GATE 2025 15th Feb 25 S1

Candidate ID	DA25S58013096
Candidate Name	SATYAM KUMAR PANT
Test Center Name	iON Digital Zone iDZ Teenpani
Test Date	15/02/2025
Test Time	9:30 AM - 12:30 PM
Subject	DA Data Science and Artificial Intelligence

Section : **General Aptitude**

Q.1 We _____ tennis in the lawn when it suddenly started to rain.

Select the most appropriate option to complete the above sentence.

Options

A. would have been playing

B. could be playing

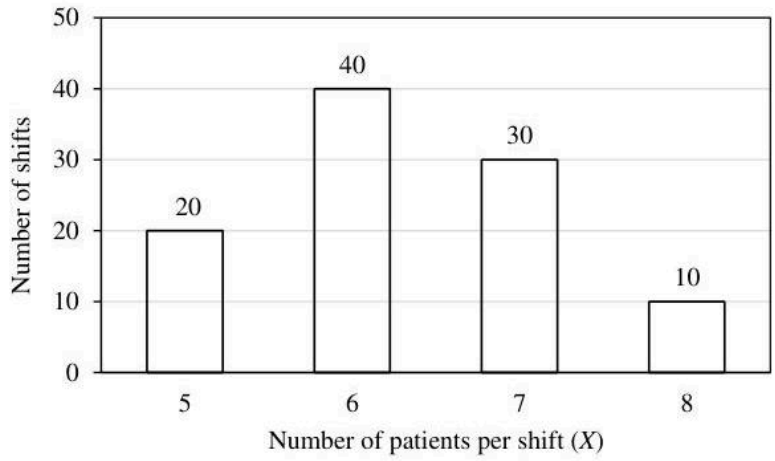
C. had been playing

D. have been playing

Question Type : **MCQ**
Question ID : **142276863**
Status : **Not Answered**
Chosen Option : **--**

Q.2 The number of patients per shift (X) consulting Dr. Gita in her past 100 shifts is shown in the figure. If the amount she earns is ₹ $1000(X - 0.2)$, what is the average amount (in ₹) she has earned per shift in the past 100 shifts?

Note: The figure shown is representative.



Options

A. 6,500

B. 6,300

C. 6,000

D. 6,100

Question Type : **MCQ**
Question ID : **142276871**
Status : **Answered**
Chosen Option : **B**

Q.3 Weight of a person can be expressed as a function of their age. The function usually varies from person to person. Suppose this function is identical for two brothers, and it monotonically increases till the age of 50 years and then it monotonically decreases. Let a_1 and a_2 (in years) denote the ages of the brothers and $a_1 < a_2$.

Which one of the following statements is correct about their age on the day when they attain the same weight?

Options

A. $a_1 < 50 < a_2$

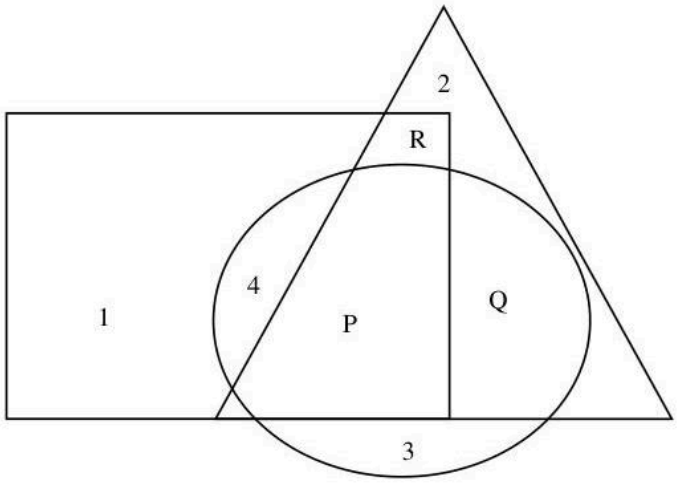
B. $50 < a_1 < a_2$

C. $a_1 < a_2 < 50$

D. Either $a_1 = 50$ or $a_2 = 50$

Question Type : **MCQ**
Question ID : **142276868**
Status : **Answered**
Chosen Option : **D**

Q.4 In the given figure, the numbers associated with the rectangle, triangle, and ellipse are 1, 2, and 3, respectively. Which one among the given options is the most appropriate combination of P, Q, and R ?



Options

A. $P = 3; Q = 6; R = 6$

B. $P = 6; Q = 5; R = 3$

C. $P = 5; Q = 3; R = 6$

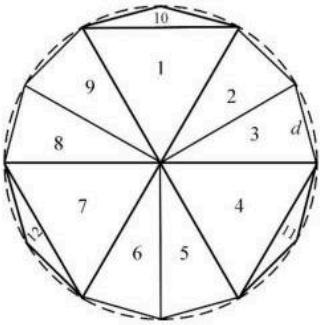
D. $P = 5; Q = 6; R = 3$

Question Type : **MCQ**
Question ID : **142276865**
Status : **Not Answered**
Chosen Option : **--**

Q.5 A regular dodecagon (12-sided regular polygon) is inscribed in a circle of radius r cm as shown in the figure. The side of the dodecagon is d cm. All the triangles (numbered 1 to 12) in the figure are used to form squares of side r cm and each numbered triangle is used only once to form a square.

The number of squares that can be formed and the number of triangles required to form each square, respectively, are:

Note: The figure shown is representative.



Options

A. 3; 2

B. 3; 3

C. 3; 4

D. 4; 3

Question Type : **MCQ**
Question ID : **142276869**
Status : **Answered**
Chosen Option : **B**

Q.6 Column-I has statements made by Shanthala; and, Column-II has responses given by Kanishk.

Column-I		Column-II	
P.	This house is in a mess.	1.	Alright, I won't bring it up during our conversations.
Q.	I am not happy with the marks given to me.	2.	Well, you can easily look it up.
R.	Politics is a subject I avoid talking about.	3.	No problem, let me clear it up for you.
S.	I don't know what this word means.	4.	Don't worry, I will take it up with your teacher.

Identify the option that has the correct match between Column-I and Column-II.

Options

A. P – 4; Q – 1; R – 2; S – 3

B. P – 1; Q – 2; R – 4; S – 3

C. P – 2; Q – 3; R – 1; S – 4

D. P – 3; Q – 4; R – 1; S – 2

Question Type : **MCQ**
Question ID : **142276867**
Status : **Answered**
Chosen Option : **D**

Q.7 A 4×4 digital image has pixel intensities (U) as shown in the figure. The number of pixels with $U \leq 4$ is:

0	1	0	2
4	7	3	3
5	5	4	4
6	7	3	2

Options

A. 11

B. 8

C. 3

D. 9

Question Type : **MCQ**
Question ID : **142276864**
Status : **Answered**
Chosen Option : **A**

Q.8

If a real variable x satisfies $3^{x^2} = 27 \times 9^x$, then the value of $\frac{2^{x^2}}{(2^x)^2}$ is:

Options

A. 2^3

B. 2^0

C. 2^{15}

D. 2^{-1}

Question Type : **MCQ**
Question ID : **142276870**
Status : **Answered**
Chosen Option : **A**

Q.9

Courage : Bravery :: Yearning : _____

Select the most appropriate option to complete the analogy.

Options

A. Yawning

B. Yelling

C. Longing

D. Glaring

Question Type : **MCQ**
Question ID : **142276862**
Status : **Not Answered**
Chosen Option : **--**

Q.10

A rectangle has a length L and a width W, where L > W. If the width, W, is increased by 10%, which one of the following statements is correct for all values of L and W?

Options

A. The rectangle becomes a square.

B. Length of the diagonals increases by 10%.

C. Perimeter increases by 10%.

D. Area increases by 10%.

Question Type : **MCQ**
Question ID : **142276866**
Status : **Answered**
Chosen Option : **D**

Section : **DA Data Science and Artificial Intelligence**

Q.1 Let p and q be any two propositions. Consider the following propositional statements.

$S_1 : p \rightarrow q, \quad S_2 : \neg p \wedge q, \quad S_3 : \neg p \vee q, \quad S_4 : \neg p \vee \neg q,$

where $\wedge$ denotes conjunction (AND operation), $\vee$ denotes disjunction (OR operation), and $\neg$ denotes negation (NOT operation). Which one of the following options is correct?

(Note: $\equiv$ denotes logical equivalence)

Options

A. $S_2 \equiv S_4$

B. $S_2 \equiv S_3$

C. $S_1 \equiv S_3$

D. $S_1 \equiv S_4$

Question Type : **MCQ**
Question ID : **142276876**
Status : **Answered**
Chosen Option : **C**

Q.2 The number of additions and multiplications involved in performing Gaussian elimination on any $n \times n$ upper triangular matrix is of the order

Options

A. $O(n^2)$

B. $O(n)$

C. $O(n^3)$

D. $O(n^4)$

Question Type : **MCQ**
Question ID : **142276873**
Status : **Marked For Review**
Chosen Option : **C**

Q.3 $\lim_{t \rightarrow +\infty} \sqrt{t^2 + t} - t = \_\_\_\_\_$

(Round off to one decimal place)

Given Answer : **.5**

Question Type : **NAT**
Question ID : **142276893**
Status : **Answered**

Q.4 For which of the following inputs does binary search take time $O(\log n)$ in the worst case?

Options

A. A linked list of n integers in any order

B. An array of n integers in any order

C. A linked list of n integers in increasing order

D. An array of n integers in increasing order

Question Type : **MSQ**
Question ID : **142276888**
Status : **Answered**
Chosen Option : **D**

Q.5 Consider a hash table of size 10 with indices $\{0, 1, \ldots, 9\}$, with the hash function

$$h(x) = 3x \pmod{10},$$

where linear probing is used to handle collisions. The hash table is initially empty and then the following sequence of keys is inserted into the hash table: $1, 4, 5, 6, 14, 15$. The indices where the keys 14 and 15 are stored are, respectively

Options

A. 4 and 6

B. 4 and 5

C. 2 and 6

D. 2 and 5

Question Type : **MCQ**
Question ID : **142276879**
Status : **Answered**
Chosen Option : **A**

Q.6 Consider designing a linear classifier

$$y = \text{sign}(f(x; w, b)), \quad f(x; w, b) = w^\top x + b$$

on a dataset $D = \{(x_1, y_1), (x_2, y_2), \ldots, (x_N, y_N)\}$, $x_i \in \mathbb{R}^d, y_i \in \{+1, -1\}$, $i = 1, 2, \ldots, N$. Recall that the sign function outputs +1 if the argument is positive, and -1 if the argument is non-positive. The parameters w and b are updated as per the following training algorithm:

$$w_{new} = w_{old} + y_n x_n, \quad b_{new} = b_{old} + y_n$$

whenever $\text{sign}(f(x_n; w_{old}, b_{old})) \neq y_n$. In other words, whenever the classifier wrongly predicts a sample (x_n, y_n) from the dataset, w_{old} gets updated to w_{new}, and likewise b_{old} gets updated to b_{new}. Consider the case $(x_n, +1)$, $f(x_n; w_{old}, b_{old}) < 0$. Then

Options

A. $f(x_n; w_{new}, b_{new}) > f(x_n; w_{old}, b_{old})$

B. $f(x_n; w_{new}, b_{new}) < f(x_n; w_{old}, b_{old})$

C. $f(x_n; w_{new}, b_{new}) = f(x_n; w_{old}, b_{old})$

D. $y_n f(x_n; w_{old}, b_{old}) > 1$

Question Type : **MCQ**
Question ID : **142276883**
Status : **Answered**
Chosen Option : **A**

Q.7 Which of the following statements is/are correct in a Bayesian network?

Options

A. Gibbs sampling is an exact inference algorithm

B. Rejection sampling is an approximate inference algorithm

C. Variable elimination is used to determine conditional probabilities

D. Variable elimination is an approximate inference algorithm

Question Type : **MSQ**
Question ID : **142276887**
Status : **Answered**
Chosen Option : **B,C**

Q.8 Given data $\{(-1, 1), (2, -5), (3, 5)\}$ of the form (x, y), we fit a model $y = wx$ using linear least-squares regression. The optimal value of w is _____

(Round off to three decimal places)

Given Answer : **.25**

Question Type : **NAT**
Question ID : **142276895**
Status : **Answered**

Q.9 If a relational decomposition is not dependency-preserving, which one of the following relational operators will be executed more frequently in order to maintain the dependencies?

Options

A. Selection

B. Projection

C. Set union

D. Join

Question Type : **MCQ**
Question ID : **142276877**
Status : **Answered**
Chosen Option : **B**

Q.10 It is given that $P(X \geq 2) = 0.25$ for an exponentially distributed random variable X with $E[X] = \frac{1}{\lambda}$, where $E[X]$ denotes the expectation of X. What is the value of λ?
($\ln$ denotes natural logarithm)

Options

A. $\ln 4$

B. $\ln 3$

C. $\ln 0.25$

D. $\ln 2$

Question Type : **MCQ**
Question ID : **142276882**
Status : **Answered**
Chosen Option : **D**

Q.11 Let X be a continuous random variable whose cumulative distribution function (CDF) $F_X(x)$, for some t, is given as follows:

$$F_X(x) = \begin{cases} 0 & x \leq t \\ \frac{x-t}{4-t} & t \leq x \leq 4 \\ 1 & x \geq 4 \end{cases}$$

If the median of X is 3, then what is the value of t?

Options

A. 2

B. -1

C. 0

D. 1

Question Type : **MCQ**
Question ID : **142276880**
Status : **Answered**
Chosen Option : **A**

Q.12 Let $f(x) = \frac{e^x - e^{-x}}{2}, x \in \mathbb{R}$. Let $f^{(k)}(a)$ denote the k^{th} derivative of f evaluated at a.
What is the value of $f^{(10)}(0)$? (Note: ! denotes factorial)

Options
A. 1
B. 0
C. $\frac{2}{10!}$
D. $\frac{1}{10!}$

Question Type : **MCQ**
Question ID : **142276875**
Status : **Answered**
Chosen Option : **B**

Q.13 Let $A = I_n + xx^\top$, where I_n is the $n \times n$ identity matrix and $x \in \mathbb{R}^n$, $x^\top x = 1$. Which of the following options is/are correct?

Options
A. Rank of A is n
B. 0 is an eigenvalue of A
C. A is invertible
D. A^{-1} has a negative eigenvalue

Question Type : **MSQ**
Question ID : **142276889**
Status : **Answered**
Chosen Option : **A,C**

Q.14 On a relation named **Loan** of a bank:

Loan		
loan_number	**branch_name**	**amount**
L11	Banjara Hills	90000
L14	Kondapur	50000
L15	SR Nagar	40000
L22	SR Nagar	25000
L23	Balanagar	80000
L25	Kondapur	70000
L19	SR Nagar	65000

the following SQL query is executed.

```
SELECT L1.loan_number
FROM Loan L1
WHERE L1.amount > (SELECT MAX (L2.amount)
                   FROM Loan L2
                   WHERE L2.branch_name = 'SR Nagar');
```

The number of rows returned by the query is _____(Answer in integer)

Given Answer : **3**

Question Type : **NAT**
Question ID : **142276894**
Status : **Answered**

Q.15 There are three boxes containing white balls and black balls.

Box-1 contains 2 black and 1 white balls.

Box-2 contains 1 black and 2 white balls.

Box-3 contains 3 black and 3 white balls.

In a random experiment, one of these boxes is selected, where the probability of choosing Box-1 is $\frac{1}{2}$, Box-2 is $\frac{1}{6}$, and Box-3 is $\frac{1}{3}$. A ball is drawn at random from the selected box. Given that the ball drawn is white, the probability that it is drawn from Box-2 is _____(Round off to two decimal places)

Given Answer : **.25**

Question Type : **NAT**
Question ID : **142276892**
Status : **Answered**

Q.16 Let C_1 and C_2 be two sets of objects. Let $D(x, y)$ be a measure of dissimilarity between two objects x and y. Consider the following definitions of dissimilarity between C_1 and C_2.

$$\textbf{DIS-1}(C_1, C_2) = \max_{x \in C_1,\, y \in C_2} D(x, y)$$

$$\textbf{DIS-2}(C_1, C_2) = \min_{x \in C_1,\, y \in C_2} D(x, y)$$

Which of the following statements is/are correct?

Options

A. Single Linkage Clustering uses **DIS-2**

B. Single Linkage Clustering uses **DIS-1**

C. Complete Linkage Clustering uses **DIS-2**

D. Complete Linkage Clustering uses **DIS-1**

Question Type : **MSQ**
Question ID : **142276891**
Status : **Answered**
Chosen Option : **A,D**

Q.17 Consider the following three relations:

`Car (model, year, serial, color)`

`Make (maker, model)`

`Own (owner, serial)`

A tuple in `Car` represents a specific car of a given `model`, made in a given `year`, with a `serial` number and a `color`. A tuple in `Make` specifies that a `maker` company makes cars of a certain `model`. A tuple in `Own` specifies that an `owner` owns the car with a given `serial` number. Keys are underlined; (`owner`, `serial`) together form key for `Own`. ($\bowtie$ denotes natural join)

$$\pi_{\texttt{owner}}(\texttt{Own} \bowtie (\sigma_{\texttt{color}=\text{“}red\text{”}}(\texttt{Car} \bowtie (\sigma_{\texttt{maker}=\text{“}ABC\text{”}}\texttt{Make}))))$$

Which one of the following options describes what the above expression computes?

Options

A. All owners of a red car, a car made by ABC, or a red car made by ABC

B. All red cars made by ABC

C. All owners of a red car made by ABC

D. All owners of more than one car, where at least one car is red and made by ABC

Question Type : **MCQ**
Question ID : **142276878**
Status : **Answered**
Chosen Option : **C**

Q.18 Let $X = aZ + b$, where Z is a standard normal random variable, and a, b are two unknown constants. It is given that

$$E[X] = 1, \quad E[(X - E[X])Z] = -2, \quad E[(X - E[X])^2] = 4,$$

where $E[X]$ denotes the expectation of random variable X. The values of a, b are:

Options
A. $a = 2, b = -1$
B. $a = -2, b = -1$
C. $a = -2, b = 1$
D. $a = 1, b = 1$

Question Type : **MCQ**
Question ID : **142276881**
Status : **Answered**
Chosen Option : **C**

Q.19 Consider the following Python declarations of two lists.

```
A=[1,2,3]

B=[4,5,6]
```

Which one of the following statements results in A= $[1, 2, 3, 4, 5, 6]$?

Options
A. `A.extend(B)`
B. `A.append(B)`
C. `A.update(B)`
D. `A.insert(B)`

Question Type : **MCQ**
Question ID : **142276884**
Status : **Answered**
Chosen Option : **A**

Q.20 Suppose X and Y are random variables. The conditional expectation of X given Y is denoted by $E[X|Y]$. Then $E[E[X|Y]]$ equals

Options
A. $E[Y]$
B. $\frac{E[X]}{E[Y]}$
C. $E[X|Y]$
D. $E[X]$

Question Type : **MCQ**
Question ID : **142276872**
Status : **Not Answered**
Chosen Option : **--**

Q.21 Suppose that insertion sort is applied to the array $[1, 3, 5, 7, 9, 11, x, 15, 13]$ and it takes exactly two swaps to sort the array. Select all possible values of x.

Options

A. 12

B. 16

C. 14

D. 10

Question Type : **MSQ**
Question ID : **142276890**
Status : **Answered**
Chosen Option : **B,C,D**

Q.22 Which of the following statements is/are correct?

Options

A. Linearly independent vectors in $\mathbb{R}^n$ are orthonormal

B. $\mathbb{R}^n$ does not have a unique set of orthonormal basis vectors

C. $\mathbb{R}^n$ has a unique set of orthonormal basis vectors

D. Orthonormal vectors $\mathbb{R}^n$ are linearly independent

Question Type : **MSQ**
Question ID : **142276886**
Status : **Answered**
Chosen Option : **B,D**

Q.23 Consider two functions $f : \mathbb{R} \to \mathbb{R}$ and $g : \mathbb{R} \to (1, \infty)$. Both functions are differentiable at a point c. Which of the following functions is/are ALWAYS differentiable at c? The symbol $\cdot$ denotes product and the symbol $\circ$ denotes composition of functions.

Options

A. $f \cdot g$

B. $f \pm g$

C. $f \circ g + g \circ f$

D. $\frac{f}{g}$

Question Type : **MSQ**
Question ID : **142276885**
Status : **Answered**
Chosen Option : **A,B,C**

Q.24 The naive Bayes classifier is used to solve a two-class classification problem with class-labels y_1, y_2. Suppose the prior probabilities are $P(y_1) = \frac{1}{3}$ and $P(y_2) = \frac{2}{3}$. Assuming a discrete feature space with

$$P(x|y_1) = \frac{3}{4} \quad \text{and} \quad P(x|y_2) = \frac{1}{4}$$

for a specific feature vector x. The probability of misclassifying x is _____

(Round off to two decimal places)

Given Answer : **.44**

Question Type : **NAT**
Question ID : **142276896**
Status : **Answered**

Q.25 The sum of the elements in each row of $A \in \mathbb{R}^{n \times n}$ is 1. If $B = A^3 - 2A^2 + A$, which one of the following statements is correct (for $x \in \mathbb{R}^n$)?

Options

A. The equation $Bx = 0$ has a unique solution

B. The equation $Bx = 0$ has exactly two solutions

C. The equation $Bx = 0$ has no solution

D. The equation $Bx = 0$ has infinitely many solutions

Question Type : **MCQ**
Question ID : **142276874**
Status : **Answered**
Chosen Option : **D**

Q.26 Consider a database relation R with attributes ABCDEFG, and having the following functional dependencies:

$A \rightarrow BCEF$ $E \rightarrow DG$ $BC \rightarrow A$

Which of the following statements is/are correct?

Options

A. A is the only candidate key of R

B. Relation R is not in Boyce-Codd Normal Form (BCNF)

C. A, BC are the candidate keys of R

D. A, BC, E are the candidate keys of R

Question Type : **MSQ**
Question ID : **142276918**
Status : **Answered**
Chosen Option : **B,C**

Q.27 Which of the following statements is/are correct about the rectified linear unit (ReLU) activation function defined as $\text{ReLU}(x) = \max(x, 0)$, where $x \in \mathbb{R}$?

Options

A. ReLU is differentiable everywhere

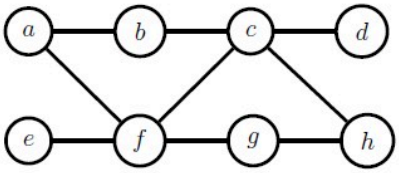
B. $\text{ReLU}(x) = \text{ReLU}(ax)$, for all $a \in \mathbb{R}$

C. ReLU is continuous everywhere

D. ReLU is not differentiable at $x = 0$

Question Type : **MSQ**
Question ID : **142276909**
Status : **Answered**
Chosen Option : **C,D**

Q.28 Let G be a simple, unweighted, and undirected graph. A subset of the vertices and edges of G are shown below.



It is given that $a - b - c - d$ is a shortest path between a and d; $e - f - g - h$ is a shortest path between e and h; $a - f - c - h$ is a shortest path between a and h. Which of the following is/are NOT the edges of G?

Options

A. (b, d)

B. (e, g)

C. (b, g)

D. (b, h)

Question Type : **MSQ**
Question ID : **142276919**
Status : **Answered**
Chosen Option : **A,B,D**

Q.29 Consider the following Python code snippet.

```
def f(a,b):
    if (a==0):
        return b
    if (a%2==1):
        return 2*f((a-1)/2,b)
    return b+f(a-1,b)
print(f(15,10))
```

The value printed by the code snippet is _____(Answer in integer)

Given Answer : **160**

Question Type : **NAT**
Question ID : **142276924**
Status : **Answered**

Q.30 A bag contains 5 white balls and 10 black balls. In a random experiment, n balls are drawn from the bag one at a time with replacement. Let S_n denote the total number of black balls drawn in the experiment.

The expectation of S_{100} denoted by $E[S_{100}] =$ _____

(Round off to one decimal place)

Given Answer : **66.7**

Question Type : **NAT**
Question ID : **142276922**
Status : **Answered**

Q.31 Consider the following pseudocode.

```
Create empty stack S
Set x=0, flag=0, sum=0
Push x onto S
while (S is not empty){
   if (flag equals 0){
      Set x = x+1
      Push x onto S}
   if (x equals 8):
      Set flag=1
   if (flag equals 1){
      x = Pop(S)
      if (x is odd):
         Pop(S)
      Set sum = sum + x}
 }
 Output sum
```

The value of `sum` output by a program executing the above pseudocode is _____

(Answer in integer)

Given Answer : **24**

Question Type : **NAT**
Question ID : **142276925**
Status : **Answered**

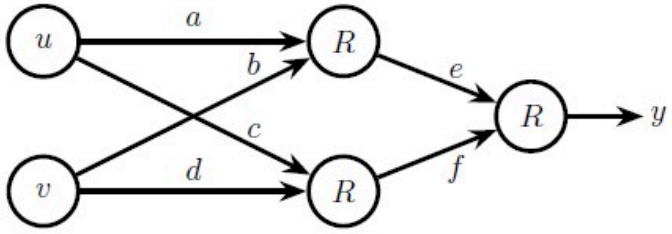
Q.32 Consider the neural network shown in the figure with

inputs: u, v

weights: a, b, c, d, e, f

output: y

R denotes the ReLU function, $R(x) = \max(0, x)$.



Given $u = 2, v = 3$,

$a = 1, b = 1, c = 1, d = -1, e = 4, f = -1$,

which one of the following is correct?

Options

A. $\frac{\partial y}{\partial a} = 1, \frac{\partial y}{\partial f} = 0$

B. $\frac{\partial y}{\partial a} = 1, \frac{\partial y}{\partial f} = -1$

C. $\frac{\partial y}{\partial a} = 2, \frac{\partial y}{\partial f} = -1$

D. $\frac{\partial y}{\partial a} = 8, \frac{\partial y}{\partial f} = 0$

Question Type : **MCQ**
Question ID : **142276903**
Status : **Not Answered**
Chosen Option : **--**

Q.33 Consider the following Python code snippet.

```
A={"this","that"}
B={"that","other"}
C={"other","this"}
while "other" in C:
    if "this" in A:
      A,B,C=A-B,B-C,C-A
    if "that" in B:
      A,B,C=C|A,A|B,B|C
```

When the above program is executed, at the end, which of the following sets contains "this"?

Options

A. Only A

B. Only B

C. Only C

D. A, C

Question Type : **MCQ**
Question ID : **142276908**
Status : **Answered**
Chosen Option : **B**

Q.34 Consider designing a linear binary classifier $f(x) = \text{sign}(w^\top x + b)$, $x \in \mathbb{R}^2$ on the following training data:

$$\text{Class-1: } \left\{ \begin{pmatrix} 2 \\ 0 \end{pmatrix}, \begin{pmatrix} 0 \\ 2 \end{pmatrix}, \begin{pmatrix} 2 \\ 2 \end{pmatrix} \right\}, \text{Class-2: } \left\{ \begin{pmatrix} 0 \\ 0 \end{pmatrix} \right\}$$

Hard-margin support vector machine (SVM) formulation is solved to obtain w and b.

Which of the following options is/are correct?

Options

A. The margin is $\sqrt{2}$

B. The number of support vectors is 3

C. Training accuracy is 98%

D. $w = \begin{pmatrix} 4 \\ 4 \end{pmatrix}$ and $b = 1$

Question Type : **MSQ**
Question ID : **142276914**
Status : **Answered**
Chosen Option : **A,B**

Q.35 Let $f : \mathbb{R} \to \mathbb{R}$ be a twice-differentiable function and suppose its second derivative satisfies $f''(x) > 0$ for all $x \in \mathbb{R}$. Which of the following statements is/are ALWAYS correct?

Options

A. f has a local minima

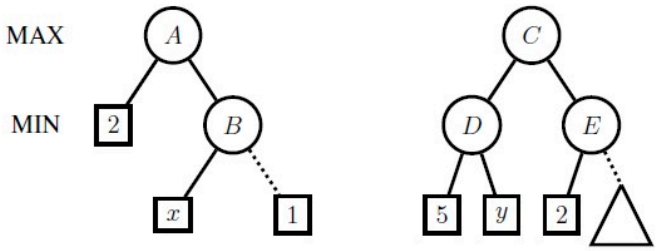
B. There does not exist x and y, $x \neq y$, such that $f'(x) = f'(y) = 0$

C. f has at most one global minimum

D. f has at most one local minimum

Question Type : **MSQ**
Question ID : **142276912**
Status : **Marked For Review**
Chosen Option : **A,C**

Q.36 Consider game trees Tree-1 and Tree-2 as shown. The first level is a MAX agent and the second level is a MIN agent. The value in the square node is the output of the utility function.



Tree-1 Tree-2

For what ranges of x and y, the right child of node B and the right child of node E will be pruned by alpha-beta pruning algorithm?

Options

A. $x \in [1, \infty)$ and $y \in (-\infty, 5]$

B. $x \in (-\infty, 2]$ and $y \in (-\infty, 5]$

C. $x \in (-\infty, 2]$ and $y \in [2, \infty)$

D. $x \in [1, \infty)$ and $y \in (-\infty, 2]$

Question Type : **MCQ**
Question ID : **142276904**
Status : **Answered**
Chosen Option : **C**

Q.37 Consider the function $f(x) = \frac{x^3}{3} + \frac{7}{2}x^2 + 10x + \frac{133}{2}$, $x \in [-8, 0]$. Which of the following statements is/are correct?

Options A. The minimum value of the derivative of f is attained at $x = -\frac{7}{2}$

B. The minimum value of f is attained at $x = -2$

C. The maximum value of f is $\frac{133}{2}$

D. The maximum value of f is attained at $x = -5$

Question Type : **MSQ**
Question ID : **142276910**
Status : **Marked For Review**
Chosen Option : **B,D**

Q.38 Let $f : \mathbb{R} \to \mathbb{R}$ be such that $|f(x) - f(y)| \leq (x - y)^2$ for all $x, y \in \mathbb{R}$. Then $f(1) - f(0) =$ _____(Answer in integer)

Given Answer : **1**

Question Type : **NAT**
Question ID : **142276920**
Status : **Answered**

Q.39 Let x_1, x_2, x_3, x_4, x_5 be a system of orthonormal vectors in $\mathbb{R}^{10}$. Consider the matrix $A = x_1x_1^\top + \ldots + x_5x_5^\top$. Which of the following statements is/are correct?

Options A. Singular values of A are also its eigenvalues

B. Singular values of A are either 0 or 1

C. A is invertible

D. Determinant of A is 1

Question Type : **MSQ**
Question ID : **142276911**
Status : **Answered**
Chosen Option : **B,C**

Q.40 A random experiment consists of throwing 100 fair dice, each die having six faces numbered 1 to 6. An event A represents the set of all outcomes where at least one of the dice shows a 1. Then, $P(A) =$

Options

A. $\left(\frac{5}{6}\right)^{100}$

B. $1-\left(\frac{5}{6}\right)^{100}$

C. 1

D. 0

Question Type : **MCQ**
Question ID : **142276906**
Status : **Answered**
Chosen Option : **B**

Q.41 Consider the following two relations, named `Customer` and `Person`, in a database:

```
Person (
      aadhaar CHAR(12) PRIMARY KEY,
      name VARCHAR(32));
Customer (
      name VARCHAR(32),
      email VARCHAR(32) PRIMARY KEY,
      phone CHAR(10),
      aadhaar CHAR(12),
         FOREIGN KEY (aadhaar) REFERENCES Person(aadhaar));
```

Which of the following statements is/are correct?

Options

A. `phone` can be NULL in the `Customer` relation

B. `aadhaar` is a candidate key in the `Person` relation

C. `aadhaar` is a candidate key in the `Customer` relation

D. `aadhaar` can be NULL in the `Person` relation

Question Type : **MSQ**
Question ID : **142276917**
Status : **Answered**
Chosen Option : **A,B**

Q.42 Consider the following tables, **Loan** and **Borrower**, of a bank.

Loan		
loan_num	**branch_name**	**amount**
L11	Banjara Hills	90000
L14	Kondapur	50000
L15	SR Nagar	40000
L22	SR Nagar	25000
L23	Balanagar	80000
L25	Kondapur	70000
L19	SR Nagar	65000

Borrower	
customer_name	**loan_num**
Anand	L11
Karteek	L11
Karteek	L14
Ankita	L15
Gopal	L19
Karteek	L22
Karteek	L23
Sunil	L23
Sunil	L25

Query: $\pi_{\text{branch\_name, customer\_name}}(\textbf{Loan} \bowtie \textbf{Borrower}) \div \pi_{\text{branch\_name}}(\textbf{Loan})$

where $\bowtie$ denotes natural join.

The number of tuples returned by the above relational algebra query is _____

(Answer in integer)

Given Answer : **1**

Question Type : **NAT**
Question ID : **142276923**
Status : **Marked For Review**

Q.43 An $n \times n$ matrix A with real entries satisfies the property: $\|Ax\|^2 = \|x\|^2$, for all $x \in \mathbb{R}^n$, where $\|\cdot\|$ denotes the Euclidean norm. Which of the following statements is/are ALWAYS correct?

Options

A. The eigenvalues of A are either $+1$ or -1

B. A must be orthogonal

C. A has full rank

D. $A = I$, where I denotes the identity matrix, is the only solution

Question Type : **MSQ**
Question ID : **142276913**
Status : **Answered**
Chosen Option : **A,C**

Q.44 Let $A \in \mathbb{R}^{n \times n}$ be such that $A^3 = A$. Which one of the following statements is ALWAYS correct?

Options

A. The sum of the diagonal elements of A is 1

B. Determinant of A is 0

C. A and A^2 have the same rank

D. A is invertible

Question Type : **MCQ**
Question ID : **142276898**
Status : **Answered**
Chosen Option : **D**

Q.45 Consider the cumulative distribution function (CDF) of a random variable X:

$$F_X(x) = \begin{cases} 0 & x \leq -1 \\ \frac{1}{4}(x+1)^2 & -1 \leq x \leq 1 \\ 1 & x \geq 1 \end{cases}$$

The value of $P(X^2 \leq 0.25)$ is

Options

A. 0.5

B. 0.625

C. 0.5625

D. 0.25

Question Type : **MCQ**
Question ID : **142276900**
Status : **Answered**
Chosen Option : **C**

Q.46 Let $\{x_1, x_2, \ldots, x_n\}$ be a set of linearly independent vectors in $\mathbb{R}^n$. Let the (i,j)-th element of matrix $A \in \mathbb{R}^{n \times n}$ be given by $A_{ij} = x_i^\top x_j$, $1 \leq i, j \leq n$. Which one of the following statements is correct?

Options

A. Determinant of A is 0

B. $z^\top A z = 0$ for some non-zero $z \in \mathbb{R}^n$

C. 0 is a singular value of A

D. A is invertible

Question Type : **MCQ**
Question ID : **142276899**
Status : **Answered**
Chosen Option : **B**

Q.47 Consider a directed graph $G = (V, E)$, where $V = \{0, 1, 2, \ldots, 100\}$ and $E = \{(i, j) : 0 < j - i \leq 2, \text{for all } i, j \in V\}$. Suppose the adjacency list of each vertex is in *decreasing* order of vertex number, and depth-first search (DFS) is performed at vertex 0. The number of vertices that will be discovered after vertex 50 is _____(Answer in integer)

Given Answer : --

Question Type : **NAT**
Question ID : **142276926**
Status : **Not Answered**

Q.48 For $x \in \mathbb{R}$, the floor function is denoted by $f(x) = \lfloor x \rfloor$ and defined as follows

$$\lfloor x \rfloor = k, \quad k \leq x < k + 1,$$

where k is an integer. Let $Y = \lfloor X \rfloor$, where X is an exponentially distributed random variable with mean $\frac{1}{\ln 10}$, where $\ln$ denotes natural logarithm. For any positive integer ℓ, one can write the probability of the event $Y = \ell$ as follows

$$P(Y = \ell) = q^{\ell}(1 - q)$$

The value of q is

Options

A. 0.5

B. 0.01

C. 0.434

D. 0.1

Question Type : **MCQ**
Question ID : **142276902**
Status : **Not Attempted and Marked For Review**
Chosen Option : **--**

Q.49 Consider a two-class problem in $\mathbb{R}^d$ with class labels *red* and *green*. Let μ_{red} and μ_{green} be the means of the two classes. Given test sample $x \in \mathbb{R}^d$, a classifier calculates the squared Euclidean distance (denoted by $\|\cdot\|^2$) between x and the means of the two classes and assigns the class label that the sample x is closest to. That is, the classifier computes

$$f(x) = \|\mu_{red} - x\|^2 - \|\mu_{green} - x\|^2$$

and assigns the label *red* to x if $f(x) < 0$, and *green* otherwise. Which of the following statements is/are correct?

Options

A. f is a linear function of x

B. f is a quadratic polynomial in x

C. The sample $x = 0$ is assigned the label *green* if $\|\mu_{red}\| < \|\mu_{green}\|$

D. $f(x) = w^\top x + b$, where w and b are functions of μ_{red} and μ_{green}

Question Type : **MSQ**
Question ID : **142276916**
Status : **Marked For Review**
Chosen Option : **B,D**

Q.50 Consider a fact table in an OLAP application: `Facts(D1, D2, val)`, where `D1` and `D2` are its dimension attributes and `val` is a dependent attribute. Suppose attribute `D1` takes 3 values and `D2` takes 2 values, and all combinations of these values are present in the table `Facts`. How many tuples are there in the result of the following query?

```
SELECT D1, D2, sum(val)
FROM Facts
GROUP BY CUBE (D1, D2);
```

Options

A. 6

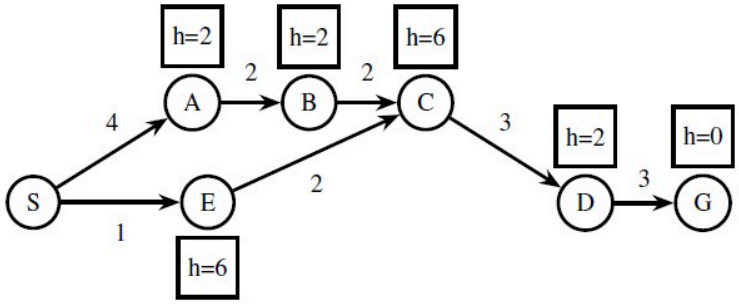
B. 1

C. 12

D. 9

Question Type : **MCQ**
Question ID : **142276907**
Status : **Not Answered**
Chosen Option : **--**

Q.51 The state graph shows the action cost along the edges and the heuristic function h associated with each state.



Suppose A^* algorithm is applied on this state graph using priority queue to store the frontier. In what sequence are the nodes expanded?

Options

A. S,A,B,E,C,D,G

B. S,A,E,C,B,D,G

C. S,A,E,B,C,D,G

D. S,E,A,C,B,D,G

Question Type : **MCQ**
Question ID : **142276905**
Status : **Answered**
Chosen Option : **C**

Q.52 A random variable X is said to be distributed as $Bernoulli(\theta)$, denoted by $X \sim Bernoulli(\theta)$, if

$$P(X = 1) = \theta, \quad P(X = 0) = 1 - \theta$$

for $0 < \theta < 1$. Let $Y = \sum_{i=1}^{300} X_i$, where $X_i \sim Bernoulli(\theta)$, $i = 1, 2, \ldots, 300$ be independent and identically distributed random variables with $\theta = 0.25$. The value of $P(60 \leq Y \leq 90)$, after approximation through Central Limit Theorem, is given by

(Recall that $\phi(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{t^2}{2}}\, dt$)

Options

A. $\phi(2) - \phi(-2)$

B. $\phi(3) - \phi(-3)$

C. $\phi(1) - \phi(-1)$

D. $\phi(90) - \phi(60)$

Question Type : **MCQ**
Question ID : **142276901**
Status : **Not Attempted and Marked For Review**
Chosen Option : **--**

Q.53 Let $Y = Z^2$, $Z = \dfrac{X-\mu}{\sigma}$, where X is a normal random variable with mean μ and variance σ^2. The variance of Y is

Options

A. 3

B. 4

C. 2

D. 1

Question Type : **MCQ**
Question ID : **142276897**
Status : **Answered**
Chosen Option : **D**

Q.54 Consider a coin-toss experiment where the probability of head showing up is p. In the i^{th} coin toss, let $X_i = 1$ if head appears, and $X_i = 0$ if tail appears. Consider

$$\widehat{p} = \frac{1}{n}\sum_{i=1}^{n} X_i$$

where n is the total number of independent coin tosses.

Which of the following statements is/are correct?

Options

A. As n increases, variance of $\widehat{p}$ decreases

B. $E[\widehat{p}] = \dfrac{p}{n}$

C. Variance of $\widehat{p}$ does not depend on n

D. $E[\widehat{p}] = p$

Question Type : **MSQ**
Question ID : **142276915**
Status : **Answered**
Chosen Option : **C,D**

Q.55 Let $D = \{x^{(1)}, \ldots, x^{(n)}\}$ be a dataset of n observations where each $x^{(i)} \in \mathbb{R}^{100}$. It is given that $\sum_{i=1}^{n} x^{(i)} = 0$. The covariance matrix computed from D has eigenvalues $\lambda_i = 100^{2-i}$, $1 \le i \le 100$. Let $u \in \mathbb{R}^{100}$ be the direction of maximum variance with $u^\top u = 1$.

The value of

$$\frac{1}{n}\sum_{i=1}^{n} \left(u^\top x^{(i)}\right)^2 = \_\_\_\_\_$$

(Answer in integer)

Given Answer : **1**

Question Type : **NAT**
Question ID : **142276921**
Status : **Answered**