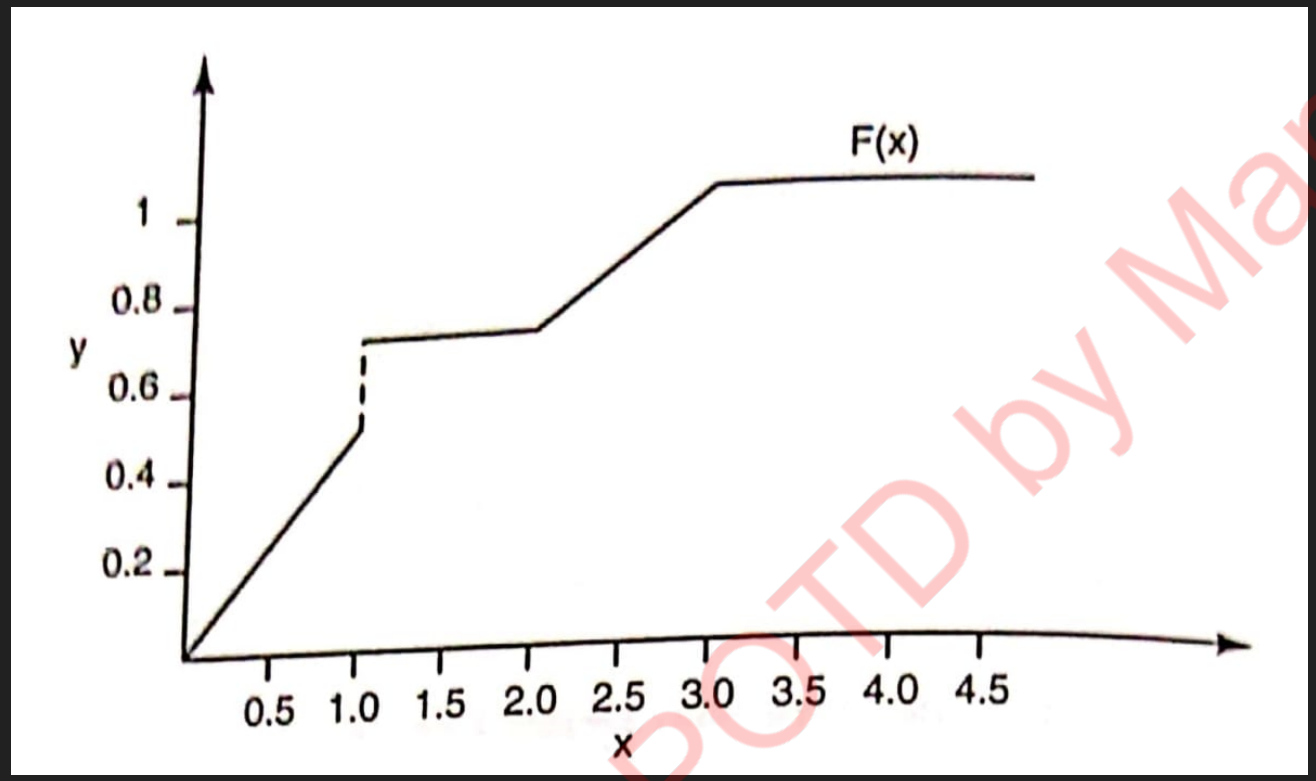
Start engaging with them now, and you'll notice a significant difference in your exam—trust me.

Happy learning!

POTD #16

Given a random variable X, its cumulative distribution function $F(x)$ is represented on the **y-axis** of the graph provided.

Find $P(X = 1)$.



POTD #17

A hiker is lost in the forest and comes across a fork in the trail that offers three different paths. The hiker randomly chooses one of the paths, each of which leads to a different outcome. The first path takes the hiker to a ranger station, which represents safety, after 4 hours. The second path leads the hiker to a dense area of the forest, but after 3 hours, the hiker finds themselves back at the fork where they started. The third path takes the hiker to a riverbank, forcing them to return to the fork after 6 hours of travel. Assuming the hiker is equally likely to choose any of the three paths, what is the expected time until the hiker finally reaches safety at the ranger station?

POTD #18

A gardener is planting seeds in a row in his garden. Each seed he plants has a 20% chance of growing into a flower, and the outcome of each planting is independent of the others.

What is the expected number of seeds the gardener needs to plant until he sees **two consecutive flowers** in his garden?

POTD #19 [MSQ]

Consider the matrix A and the equation $A\mathbf{x} = \mathbf{b}$, where:

$$A = \begin{bmatrix} 1 & 2 \\ -1 & -2 \\ -2 & -4 \end{bmatrix}$$

Which of the following statements are **correct** regarding the system $A\mathbf{x} = \mathbf{b}$?

(A) The system does not have a solution for any vector $\mathbf{b}$.

(B) For matrix A, all columns are on the same line and all rows are on the same line.

(C) For a vector $\mathbf{b}$ that is in the opposite direction to the first column of A, no solution exists.

(D) The column space of the zero matrix is a line.

(E) All rows and columns of matrix A lie on the same line.

POTD #20 [MSQ]

Given a matrix A of size 3×4, determine which of the following statements are correct:

1. The equation $A\mathbf{x} = 0$ will have a solution only when $\mathbf{x}$ is the zero vector.
2. If matrix A with rank r is broken into two matrices: C, which contains the first r independent columns of A, and R, then the number of dependent columns in A and R would be the same.
3. If matrix A is broken into C and R as described in option 2, then the rank of R is always equal to the number of columns in C.
4. If the matrix A is multiplied by another matrix of size 4×4 with full rank, the rank of the resulting matrix could be greater than the rank of A.

POTD #21[MSQ]

Which of the following statement(s) about the initialization of neural network weights is/are true?

Options:

1. Two different initializations of the same network could converge to different minima.
2. For a given initialization, gradient descent will converge to the same minima irrespective of the learning rate.
3. The weights should be initialized to a constant value.
4. The initial values of the weights should be sampled from a probability distribution.

Similar Gate Problems

Suppose the probability that a coin toss shows "head" is p, where $0 < p < 1$. The coin is tossed repeatedly until the first "head" appears. The expected number of tosses required is:

(a) $\frac{p}{1-p}$

(b) $\frac{(1-p)}{p}$

(c) $\frac{1}{p}$

(d) $\frac{1}{p^2}$

Similar Gate Problems

Passengers try repeatedly to get a seat reservation in any train running between two stations until they are successful. If there is 40% chance of getting a reservation in any attempt by a passenger, then the average number of attempts that passengers need to make to get a seat reserved is _____.

Similar Gate Problems

Let the random variable X represent the number of times a fair coin needs to be tossed till two consecutive heads appear for the first time. The expectation of X is _____.

Similar Gate Problems

A fair die with faces $\{1, 2, 3, 4, 5, 6\}$ is thrown repeatedly till '3' is observed for the first time. Let X denote the number of times the die is thrown. The expected value of X is _____.

Similar Gate Problems

In any given year, the probability of an earthquake greater than magnitude 6 occurring in the Garhwal Himalayas is 0.04. The average time between successive occurrences of such an earthquake is _____ (in years).

Similar Gate Problems

A fair six-sided die (with faces numbered 1, 2, 3, 4, 5, 6) is repeatedly thrown independently.

What is the expected number of times the die is thrown until **two consecutive throws of even numbers** are seen?

Similar Gate Problems

The probability mass function $P(x)$ of a discrete random variable X is given by $P(x) = \frac{1}{2^x}$, where $x = 1, 2, \ldots, \infty$. The expected value of X is _____ [in integer].

Free answers and solutions link-

https://unacademy.com/class/potd-week-4-august/MPE8NJQC

Discuss your Doubts here - https://t.me/ManojGateDA