NPTEL Online Certification Courses

Indian Institute of Technology Kharagpur

Deep Learning

Assignment- Week 0

TYPE OF QUESTION: MCQ/MSQ

Number of questions: 10 **Total mark: 10 X 1 = 10**

QUESTION 1:

Find $\frac{df}{dx}$ where $f = |x|$? $|x|$ means absolute of x.

a. 1
b. $Sign(x)$
c. 0
d. ∞

Correct Answer: b

Detailed Solution:

$$\frac{df}{dx} = \begin{cases} 1 & x > 0 \\ -1 & x < 0 = sign(x) \\ 0 & x = 0 \end{cases}$$

QUESTION 2:

Find $\frac{d\sigma}{dx}$, where $\sigma(x) = \frac{1}{1+e^{-x}}$

a. $\frac{d\sigma}{dx} = 1 - \sigma(x)$
b. $\frac{d\sigma}{dx} = 1 + \sigma(x)$
c. $\frac{d\sigma}{dx} = \sigma(x)(1 - \sigma(x))$
d. $\frac{d\sigma}{dx} = \sigma(x)(1 + \sigma(x))$

Correct Answer: c

Detailed Solution:

$$\sigma(x) = \frac{1}{1+e^{-x}}$$

$$\frac{d\sigma}{dx} = (1+e^{-x})^{-2} * e^{-x}$$

$$\frac{d\sigma}{dx} = \frac{e^{-x}}{(1+e^{-x})^2} = \frac{1+e^{-x}-1}{(1+e^{-x})^2} = \frac{1}{1+e^{-x}} - \frac{1}{(1+e^{-x})^2} = \frac{1}{1+e^{-x}}\left(1 - \frac{1}{1+e^{-x}}\right)$$

$$\frac{d\sigma}{dx} = \sigma(x)(1-\sigma(x))$$

QUESTION 3:

There are 5 black 7 white balls. Assume we have drawn two balls randomly one by one without any replacement. What will be the probability that both balls are black?

a. $20/132$
b. $25/144$
c. $20/144$
d. $25/132$

Correct Answer: a

Detailed Solution:

Probability of first ball being black $= \mathbf{5/(5+7) = 5/12.}$

Probability of drawing second ball black is $= \mathbf{4/(4+7) = 4/11.}$

Now overall probability of both balls being black $= \mathbf{(5/12) \times (4/11) = 20/132}$

QUESTION 4:

Two dices are rolled together. What will be the probability of getting 1 and 4 together?

a. $1/18$
b. $1/36$
c. 1
d. None of the above

Correct Answer: a

Detailed Solution:

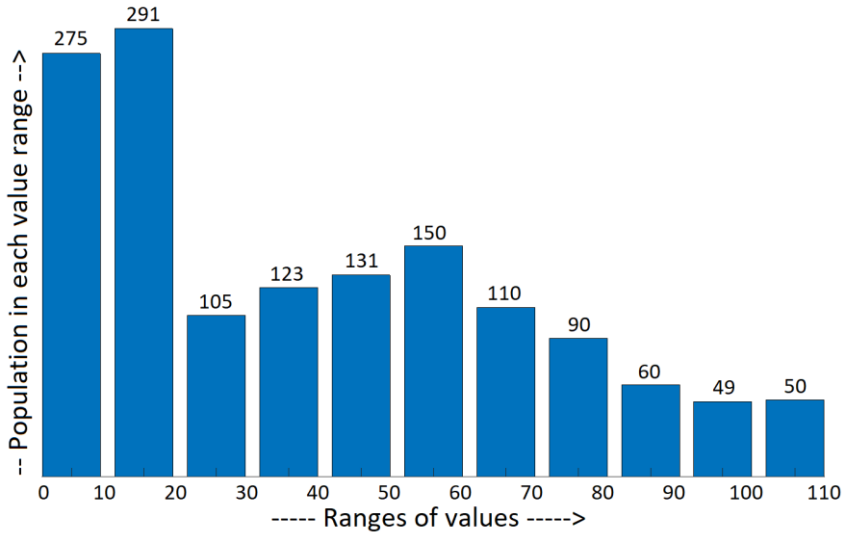
Number of possible outcomes $= (6 \times 6) = 36.$

Number of times getting 1 & 4 together $=$ **2 (where 1 in first dice, 4 in second dice or 4 in first dice, 1 in second dice).**

So, probability $= 2/36 = 1/18$

QUESTION 5:

What will be possible median of the distribution?



a. 26
b. 34
c. 43
d. 55

Correct Answer: b

Detailed Solution:

Total Population $= (275 + 291 + 105 + 123 + 131 + 150 + 110 + 90 + 60 + 49 + 50) = 1434.$

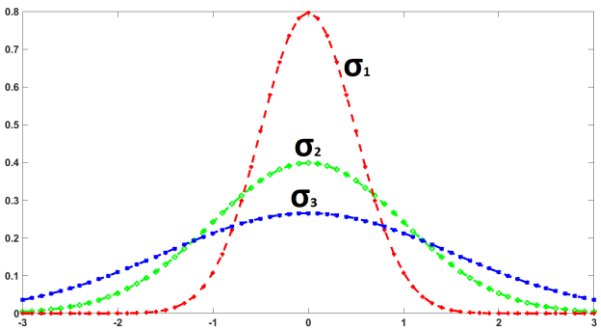
So, median is the average of $(1434/2) = 717^{th}$ value and 718^{th} value.

So, median of the distribution is in the range of $30 - 40$.

So, option b may be the result.

QUESTION 6:

Image shows there normally distributed probability distribution function with zero mean and three different variances $(\sigma_1, \sigma_2, \sigma_3)$. Which of the following relationship is valid?



a. $\sigma_1 > \sigma_2 > \sigma_3$
b. $\sigma_1 < \sigma_2 < \sigma_3$
c. $\sigma_1 = \sigma_2 = \sigma_3$
d. $\sigma_1 > \sigma_2 < \sigma_3$

Correct Answer: b

Detailed Solution:

Higher variance means the spread of the distribution will be higher. So, $\sigma_1 < \sigma_2 < \sigma_3$

QUESTION 7:

Matrix inverse of a square matrix A exists if.

a. Determinant of A, $det(A) = 0$
b. Eigen values of A are non-zero
c. Sum of eigen values are non-zero
d. None of the above

Correct Answer: b

Detailed Solution:

Matrix inverse exists if $det(A)$ is not equal to zero. $det(A)$ = product of all the eigen values of the square matrix.

QUESTION 8:

x_1, x_2, x_3 are the linearly independent vectors. If $x_1 = \begin{bmatrix}1\\3\\0\end{bmatrix}, x_2 = \begin{bmatrix}-2\\4\\-5\end{bmatrix}$, what is the possible value of x_3?

a. $\begin{bmatrix}-1\\7\\-5\end{bmatrix}$

b. $\begin{bmatrix}0\\10\\-5\end{bmatrix}$

c. $\begin{bmatrix}3\\4\\5\end{bmatrix}$

d. $\begin{bmatrix}5\\-5\\10\end{bmatrix}$

Correct Answer: c

Detailed Solution:

$\boldsymbol{X = [x_1 \quad x_2 \quad x_3]}$**. x_1, x_2, x_3 are linearly independent if $determinant(X)/det(X) = 0$**

$$det\left(\begin{bmatrix}1 & -2 & 3\\3 & 4 & 4\\0 & -5 & 5\end{bmatrix}\right) \neq 0$$

We also can validate linear dependency of option a, b, d.

Option a: $x_1 + x_2 = x_3$,

Option b: $2x_1 + x_2 = x_3$,

Option d: $x_1 - 2x_2 = x_3$

QUESTION 9:

$$x + 2y - z = 1 \quad \cdots\cdots\cdots (1)$$
$$-2x - 4y + 2z = -2 \quad \cdots\cdots\cdots (2)$$
$$z = 2 \quad \cdots\cdots\cdots (3)$$

What are the values of x, y, z?

a. $x = 0, y = 0, z = 2$
b. $z = 2$ and infinitely possible x, y
c. $z = 2$ and no possible x, y
d. None of the above

Correct Answer: b

Detailed Solution:

QUESTION 10:

What are the eigen values of the matrix A?

$$A = \begin{bmatrix} 5 & 4 \\ -3 & -2 \end{bmatrix}$$

a. $4, -3$
b. $5, -2$
c. $-2, -1$
d. $2,\ 1$

Correct Answer: d

Detailed Solution:

$\boldsymbol{det(\lambda I - A) = 0}$

$\boldsymbol{or, det\left(\begin{bmatrix} \lambda - 5 & -4 \\ 3 & \lambda + 2 \end{bmatrix}\right) = 0\ or, (\lambda - 5)(\lambda + 2) + 12 = 0\ \ or, \lambda^2 - 3\lambda + 2 = 0\ \ or, \lambda = 2, 1}$

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