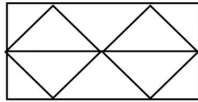


Real Test-01

DA & AI

- Q1** In the figure shown below, various horizontal and vertical segments divide the outer shape into multiple regions. How many rectangles and triangles are there in the figure?



- (A) Two rectangles & Twelve triangles
 (B) Five rectangles & Ten triangles
 (C) Six rectangles & Twelve triangles
 (D) Eight rectangles & Eleven triangles
- Q2** Train P leaves station A at 08:00 hours and reaches station B at 12:00 noon. Train Q leaves station B at 09:00 hours and reaches station A at 15:00 hours. Assuming both trains travel at constant speeds, at what exact time do the two trains cross each other?
 (A) 10:15 hours
 (B) 10:36 hours
 (C) 10:48 hours
 (D) 11:30 hours
- Q3** Two fair dice are thrown simultaneously. In how many possible outcomes is the number shown on the top face of the first die greater than the number on the bottom face of the second die?
 (A) 18
 (B) 36
 (C) 6
 (D) 15
- Q4** Select the most appropriate meaning of the underlined idiom.
 The actor decided to live life **in the fast lane**.
 (A) Racing away to the moon
 (B) A life of extreme speed
 (C) A life filled with excitement
 (D) Dropping charges of crime
- Q5** Select the most appropriate synonym of the given word.
LUCID
 (A) Lucky
 (B) Timely
 (C) Clear
 (D) Happy
- Q6** Which of the following powers of 6 is the largest factor of : $1 \times 2 \times 3 \times 4 \times 5 \dots \times 89 \times 90$.

- (A) 6^{24}
 (B) 6^{44}
 (C) 6^{34}
 (D) 6^{18}

- Q7** In a bakery, Rohan can bake half as many cakes as Meera in one-sixth of the time it takes Meera. If they decide to work together, they can bake all the cakes in 10 days. How many days would Meera need to bake all the cakes by herself?

- (A) 40 days
 (B) 25 days
 (C) 30 days
 (D) 35 days

- Q8** The given sentence contains a grammatical error. Identify the segment that contains the error.
 Smitha was offered the job although having no qualifications.

- (A) although having
 (B) Smitha was offered
 (C) the job
 (D) no qualifications

- Q9** A rectangular sheet of cardboard has its sides in the ratio 1:4. Riya keeps cutting it in half along the longer side. After several cuts, she wonders: after how many cuts will the rectangle again have the same 1:4 ratio of sides?

- (A) 4 cuts
 (B) 6 cuts
 (C) 3 cuts
 (D) Never

- Q10** A chef intends to fill a display case with 20 cupcakes, reaching its full capacity. Every 30 seconds, he adds 2 cupcakes, but a mischievous helper takes 1 cupcake out. How much time will it take for all 20 cupcakes to be in the display case for the first time?

- (A) 600 seconds
 (B) 328 seconds
 (C) 570 seconds
 (D) 300 seconds

- Q11** Given the function $f(x) = \frac{2x}{x^2+1}$, find the range of the function

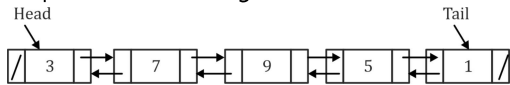
- (A) [-1, 1]
 (B) [0, ∞)
 (C) $(-\infty, 0]$
 (D) [-2, 2]

- Q12** Given a doubly linked list where each node has two references (prev and next): one that points



to a previous node and another that points to a next node.

Assume the linked list below and provide the output for the following two lines.

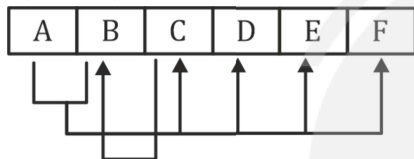


The list is restored to its initial state before each line executes:

```
Line1: print(head.next.next.next.prev.prev.data)
Line2:
print(tail.prev.prev.prev.prev.next.next.data)
```

- Which of the options is correct.
- (A) Output of line 1 is 7 and Output of line 2 is 9
 - (B) Output of line 1 is 9 and Output of line 2 is 7
 - (C) Both lines output 7
 - (D) Both lines output 7

Q13 Consider the following table. The table R(ABCDEF) is in which normal Form?



- (A) First Normal Form but Not second Normal Form.
- (B) Second Normal Form but Not Third Normal Form.
- (C) Third Normal Form but Not BCNF
- (D) Third Normal Form and BCNF

Q14 Consider a table Employee which has 500 records. It has NOT NULL column Salary which is also unique.

```
SELECT COUNT (*)
FROM Employee
WHERE Salary > ALL (SELECT Salary FROM Employee)
```

How many tuples will be present in the output when the above query is executed?

- (A) 0
- (B) 1
- (C) 499
- (D) 500

Q15 Let $R_1(P_1, Q_1, R_1)$ and $R_2(P_2, Q_2, R_2)$ be two relations in which P_1 is the foreign key of R_1 that refers to the primary key of R_2 .

Which of the following operation(s) can cause violation for maintaining referential integrity constraint?

- (A) Insert into R_1
- (B) Insert into R_2

- (C) Delete from R_1
- (D) Delete from R_2

Q16 class Node:

```
def __init__(self, data, next=None):
    self.data = data
    self.next = next
def print_nodes (ptr):
    if ptr:
        print(ptr.data, end=' ')
        while ptr.next:
            ptr = ptr.next
            print(ptr.data, end=' ')
```

What is the output, if the address of the first node of singly linked list 1→2→3→4→5 is passed in the above python code?

- (A) 12345
- (B) 112345
- (C) 1123455
- (D) None of these

Q17 A doubly linked list is declared as:

```
class Node:
    def __init__(self, value=0, prev=None, next=None):
        self.value = value
        self.prev = prev
        self.next = next
```

Which of the following segment of code deletes the node pointed to by X from the doubly linked list, if it is assumed that X points to neither the first nor the last node of the list?

- (A) X.prev.next = X.next; X.next.prev = X.prev; free(X);
- (B) X.prev.next = X.next; X.next.prev = X.prev; free(X);
- (C) X.prev.next = X.prev; X.next.prev = X.prev; free(X);
- (D) X.prev.next = X.prev; X.next.prev = X.next; free(X);

Q18 Which of the following is/are correct searching order using binary search for search element 200?

[Array contain 1 to 1000 elements in ascending order]

- (A) 800, 265, 180, 190, 200
- (B) 500, 600, 260, 190, 200
- (C) 780, 435, 196, 436, 200
- (D) 890, 435, 165, 285, 200

Q19 Which of the following statements is false regarding Discretization technique of data transformation?



- (A) Discretization only applies to continuous data.
- (B) Discretization can help make continuous data usable for classification algorithms.
- (C) Discretization is unnecessary if the data is already in categorical form.
- (D) Discretization is only useful for clustering algorithms.

- Q20** Consider the following sorted data:
 {2.5, 10, 15, 20, 25, 30, 35, 40, 45 }
 What will be the result of applying Equal-Width Binning b dividing the range into 3 bins?
- (A) {2, 5, 10}, {15, 20, 25}, {30, 35, 40, 45}
- (B) {2, 5, 10, 15}, {20, 25, 30}, {35, 40, 45}
- (C) {2, 5, 10}, {15, 20, 25}, {30, 35, 40}
- (D) {2, 5, 10, 15, 20}, {25, 30, 35}, {40, 45}

- Q21** Fill in the blanks:
 In the star schema for data storage, the fact table contains ____ that refer to ____ in ____.
- (A) Primary keys, secondary keys, dimension tables
- (B) Integers, primary keys, dimension tables
- (C) Primary keys, dimension tables, foreign keys
- (D) Primary keys, foreign keys, dimension tables

- Q22** The local minima point for the function $f(x) = x^2\sqrt{1-2x}$ where $x \leq \frac{1}{2}$ will be :
- (A) 2 (B) -2
- (C) -1 (D) 0

- Q23** Let (x, y) be a pair of continuous random variables with joint probability density function p.d.f given by:

$$f_{x,y}(x, y) = \begin{cases} C(3x^2 - y^2), & 0 \leq x \leq 1, 0 \leq y \leq 1 \\ 0, & \text{otherwise} \end{cases}$$

- Which of the following is correct marginal density function $f_x(x)$ for the random variable (x)
- (A) $f_x(x) = \frac{3}{2}x^2 - \frac{1}{3}, 0 \leq x \leq 1$
- (B) $f_x(x) = 3x^2 - \frac{1}{3}, 0 \leq x \leq 1$
- (C) $f_x(x) = \frac{9}{2}x^2 - \frac{1}{2}, 0 \leq x \leq 1$
- (D) $f_x(x) = 9x^2 - 1, 0 \leq x \leq 1$

- Q24** Consider the following statements.
 S_1 : Insertion sort will take $\theta(n^2)$ time when array is sorted.

S_2 : Searching a key in sorted array using binary search can be done in $\theta(\log n)$ time
 Which of the following statement is correct when the array is sorted?

- (A) S_1 only (B) S_2 only
- (C) Both (D) None

- Q25** The value of the limit, $\lim_{x \rightarrow 1} \sin^{-1} \left(\frac{1-\sqrt{x}}{1-x} \right)$ is _____. (Round off to two decimal places)

- Q26** Consider the system of equations:
 $2x + y - 2 = 4$
 $3x + 3y + z = 10$
 $x - y + 2z = 3$
 Which of the following statement is correct?
- (A) The system has no solutions
- (B) The system has infinitely many solutions
- (C) The system has a unique solutions
- (D) The system has inconsistent equations

- Q27** A machine produces defective items follows a poisson distribution with initial mean defect rate of 2 defects per hour. However every 2 hours, the defect rate increases by 50%. What is the probability that exactly 12 defects are found after 4 hours of operation?

- (A) $\frac{12^{10}e^{-12}}{12!}$
- (B) $\frac{10^{12}e^{-10}}{12!}$
- (C) $\frac{3^{12}e^{-3}}{12!}$
- (D) $\frac{6^{12}e^{-6}}{12!}$

- Q28** Consider the following statements:

S_1 : Number of levels in a tree is same as number of function calls in merge sort (To sort the array)

S_2 : The smallest element in a min heap tree will always a leaf node.

Which of the following statement is correct?

- (A) S_1 is correct.
- (B) S_2 is correct.
- (C) Both are correct
- (D) Neither S_1 nor S_2 is correct.

- Q29** If the function $g(x)$ is defined as:

$$g(x) = \begin{cases} c|\pi - x| + 2, & x \leq 6 \\ d|x - \pi| + 4, & x > 6 \end{cases}$$

and is continuous at $x = 6$, find the value of $c-d$

- (A) $\frac{3}{\pi+6}$
- (B) $-\frac{3}{\pi-6}$



- (C) $\frac{3}{\pi-6}$
 (D) $\frac{2}{6-\pi}$

- Q30** Let A and B are two independent random variables. Which of the following statements is/are incorrect?
 (A) $E((A+B)^2) = E(A^2) + E(B^2) + 2E(A) \cdot E(B)$
 (B) $\text{Var}(A + B) = \text{Var}(A) + \text{Var}(B) + 2E(A) \cdot E(B)$
 (C) $E((A^2 + B^2)) = \text{Var}(A) + \text{Var}(B) + E(A)^2 + E(B)^2$
 (D) $E((A+B)^2) = E(A^2) + E(B^2)$
- Q31** Consider a function $f(x)$ defined on interval $(0, \pi)$ by:

$$f(x) = \begin{cases} \frac{\frac{\sin x}{2} - \frac{1}{2}}{x - \frac{\pi}{2}}, & x \neq \frac{\pi}{2} \\ k, & x = \frac{\pi}{2} \end{cases}$$
 If $f(x)$ is continuous of $x = \frac{\pi}{2}$, find the value of k.
 (A) -1 (B) 2
 (C) 1 (D) 0
- Q32** Which of the following first order logic sentence matches closest with the sentence "All students are not equal"?
 (A) $\forall x \exists y [\text{student}(x) \wedge \text{student}(y)] \Rightarrow \neg \text{Equal}(x, y)$
 (B) $\forall x \forall y [\text{student}(x) \wedge \text{student}(y)] \Rightarrow \neg \text{Equal}(x, y)$
 (C) $\forall x \exists y [\text{student}(x) \wedge \text{student}(y) \wedge \neg \text{Equal}(x, y)]$
 (D) $\forall x \forall y [\text{student}(x) \wedge \text{student}(y) \wedge \neg \text{Equal}(x, y)]$
- Q33** Consider the game tree shown below. The value below each node is the output of the utility function. The subtree rooted at which of these nodes will be pruned because of alpha-beta pruning?
 (A) m and j
 (B) r and j
 (C) h and p
 (D) no nodes are are pruned
- Q34** Which of the following function is not differentiable over complete set of Real numbers?
 (A) x^2 (B) $\frac{1}{x^2}$
 (C) $\sin x$ (D) e^x

- Q35** Imagine you have a dataset that contains information about a binary classification model. The model classifies instances into two classes: "Positive" and "Negative". After evaluating the model, you have the following results:
 True Positives (TP): 120
 False Positives (FP): 25
 True Negatives (TN): 800
 False Negatives (FN): 30
 Calculate the precision of the model using the given information.
 (A) 0.75 (B) 0.80
 (C) 0.82 (D) 0.85
- Q36** In a decision tree, if a node has 6 possible outcomes with probabilities 0.1, 0.2, 0.1, 0.2, 0.2 and 0.2. What is its Gini index?
 (A) 0.16 (B) 0.20
 (C) 0.82 (D) 0.60
- Q37** In a doubly linked list, the number of pointers affected for an insertion operation will be
 (A) 0
 (B) 5
 (C) 1
 (D) None of these
- Q38** Let $R_1(A_1, A_2, A_3, A_4)$ and $R_2(A_1, A_2, A_5, A_6)$ be two relations where $\{A_1, A_2\}$ is the key for both the schemas.
 Consider the following statements:
S₁: Queries $\pi_{A_1}(R_1 \times R_2)$ and $\pi_{A_1}(R_1) \times \pi_{A_1}(R_2)$ are equivalent.
S₂: Queries $\pi_{A_2}(R_1 \times R_2)$ and $\pi_{A_2}(R_1) \times \pi_{A_2}(R_2)$ are equivalent.
 Choose the correct option:
 (A) S_1 is true, S_2 is true
 (B) S_1 is false, S_2 is true
 (C) S_1 is false, S_2 is false
 (D) S_1 is true, S_2 is false
- Q39** Which of the following queries would retrieve the regNo, name and marks of students who obtained the minimum marks in the branch of CS?
 (A) select name, min(marks) from gateMarks where branch="CS"
 (B) select regNo, name, marks from gateMarks where branch="CS" and marks = (select



min(marks) from gateMarks where
branch="CS")

(C) select regNo, name, marks
from gateMarks
where branch="CS" and marks ≤ALL (select
marks
from gateMarks
where branch="CS")

(D) select regNo, name, marks
from gateMarks
where branch="CS" and marks ≤ANY (select
marks
from gateMarks where branch="CS")

Q40 Consider the following dataset
Which among the following split-points for the
feature1 would give the best split according to
the information gain measure?

Feature 1	Feature 2	Feature 3
18.3	187.6	A
14.7	184.9	A
19.4	193.3	A
17.9	180.5	A
19.1	189.1	A
17.6	191.9	B
19.9	190.2	B
17.3	198.6	B
18.7	182.6	B
15.2	187.3	B

Q41 Given the following information

	Actual Positive	Actual Negative
Predicted Positive	15	35
Predicted Negative	10	45

What is the precision and recall?

- (A) 0.5, 0.6
- (B) 0.3, 0.8
- (C) 0.3, 0.6
- (D) 0.5, 0.8

Q42 For a binary classification problem, consider the
two statements below:

A: A classifier with AUC=0 is the least useful
classifier.

B: A classifier with AUC=0.5 is the least useful
classifier

[Hint: For A, what if the labels were reversed?]

(A) A is True. B is False

(B) A is False. B is True

(C) Both are False

(D) Their ensemble will be the worst classifier

Q43 Questions are based on the following models A
and B: Model A characteristics

Number of True Positive = Number of True
Negative

Accuracy = 1/2

Precision = 1/2

Model B characteristics:

Number of True Positive = Number of True
Negative

Accuracy = 1/3

Precision = 2/3

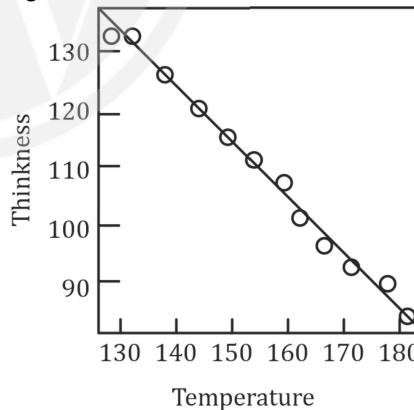
(A) Recall(A) > Recall(B)

(B) Recall(A) < Recall(B)

(C) Recall(A) = Recall(B)

(D) Can not be determine

Q44 On a machine that folds plastic film the
temperature may be varied in the range of 130-
185 °C For obtaining, if possible, a model for the
influence of temperature on the folding
thickness, n = 12 related set of values of
temperature and the fold thickness were
measured that is illustrated in the following
figure:



Perform linear regression and $BO, B1$ ($Th=BO+B1Te$),
 BO - Intercept

(A) Determine by looking at the figure, which of
the following sets of estimates for the
parameters in the usual regression model is
correct:

(B) $\hat{\beta}_0 = 0, \hat{\beta}_1 = - - - -0.9, \hat{\sigma} = 36$

(C) $\hat{\beta}_0 = 0, \hat{\beta}_1 = - - - -0.9, \hat{\sigma} = 3.6$

(D) $\hat{\beta}_0 = 252, \hat{\beta}_1 = - - - -0.9, \hat{\sigma} = 3.6$

Q45



Consider the following logical inferences:

1₁: If Elizabeth is human, then Socrates is mortal.

Elizabeth is human.

Inference: Elizabeth is mortal.

1₂: If it rains today, school will close.

School is not closed today.

Inference: It will not rain today.

Which of the following is true?

- (A) Both 1₁ and 1₂, are correct inferences.
- (B) 1₁ is correct but 1₂ is not a correct inference.
- (C) 1₁ is not correct but 1₂ is not a correct inference.
- (D) Both 1₁ and 1₂ are not correct inference.

Q46 Which of the following statements is/are correct about variable elimination?

S₁: Selecting an optimal elimination order in variable elimination minimizes network variable.

S₂: Selecting an optimal elimination order in variable elimination minimizes intermediate factor size.

- (A) Only S₁
- (B) Only S₂
- (C) Both S₁ and S₂
- (D) None of these

Q47 Which of the following is NOT a type of sampling method used for approximate inference?

- (A) Importance Sampling
- (B) Gibbs Sampling
- (C) Rejection Sampling
- (D) Dijkstra Sampling

Q48 Which of the following statement is/are correct?

S₁: Likelihood function can be used to directly estimate the parameters of a statistical model.

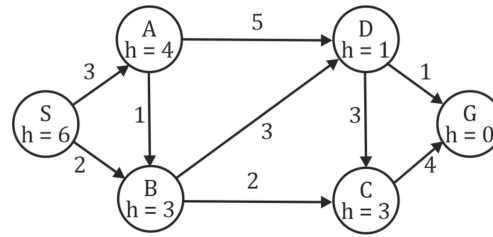
S₂: Rejection sampling requires knowledge of the exact shape of the posterior distribution.

- (A) Only S₁
- (B) Only S₂
- (C) Both S₁ and S₂
- (D) Neither S₁ nor S₂

Q49 Consider the following graph.

In case of multiple paths of same costs, the ties are broken in alphabetical order.

Comment on the Heuristic properties of the below graph:



- (A) Graph is Consistent
- (B) Graph is not Consistent
- (C) Graph is Admissible
- (D) Graph is Not Admissible

Q50 A shipment of 16 non-faulty computer chips also contains 4 faulty chips. If 2 chips are chosen at random, find the probability distribution of x, the number of faulty chips?

(A)	x	0	1	2
	P(x)	12/19	3/95	32/95
(B)	x	0	1	2
	P(x)	13/19	32/95	3/95
(C)	x	0	1	2
	P(x)	12/19	32/95	4/95
(D)	x	0	1	2
	P(x)	12/19	32/95	3/95

Q51 What does the following function print for a given Linked List with input 1,2,3,4,5,6 ?

```
class Node:
    def __init__(self, data):
        self.data = data
        self.next = None
    def fun1 (head):
        if head.next is None:
            return
        print(head.data, end=' ')
        fun1 (head.next)
        print(head.data, end=' ')
(A) 1,2,3,4,5,6,6,5,4,3,2,1
(B) 1,2,3,4,4,3,2,1
(C) 1,2,3,4,5,5,4,3,2,1
(D) 1,2,3,4,5,1,2,3,4,5
```

Q52 Given the matrix A as follows:

$$A = \begin{bmatrix} 1 & 2 & 1 \\ 3 & 6 & 3 \\ 2 & 4 & 2 \end{bmatrix}$$

What can be concluded about the system AX = b for any vector b?

- (A) The system has a unique solution for any b.
- (B) The system has no solution for any b.



- (C) The system has infinitely many solutions for any b.
- (D) The system may have no solutions or infinitely many solutions depending on b.

Q53 A box contains 15 marbles, and the probability that the box contains exactly 2 green marbles is 0.4, while the probability that the box contains exactly 3 green marbles is 0.6. The marbles are drawn at random one by one without replacement until all green marbles are found. What is the probability that the process ends at 10 draws?
 (A) 0.082 (B) 0.053
 (C) 0.057 (D) None of these

Q54 An electric current, when flowing in a circular coil of radius 'r', exerts a force $F = \frac{kx}{(x^2+r^2)^{5/2}}$, on a small magnet located at a distance 'x' above the center of coil. The value of F is greatest at 'x' equal to
 (A) $\frac{r}{3}$ (B) $\frac{r}{2}$
 (C) $\frac{3r}{5}$ (D) $\frac{2r}{5}$

Q55 Consider the following functions:
 $f(n) = n^{\frac{1}{3}}$
 $g(n) = \frac{n}{\log(n)}$
 Which of the following is/are correct?
 (A) $f(n) = O(g(n))$
 (B) $g(n) = \omega(f(n))$
 (C) $f(n) = o(g(n))$
 (D) $g(n) = \Omega(f(n))$

Q56 For the function $f(x, y) = x^3 - 6xy + y^3$, Choose the correct statement(s) from below.
 (A) The point (0, 0) is a point of minimum
 (B) The point (0, 0) is a saddle point
 (C) The point (2, 2) is a point of minimum
 (D) The point (2, 2) is a saddle point

Q57 If the rectangle $[\frac{\pi}{2}, \frac{0}{2}] \times [0, 1] \subset R^2$, A point (x, y) is chosen at random. The probability that the point (x, y) satisfies $y < \sin x$ is _____.
 (A) $1/\pi$ (B) $2/\pi$
 (C) $1/3$ (D) $1/5$

Q58 For which of the following value(s) of 'K', the mean value of the function $f(x) = x^2 \log_e x + Kx^2$ in the interval [2, 8] can be evaluated using Rolle's Mean value theorem?

- (A) K = 4 (B) K = 5
- (C) K = 6 (D) K = 7

Q59 A sainted predicts that the distribution of a specific plant species across four different habitats (forest, grasslands, wetland and desert). Follows the ratio 5 : 3 : 2 : 1. A survey of 1100 plants across these habitats yielded the following observed frequencies.

Habitats	Forest	Grassland	Wetland	Desert
Observed frequency	550	330	150	70

Based on total of 1100 plants test whether the observed frequencies are consistent with the predicted ratio at a 5% level of significance. Use the following critical χ^2 values for different degrees of freedom.

df	2	3	4
χ^2 critical	5.991	7.815	9.488

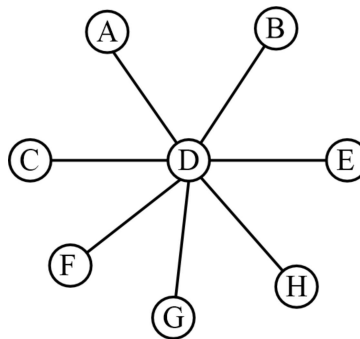
What conclusion can be drawn based on above data?

- (A) Reject H_0 ; $\chi^2 \text{ cal} < \chi^2 \text{ critical}$
- (B) Reject H_0 ; $\chi^2 \text{ cal} > \chi^2 \text{ critical}$
- (C) Fail to reject H_0 ; $\chi^2 \text{ cal} < \chi^2 \text{ critical}$
- (D) Fail to reject H_0 ; $\chi^2 \text{ cal} > \chi^2 \text{ critical}$

Q60 Let $A = \begin{bmatrix} 9 & 2 & 7 & 1 \\ 0 & 7 & 2 & 1 \\ 0 & 0 & 11 & 6 \\ 0 & 0 & -5 & 0 \end{bmatrix}$.

Then the value of $|\det(8I - A)^3|$ is _____. (Enter in integer)

Q61 Consider the following graph G:
 G:



What is the minimum unit of stack size is required for DFS traversals _____ ?



Q62 The value of the following series $\frac{1}{2} - \frac{1}{6} + \frac{1}{24} - \frac{1}{120} + \dots$ is _____
(Round off to two decimal places).

Q63 A library has 1500 fiction books, 2000 non-fiction books and 1000 magazines. The probability of a book being misplaced is 0.02 for fiction books, 0.01 for non-fiction books and 0.03 for magazines. If a misplaced item is found, what is the probability that it is a magazine?

- (A) $\frac{3}{8}$ (B) $\frac{2}{9}$
(C) $\frac{4}{9}$ (D) $\frac{6}{13}$

Q64 If the rank of an $n \times n$ matrix A is m, where m, n are positive integers and $1 \leq m \leq n$. Then the rank of matrix A^2 is

- (A) m (B) $m - 1$
(C) 2m (D) $m - 2$

Q65 A machine produces items with three different sizes: $x = 2$, $x = 4$ and $x = 6$ units, with corresponding probabilities $P(x)$ given below:

x	2	4	6
P(x)	0.2	0.5	0.3

What is the standard deviation of the produced sizes?

- (A) 1.2 (B) 1.48
(C) 1.80 (D) 1.4



Answer Key

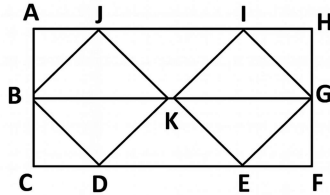
Q1	(B)	Q34	(B)
Q2	(C)	Q35	(C)
Q3	(D)	Q36	(C)
Q4	(C)	Q37	(D)
Q5	(C)	Q38	(C)
Q6	(B)	Q39	(B, C)
Q7	(A)	Q40	19.8~19.8
Q8	(A)	Q41	(C)
Q9	(D)	Q42	(C)
Q10	(C)	Q43	(A)
Q11	(A)	Q44	(B)
Q12	(A)	Q45	(A)
Q13	(C)	Q46	(A)
Q14	(A)	Q47	(D)
Q15	(A, D)	Q48	(A)
Q16	(A)	Q49	(B, C)
Q17	(B)	Q50	(D)
Q18	(A, D)	Q51	(C)
Q19	(D)	Q52	(D)
Q20	(B)	Q53	(A)
Q21	(D)	Q54	(B)
Q22	(D)	Q55	(A, B, C, D)
Q23	(C)	Q56	(B, C)
Q24	(B)	Q57	(B)
Q25	0.5~0.55	Q58	(A, B, C, D)
Q26	(C)	Q59	(B)
Q27	(B)	Q60	216~216
Q28	(D)	Q61	2
Q29	(D)	Q62	0.35~0.38
Q30	(B, D)	Q63	(A)
Q31	(D)	Q64	(A)
Q32	(C)	Q65	(D)
Q33	(B)		



Hints & Solutions

Q1 Text Solution:

Pointing the figure as



The Rectangles are :

ABGH, BCFG, ACFH, BDKJ & KEGI. Total 5.

The Triangles are:

ABJ, BJK, JKI, IKG, IHG, BCD, BDK, KDE, KEG & GEF. Total 10.

Q2 Text Solution:

If the distance between Stations A and B is D km

Train P speed = $D/4$ (covers in 4 hours i.e. 0800 to 1200)

Train Q speed = $D/6$ (covers in 6 hours i.e. 0900 to 1500)

To reach the meeting point, Distance covered by Train P + Distance covered by Train Q = Total Distance (D).

Let's say they meet after 'x' hours from 0800.

Thus, $x(D/4) + (x-1)(D/6) = D$

Or $(x/4) + (x-1/6) = 1$

Or $3x + 2x - 2 = 12$

Or $5x = 14$

Thus $x = 14/5 = 2$ and $4/5$ hours = 2 hours 48 minutes

From 0800, 2 hours 48 minutes = 10:48 hours

Q3 Text Solution:

If top face of 1st die is 2, then second die is 1 (Only 1 case)

If top face of 1st die is 3, then second die is 1 or 2 (2 cases)

If top face of 1st die is 4, then second die is 1 or 2 or 3 (3 cases)

Similarly, If top face of 1st die is 5, then 4 cases

If top face of 1st die is , then 5 cases.

Total $1 + 2 + 3 + 4 + 5 = 15$

Q4 Text Solution:

The idiom "live life in the fast lane" means a life filled with excitement → Option C.

Q5 Text Solution:

Lucid means easy to understand, clear, transparent in meaning or thought.

Q6 Text Solution:

As 6 is formed by the product of 3 and 2. Also number of 3's is less as compared to 2's. So, as many 3's those many 6's are formed.

To find in 90!

$\frac{90}{3}$ gives 30

$\frac{30}{3}$ gives 10

$\frac{10}{3}$ gives 3 (whole number)

$\frac{3}{3}$ gives 1

And $\frac{1}{3}$ gives 0 (whole number).

Thus total $30 + 10 + 3 + 1 = 44$. Thus 90! has largest factor 6^{44} .

Q7 Text Solution:

If Meera bakes 1 cake in 1 unit time, Rohan bakes $\frac{1}{2}$ cake in $\frac{1}{6}$ unit time.

Or Rohan bakes 1 cake $\frac{2}{6}$ unit time.

Comparing Time taken to do the work

Meera : Rohan = $1 : \frac{1}{3} = 3 : 1$

If Rohan takes x days, Meera takes 3x days.

Given that they do together the work in 10 days,

i.e. $(\frac{1}{x}) + (\frac{1}{3x}) = \frac{1}{10}$

Or $(\frac{4}{3x}) = \frac{1}{10}$ Or $\frac{3x}{4} = 10$ Or $x = \frac{40}{3}$.

Thus Meera takes $3(\frac{40}{3}) = 40$ days.

Q8 Text Solution:

"Although" is a conjunction and must be followed by a subject + finite verb (e.g., "although she had no qualifications").

Here it is incorrectly followed by just the participle "having", so the phrase is ungrammatical.

Correct versions would be:

- "Smitha was offered the job although she had no qualifications."
- "Smitha was offered the job despite having no qualifications."

Q9 Text Solution:

Initial ratio 1 : 4.

Always cutting the longer side.

1st Cut ratio 1 : 2

2nd Cut ratio 1 : 1

3rd cut ratio (any side) 2 : 1.

4th Cut ratio again 1 : 1.

Thus Never it will come again to same ratio 1 : 4.



Q10 Text Solution:

In 30 seconds net cupcakes in display = 1 (2-1)
 1 cup cake in 30 seconds
 18 cupcakes in 30 × 18 = 540 seconds.
 In the next 30 seconds chef adds 2 cupcakes to make it 20.
 Thus total earliest time = 540 + 30 = 570 seconds.
 Note: The last moment can't be withdrawal as the display holds only 20 cupcakes.

Q11 Text Solution:

$$f(x) = \frac{2x}{x^2+1}$$

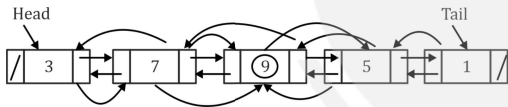
$$f'(x) = \frac{2(x^2+1) - 4x^2}{(x^2+1)^2} = \frac{2-2x^2}{(x^2+1)^2}$$

$$f''(x) = \frac{2(1-x^2)}{(x^2+1)^3}$$

$$f'(x) = 0 \Rightarrow x = \pm 1$$

Value of function at critical points $x = \pm 1$
 $f(1) = 1 \quad f(-1) = -1$
 $\lim_{x \rightarrow \infty} f(x) = \lim_{x \rightarrow \infty} \frac{2x}{x^2+1} = 0$
 $\lim_{x \rightarrow -\infty} f(x) = \lim_{x \rightarrow -\infty} \frac{2x}{x^2+1} = 0$
 $\Rightarrow \text{Range} = [-1, 1]$

Q12 Text Solution:



Q13 Text Solution:

R(ABCDEF) [AB → CDEF, C → B]
 Candidate key = [AB, AC]
 Key/prime Attribute = [A,B,C]
 Here, no violation of 2NF so R is in 2NF.
 AB → CDEF ; 3NF [AB is super key]
 C → D ; 3NF [B is prime Attribute]
 So, R is in 3NF.
 R is not in BCNF as LHS is not super key in C → D.

Q14 Text Solution:

It returns 0 tuple in output as the highest salary will be greater than equal to all other salaries but not strictly greater (because it will compare with itself also).

Q15 Text Solution:

Insert into R₁ can cause violation because if user wants to insert any value into P₁ of R₁ which is not in P₂ of R₂ then violation occurs.

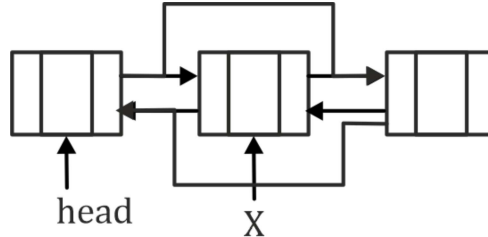
Delete from R₂ can casue violation if user deletes any value of P₂ in R₂, then the value referred by P₁ in R₁ should also be deleted.

Q16 Text Solution:

12345

Q17 Text Solution:

→ X .prev .next = X. next
 → X .next .prev = X. next



Q18 Text Solution:

- (a) 800, 265, 180, 190, 200 Correct
- (b) 500, 600, 260, 190, 200 Incorrect (After 500 we can not go to in right))
- (c) 780, 435, 196, 436, 200 InCorrect (element 435 left side 436 is not allowed)
- (d) 890, 435, 165, 285, 200 Correct

Q19 Text Solution:

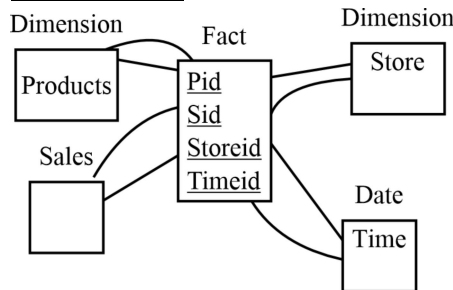
Continuous → Discrete

Q20 Text Solution:

- 1 to 15 → 2, 5, 10, 15
- 16 to 30 → 20, 25, 30
- 31 to 45 → 35, 40, 45

Q21 Text Solution:

In the star schema for data storage, the fact table contains foreign keys that refer to primary keys in dimension tables.



Q22 Text Solution:

$$f(x) = x^2\sqrt{1-2x}$$

$$f'(x) = 2x\sqrt{1-2x} + x^2 \times \frac{1 \times (-2)}{2\sqrt{1-2x}}$$

$$f'(x) = 0$$

$$\Rightarrow 2x\sqrt{1-2x} = \frac{x^2}{\sqrt{1-2x}}$$

$$2x(1-2x) = x^2$$



$$2x - 4x^2 = x^2$$

$$\Rightarrow 5x^2 - 2x = 0$$

$$x(5x - 2) = 0$$

$$\Rightarrow x = 0, \frac{2}{5}$$

$$\text{Critical point: } x = 0, \frac{2}{5}$$

$$f(0) = 0$$

$$f\left(\frac{2}{5}\right) = \left(\frac{2}{5}\right)^2 \sqrt{1-2} \times \frac{2}{5}$$

$$= \frac{4}{25} \sqrt{\frac{1}{5}}$$

$$= \frac{4}{25\sqrt{5}}$$

Local minimum will be at $x = 0$ i.e. $f(0) = 0$

Q23 Text Solution:

$$\int_0^1 \int_0^1 C(3x^2 - y^2) dy dx = 1$$

$$\int_0^1 \left[C \left(3x^2 y - \frac{y^3}{3} \right) \right]_0^1 dx = 1$$

$$\int_0^1 C \left(3x^2 - \frac{1}{3} \right) dx = 1$$

$$C \left[x^3 - \frac{x}{3} \right]_0^1 = 1 \Rightarrow C \left[1 - \frac{1}{3} \right] = 1$$

$$C \left[\frac{2}{3} \right] = 1$$

$$\Rightarrow C = \frac{3}{2}$$

$$\text{Now, } f_x(x) = \int_0^1 f_{xy}(x, y) dy$$

$$\Rightarrow f_x(x) = \int_0^1 \frac{3}{2} (3x^2 - y^2) dy$$

$$= \frac{3}{2} \left[3x^2 y - \frac{y^3}{3} \right]_0^1$$

$$= \frac{3}{2} \left[3x^2 - \frac{1}{3} \right]$$

$$= \frac{9}{2} x^2 - \frac{1}{2}, \quad 0 \leq x \leq 1$$

Q24 Text Solution:

S_1 : In sort will take $\theta(n)$ time when array is sorted. **Incorrect**

S_2 : Searching a key in sorted array using binary search can be done in $\theta(\log n)$ time. **Correct**

Q25 Text Solution:

$$\text{Given limit is } \lim_{x \rightarrow 1} \sin^{-1} \left(\frac{1 - \sqrt{x}}{1 - x} \right)$$

$$= \lim_{x \rightarrow 1} \sin^{-1} \left(\frac{1 - \sqrt{x}}{(1-x)(1+\sqrt{x})} \right)$$

$$= \lim_{x \rightarrow 1} \sin^{-1} \left(\frac{1}{(1+\sqrt{x})} \right) = \sin^{-1} \left(\frac{1}{1+1} \right) = \frac{\pi}{6}$$

$$= 0.5236$$

$$\therefore \lim_{x \rightarrow 1} \sin^{-1} \left(\frac{1 - \sqrt{x}}{(1-x)} \right) \approx 0.52$$

Q26 Text Solution:

Given system is:

$$2x + y - 2 = 4$$

$$3x + 3y + z = 10$$

$$x - y + 2z = 3$$

$$\begin{bmatrix} 2 & 1 & -1 \\ 3 & 3 & 1 \\ 1 & -1 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ 10 \\ 3 \end{bmatrix}$$

\therefore Augmented Matrix i.e.

$$[A/B] = \begin{bmatrix} 2 & 1 & -1 & 4 \\ 3 & 3 & 1 & 10 \\ 1 & -1 & 2 & 3 \end{bmatrix}$$

$$R_2 \rightarrow 2R_2 - 3R_1 \rightarrow R_1$$

$$R_3 \rightarrow 2R_3 - R_1$$

$$\begin{bmatrix} 2 & 1 & -1 & 4 \\ 0 & 3 & 5 & 8 \\ 0 & -3 & 5 & 2 \\ 2 & 1 & -1 & 4 \\ 0 & 3 & 5 & 8 \\ 0 & 0 & 10 & 10 \end{bmatrix} \xrightarrow{R_3 \rightarrow R_3 + R_2} \begin{bmatrix} 2 & 1 & -1 & 4 \\ 0 & 3 & 5 & 8 \\ 0 & 3 & 5 & 8 \\ 2 & 1 & -1 & 4 \\ 0 & 3 & 5 & 8 \\ 0 & 0 & 10 & 10 \end{bmatrix}$$

$$\Rightarrow \text{rank}(A) = \text{rank}(A/B) = 3$$

\therefore System has unique solution.

Q27 Text Solution:

Initial defect rate = 2 defect/hr.

defect rate increase by 50% every 2 hours.

First 2 hours: The rate is 2 defects per hour 1 over 2 hours, the total expected no. of defect = $\lambda_1 = 2 \times 2 = 4$

Next 2 hours: The rate increase by 50% \rightarrow New rate = $2 \times 1.5 = 3$ = defect per hour.

Total total expected defects = $\lambda_2 = 3 \times 2 = 6$

Total expected number of defect over 4 hours.

$$\lambda = \lambda_1 + \lambda_2 = 4 + 6 = 10$$

$$P(x = p) = \frac{\lambda^k e^{-\lambda}}{k!}$$

$$P(x = 12) = \frac{(10)^{12} e^{-10}}{12!}$$

\Rightarrow Option 'b' is correct.

Q28 Text Solution:

- number of levels in a tree is same as stack size of recursive calls.

- number of function calls $2n - 1$ for n element.

- Smallest element in min heap always a root node :

Q29 Text Solution:

L.H.L

$$\lim_{x \rightarrow 6^-} g(x) = \lim_{x \rightarrow 6^-} c |\pi - x| + 2$$

$$\lim_{h \rightarrow 0} c |\pi - (6 - h)| + 2 = \lim_{h \rightarrow 0} c |\pi - 6 + h| + 2$$

$$= \lim_{h \rightarrow 0} c |\pi - 6 + h| + 2$$

$\therefore \pi - 6$ is -ve



$$\begin{aligned} &\Rightarrow \lim_{h \rightarrow 0} c [-(\pi - 6) - h] + 2 \\ &\Rightarrow \lim_{h \rightarrow 0} c (-\pi + 6 + h) + 2 = c(6 - \pi) + 2 \\ &\text{R.H.L} \\ &\lim_{x \rightarrow 6^+} g(x) = \lim_{x \rightarrow 6^+} d |x - \pi| + 4 \\ &\because \pi < 6 \Rightarrow x - \pi \text{ is +ve} \\ &\Rightarrow \lim_{x \rightarrow 6^+} d(x - \pi) + 4 \\ &\Rightarrow \lim_{h \rightarrow 0} d(6 + h - \pi) + 4 = d(6 - \pi) + 4 \\ &g(6) = c(\pi - 6) + 2 \\ &\text{For } f(x) \text{ to be continuous L.H.L} = \text{R.H.L} \\ &\Rightarrow C(6 - \pi) + 2 = d(6 - \pi) + 4 \\ &c \times 6 - c\pi + 2 = d \times 6 - d\pi + 4 \\ &6(c - d) = c\pi - d\pi + 2 \\ &6(c - d) - \pi(c - d) = 2 \\ &(c - d) = \frac{2}{6 - \pi} \end{aligned}$$

Q30 Text Solution:

$$\begin{aligned} &\because \text{Var}(A + B) = \text{Var}(A) + \text{Var}(B) \\ &\Rightarrow \text{option 'b' is incorrect} \\ &E(A^2 + B^2) = \text{Var}(A) + \text{Var}(B) + E(A)^2 + E(B)^2 \\ &E(A^2) = (E(A))^2 + \text{Var}(A) \\ &E(B^2) = (E(B))^2 + \text{Var}(B) \\ &\text{Option c is correct} \\ &E((A + B)^2) = E(A^2) + E(B^2) + 2E(A)E(B) \\ &\text{Option 'a' is correct} \\ &\text{Option 'd' is incorrect} \\ &\Rightarrow \text{b and d are incorrect} \end{aligned}$$

Q31 Text Solution:

For f(x) to be continuous

$$\begin{aligned} &\lim_{x \rightarrow \frac{\pi}{2}^-} f(x) = \lim_{x \rightarrow \frac{\pi}{2}^+} f(x) = f\left(\frac{\pi}{2}\right) \\ &\lim_{h \rightarrow 0} \left(\frac{\pi}{2} - h\right) = \lim_{h \rightarrow 0} f\left(\frac{\pi}{2} - h\right) = f\left(\frac{\pi}{2} - h\right) \\ &= f\left(\frac{\pi}{2}\right) \\ &\lim_{h \rightarrow 0} \frac{\sin\left(\frac{\pi}{2} - h\right) - \frac{1}{2}}{\frac{\pi}{2} - h - \frac{\pi}{2}} = \lim_{h \rightarrow 0} \frac{\sin\left(\frac{\pi}{2} + h\right) - \frac{1}{2}}{\frac{\pi}{2} + h - \frac{\pi}{2}} = k \\ &\lim_{h \rightarrow 0} \frac{\cos h - \frac{1}{2}}{-h} = \lim_{h \rightarrow 0} \frac{\cos h - \frac{1}{2}}{h} = k \\ &(\because \% \text{ form}) \\ &\Rightarrow \lim_{h \rightarrow 0} \frac{\sin h}{-1} = \lim_{h \rightarrow 0} \frac{-\sin h}{1} = k \\ &0 = 0 = k \\ &\Rightarrow \boxed{k = 0} \end{aligned}$$

Q32 Text Solution:

(A) $\forall x \exists y[\text{student}(x) \wedge \text{student}(y)] \Rightarrow \neg \text{Equal}(x, y)$: This suggests that for every student x, there exists some student y such that x and y are not equal. This doesn't cover the case for all pairs of students.

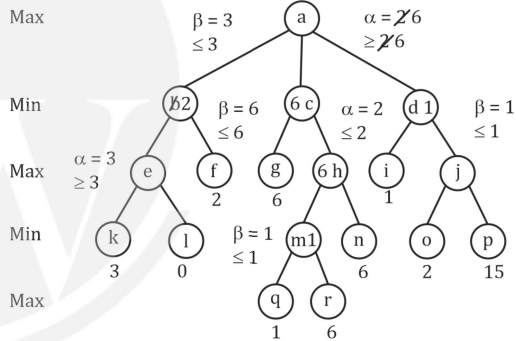
(B) $\forall x \forall y[\text{student}(x) \wedge \text{student}(y)] \Rightarrow \neg \text{Equal}(x, y)$: This states that for all students a and y, x and y are not equal. This is too strong since it would imply that no two students can ever be equal, which is not necessarily what we want.

(C) $\forall x \exists y[\text{student}(x) \wedge \text{student}(y) \wedge \neg \text{Equal}(x, y)]$: This means that for every student x, there exists at least one student y such that x and y are not equal. This aligns well with the notion that students are not equal.

(D) $\forall x \forall y[\text{student}(x) \wedge \text{student}(y) \wedge \neg \text{Equal}(x, y)]$: Similar to (B), this means that every pair of students x and y are not equal, which is too strong.

Q33 Text Solution:

Nodes r and j will be pruned.



Q34 Text Solution:

- (i) For $f(x) = x^2 \Rightarrow f'(x) = 2x \exists \forall x \in R$
 - (ii) For $f(x) = \frac{1}{x^2} \Rightarrow f'(x) = \frac{-2}{x^3} \exists \text{ for } x = 0$
 - (iii) For $f(x) = \sin x \Rightarrow f'(x) = \cos x \exists \forall x \in R$
 - (iv) For $f(x) = e^x \Rightarrow f'(x) = e^x \exists \forall x \in R$
- $\therefore \frac{1}{x^2}$ is not differentiable at $x = 0$

Q35 Text Solution:

$$\text{Precision} = \frac{\text{True positives}}{\text{True Positives} + \text{False Positives}}$$

Substitute the given values:

$$\text{Precision} = \frac{120}{120 + 25} = \frac{120}{145} \approx 0.8276$$

So, the closest answer choice is option(c)

Q36 Text Solution:

The Gini index measures the impurity or diversity of a node in a decision tree. It is calculated as:



$$Gini = 1 - \sum_{i=1}^n p_i^2$$

where p_i is the probability of each outcome, and n is the total number of outcomes.

Given probabilities:

$$p_2 = 0.2 \quad p_1 = 0.1 \quad p_3 = 0.1 \quad p_4 = 0.2 \quad p_5 = 0.2 \quad p_6 = 0.2$$

Step-by-step Calculation:

$$Gini = 1 - (0.1^2 + 0.2^2 + 0.1^2 + 0.2^2 + 0.2^2 + 0.2^2)$$

$$Gini = 1 - (0.01 + 0.04 + 0.01 + 0.04 + 0.04 + 0.04)$$

$$Gini = 1 - 0.18 = 0.82$$

Q37 Text Solution:

It depends on the position at which the insertion is done. However, there can be at most 3 cases :-

- (1) Insertion at Begin - 3 pointers affected
- (2) Insertion at Middle - 4 pointers affected
- (3) Insertion at End 3 pointers affected

Q38 Text Solution:

Statement S_1 and S_2 both are false as the schema itself will not be same at both sides.

Q39 Text Solution:

- A) regNo is not getting displayed.
D) It will display all students except the highest scoring student.

Q40 Text Solution:

info feature 1 (19.8) (D)

$$= \left(\frac{9}{10} \left(-\log_2 \frac{5}{9} - \frac{4}{9} \log_2 \frac{4}{9} \right) + \left(\frac{1}{10} \left(-\log_2 \frac{0}{1} - \frac{1}{2} \log_2 \frac{1}{2} \right) \right) \right) = 0.891$$

info feature 1 (18.1) (D)

$$= \left(\frac{5}{10} \left(-\frac{2}{5} \log_2 \frac{2}{5} - \frac{3}{5} \log_2 \frac{3}{5} \right) + \left(\frac{5}{10} \left(-\frac{3}{5} \log_2 \frac{3}{5} - \frac{2}{5} \log_2 \frac{2}{5} \right) \right) \right) = 0.970$$

info feature 1 (16.4) (D)

$$= \left(\frac{2}{10} \left(-\frac{1}{2} \log_2 \frac{1}{2} - \frac{1}{2} \log_2 \frac{1}{2} \right) + \left(\frac{8}{10} \left(-\frac{4}{8} \log_2 \frac{4}{8} - \frac{4}{8} \log_2 \frac{4}{8} \right) \right) \right) = 1$$

info feature 1 (15.1) (D)

$$= \left(\frac{1}{10} \left(-\log_2 \frac{1}{1} - \frac{0}{1} \log_2 \frac{0}{1} \right) + \left(\frac{9}{10} \left(-\frac{4}{9} \log_2 \frac{4}{9} - \frac{5}{9} \log_2 \frac{5}{9} \right) \right) \right) = 0.891$$

Q41 Text Solution:

$$\text{Precision} = 15 / (15 + 35) = 0.3$$

$$\text{Recall} = 15 / (15 + 10) = 0.6$$

Q42 Text Solution:

A is false because you can take the negation of the output of the classifier and achieve 100% accuracy. B is false because AUC is not indicative of how the ROC curve may look like. If the model

is completely random, then it is the least useful. A random model AUC = 0.5 but not vice versa.

Q43 Text Solution:

Step 1: Expressing Precision Formula

Precision is given by:

$$\text{Precision} = \frac{TP}{TP + FP}$$

Where:

- TP = True Positives
- FP = False Positives

Step 2: Using Given Information for Model A

For Model A:

- TP = TN
- Accuracy 1/2 which means:

$$\frac{TP + TN}{TP + TN + FP + FN} = \frac{1}{2}$$

Since TP = TN, we replace TN with TP:

$$\frac{2TP}{2TP + FP + FN} = \frac{1}{2}$$

Multiplying both sides by $(2TP + FP + FN)$

$$2TP = \frac{1}{2}(2TP + FP + FN)$$

$$4TP = 2TP + FP + FN$$

$$2TP = FP + FN$$

Also, given Precision = 1/2 we use:

$$\frac{TP}{TP + FP} = \frac{1}{2}$$

$$TP + FP = 2TP$$

$$FP = TP$$

Now, substituting $FP = TP$ in the equation $2TP = FP + FN$:

$$2TP = TP + FN$$

$$FN = TP$$

Thus, **Recall(A):**

$$\text{Recall}_A = \frac{TP}{TP + TP} = \frac{1}{2TP} = \frac{1}{2}$$

Step 3: Using Given Information for Model B

For Model B:

- TP = TN

Accuracy = 1/3 which means:

$$\frac{TP + TN}{TP + TN + FP + FN} = \frac{1}{3}$$

Since TP = TN, we replace TN with TP:

$$\frac{2TP}{2TP + FP + FN} = \frac{1}{3}$$

Multiplying both sides by $(2TP + FP + FN)$:

$$6TP = 2TP + FP + FN$$

$$4TP = FP + FN$$

Also, given **Precision** = 2/3, we use:

$$\frac{TP}{TP + FP} = \frac{2}{3}$$

$$TP + FP = \frac{3}{2}TP$$

$$FP = \frac{1}{2}TP$$

Now, substituting $FP = (1/2)TP$ in the equation

$$4TP = FP + FN:$$



$$4TP = \frac{1}{2}TP + FN$$

$$FN = \frac{7}{2}TP$$

Thus, Recall(B):

$$\text{Recall}_B = \frac{TP}{TP+FN} = \frac{TP}{TP+\frac{7}{2}TP} = \frac{TP}{\frac{9}{2}TP} = \frac{2}{9}$$

Step 4: Comparing Recall(A) and Recall(B)

- Recall(A) = 1/2 = 0.5
- Recall(B) = 2/9 ≈ 0.222

Answer: (A) Recal (B) (A) > Recall (B)

Q44 Text Solution:

First of all only possible intercept ($\hat{\beta}_0$) among the ones given in the answers is 252. And then the slope estimate of -0.9 in these two options looks reasonable. We just need to decide on whether the estimated deviations of the error $sc = d$ is 3.6 or 36. From the figure it is clear that the points are NOT having an average vertical distance to the line in the size of 36, so 3.6 must be the correct number and hence the correct answer is.

Q45 Text Solution:

In I_1 both hypothesis are true and conclusion is also true by Modus ponens.

Elizabeth is human: p

Elizabeth is mortal: q

p → q

p

∴ q → by modus penens

In I_2 , both hypothesis are true and conclusion is also true by Modus tollens.

School is closed today: q

It will rain today: p

p → q

~d

∴ q → by modus tollens

In this case:

- "If it rains today (P), then school will close (Q)" is given.
- "School is not closed today (not Q)" is true.
- Therefore, we can conclude "It will not rain today (not P)" because if it had rained, school would have closed.
- The correct option is **A**: Both I_1 and I_2 are correct inferences.

Q46 Text Solution:

If by "minimizes network variable" we mean minimizing the number of variables involved in intermediate computations (not the total

variables in the original network), then yes, this could be interpreted as correct in terms of computation.

Q47 Text Solution:

- This method is used in approximate inference to estimate properties of a target distribution by sampling from a proposal distribution.
- This method is used in Markov Chain Monte Carlo (MCMC) methods for approximate inference, particularly in Bayesian statistics, to sample from high-dimensional distributions.
- This method generates samples from a proposal distribution and filters them based on acceptance criteria defined by the target distribution.
- Dijkstra's algorithm is a graph search algorithm, not a statistical sampling method used in approximate inference.

Q48 Text Solution:

S_1 : The likelihood function can indeed be used to estimate the parameters of a statistical model by finding the set of parameters that maximize the likelihood of the observed data. So option S_1 is correct.

S_2 : Rejection sampling does not require knowledge of the exact shape of the posterior distribution.

It requires a proposal distribution and can generate samples from the target distribution without needing to know its exact shape. So option S_2 is incorrect.

Q49 Text Solution:

The heuristic is **admissible but not consistent**.

It never overestimates the true cost to goal (so admissible), but it violates the consistency condition on edge $S \rightarrow B$ since $h(S) > c(S,B) + h(B)$.

Q50 Text Solution:

Let $X = \{\text{number of faulty chips}\}$

$$P(x = 0) = P(\text{Number faulty chips}) = \frac{{}^{16}C_2}{{}^{20}C_2} = \frac{12}{19}$$

$$P(X = 1) = P(\text{Exactly are faulty chps}) =$$

$$\frac{{}^4C_1 \times {}^{16}C_1}{{}^{20}C_2} = \frac{32}{95}$$

$$P(X = 2) = P(\text{Exactly 2 faulty chip}) = \frac{{}^4C_2}{{}^{20}C_2} = \frac{3}{95}$$

X	0	1	2
P(X)	$\frac{12}{19}$	$\frac{32}{95}$	$\frac{3}{95}$

Option 'd' is correct.

Q51 Text Solution:



```
def fun1(head):
    if head.next is None:
        return

    print(head.data, end=' ')
    fun1(head.next)
    print(head.data, end=' ')
```

Given linked list:

1 → 2 → 3 → 4 → 5 → 6

1. For node 1:

- Prints 1
- Calls fun1(2)

2. For node 2:

- Prints 2
- Calls fun1(3)

3. For node 3:

- Prints 3
- Calls fun1(4)

4. For node 4:

- Prints 4
- Calls fun1(5)

5. For node 5:

- Prints 5
- Calls fun1(6)

6. For node 6:

- head.next is None, so return (no print)

- After returning from fun1(6), control goes back to node 5 — prints 5 again.
- Then node 4 prints 4,
- Then node 3 prints 3,
- Then node 2 prints 2,
- Then node 1 prints 1.

Final Output:

1 2 3 4 5 5 4 3 2 1

Q52 Text Solution:

Given:

$$A = \begin{bmatrix} 1 & 2 & 1 \\ 3 & 6 & 3 \\ 2 & 4 & 2 \end{bmatrix}$$

$$\det A = \begin{vmatrix} 1 & 2 & 1 \\ 3 & 6 & 3 \\ 2 & 4 & 2 \end{vmatrix} = 0$$

∴ det (A) = 0, the matrix is singular, meaning it is not invertible. This implies the system does not have a unique solution.

Nature of solution :

If the rank of the augmented matrix [A/B] equals the rank of A, the system has infinitely many solutions; otherwise, it has no solutions.

Therefore depending on b, the system may have no solution or infinitely many solution

Option 'd' is correct

Q53 Text Solution:

A = {process ends at 10 draws}

E₁ = {Box contains exactly 2 green marbles}

E₂ = {Box contains exactly 3 green marbles}

$$P(E_1) + P(E_2) = 0.4 + 0.6 = 1$$

⇒ E₁ and E₂ are mutually exclusive and exhaustive events

P(A/E₁) = P(Process ends at 10th draw when box contains 2 green marbles)

= P(drawing 1 green marble in 1st 9 draws) × P(drawing 1 green marble in 10th draw)

$$= \frac{{}^2C_1 \times {}^{13}C_8}{{}^{15}C_9} \times \left(\frac{1}{6}\right)$$

P(A/E₂) = P(Process ends at 10th draw when box contains 3 green marbles)

= P(drawing 2 green marbles in 1st 9 draws) × P(drawing 1 green marble in 10th draw)

$$= \frac{{}^3C_2 \times {}^{12}C_7}{{}^{15}C_9} \times \frac{1}{6}$$

Required probability = P(A)

$$\Rightarrow P(A) = P(E_1) \times P(A/E_1) + P(E_2) \times P(A/E_2)$$

$$= 0.4 \times \frac{{}^2C_1 \times {}^{13}C_8}{{}^{15}C_9} \times \frac{1}{6} + 0.6 \times \frac{{}^3C_2 \times {}^{12}C_7}{{}^{15}C_9}$$

$$\times \frac{1}{6}$$

$$= \frac{1}{6 \times {}^{15}C_9} [0.8 \times {}^{13}C_8 + 13.8 \times {}^{12}C_7]$$

$$= \frac{1}{6 \times {}^{15}C_9} \left[0.8 \times \frac{13!}{8!5!} + 1.8 \times \frac{12!}{7! \times 5!} \right]$$

$$= \frac{12!}{5! \times 6!^{15}C_9 \times 7!} \left[\frac{0.8 \times 13}{8} + 1.8 \right]$$

$$= \frac{12!}{5! \times 6!^{15}C_9 \times 7!} [3.1]$$

$$= \frac{12! \times 7! \times 6!}{7! \times 6!^{15}C_9} \times 3.1 = \frac{3.1 \times 9 \times 8 \times 7! \times 12!}{7! \times 15 \times 14 \times 13 \times 12!}$$

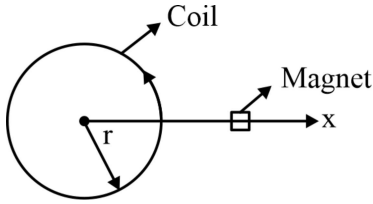
$$= \frac{3.1 \times 9 \times 8}{15 \times 14 \times 13} = 0.082$$

Q54 Text Solution:

$$\text{Given: } F = \frac{kx}{(x^2 + r^2)^{5/2}}$$

For 'F' to be maximum, $\frac{dF}{dx} = 0$



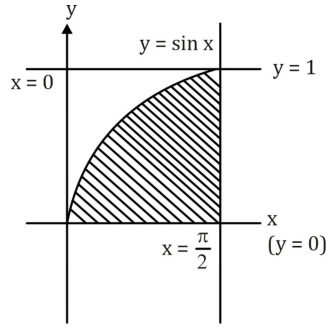


$$\Rightarrow k \left\{ \frac{(x^2+r^2)^{5/2}(1) - x \cdot \frac{5}{2}(x^2+r^2)^{3/2} \cdot 2x}{\{(x^2+r^2)^{5/2}\}^2} \right\} = 0$$

$$\Rightarrow (x^2 + r^2) - 5x^2 = 0 \Rightarrow r^2 - 4x^2 = 0$$

$$\Rightarrow x^2 = \frac{r^2}{4} \Rightarrow x = \frac{r}{2}$$

$\therefore x = \frac{r}{2}$ is the location of greatest force



Probability = $\frac{\text{Shaded area}}{\text{Area of Rectangle}}$

Probability ($y < \sin x$) = $\frac{\int_0^{\pi/2} \sin x dx}{\text{Area of Rectangle}}$

= $\frac{-\cos x \Big|_0^{\pi/2}}{\frac{\pi}{2}} = \frac{-\{0-1\}}{\frac{\pi}{2}}$

$\therefore P(y < \sin x) = \frac{2}{\pi}$

Q55 Text Solution:

$f(n) = n^{1/3}, g(n) = \frac{n}{\log n}$

Now comparing f & g

$n^{1/3} > \frac{n}{\log n}$
 $\frac{n}{n^3} > \frac{n}{\log n}$ [eliminating common term n]

$\frac{1}{n^3} < \frac{1}{\log n}$

$f(n) < g(n)$

All are correct.

Q56 Text Solution:

Given

$f(x, y) = x^3 - 6xy + y^3$

$\Rightarrow P = \frac{\partial f}{\partial x} = 3x^2 - 6y = 0; q = \frac{\partial f}{\partial y} =$

$-6x + 3y^2 = 0$

Solving P = 0 & q = 0

$\Rightarrow (x, y) = (0, 0)$ (or) $(x, y) = (2, 2)$

$\therefore r = \frac{\partial^2 f}{\partial x^2} = 6x; s = \frac{\partial^2 f}{\partial x \partial y} = -6; t = \frac{\partial^2 f}{\partial y^2} =$

$6y$

$\Rightarrow rt - s^2 = (6x)(6y) - 36 = 36(xy - 1)$

(i) At (0, 0) $\Rightarrow r = 0 \rightarrow$ Saddle point

(ii) At (2, 2) $\Rightarrow r = 12 > 0$ and $rt - s^2 = 36(xy - 1) = 36(3) > 0$

$\Rightarrow (2, 2)$ is a point of minimum

Q57 Text Solution:

Q58 Text Solution:

Given: $f(x) = x^2 \log_e x + kx^2$

By Rolle's Theorem

$\Rightarrow f'(c) = \frac{f(b) - f(a)}{b - a}$

$\Rightarrow f'(x) = x^2 \frac{1}{x} + \log_e x \cdot (2x) + 2kx$
 $= x + 2x \{\log_e x + k\}$

\Rightarrow The mean value can be calculated for any value of 'k'

Q59 Text Solution:

Habial	Observed frequencies (O_i)	Expected frequencies (E_i)	$(\chi_{cal}^2)_i = \frac{(O_i - E_i)^2}{E_i}$
Forest	550	$\frac{5}{11} \times 1100 = 500$	5
Grassland	330	$\frac{3}{11} \times 1100 = 300$	3
Wetland	150	$\frac{2}{11} \times 1100 = 200$	12.5
Desert	70	$\frac{1}{11} \times 1100 = 100$	9

$\chi_{cal}^2 = 5 + 3 + 12.5 + 9 = 29.5$

dof = number of categories - 1 = 4 - 1 = 3

$\chi_{critical}^2 = 7.815$ for dof = 3

$\chi_{cal}^2 > \chi_{critical}^2$ we reject the null hypothesis.

Option 'b' is correct.

Q60 Text Solution:

Given:

$A = \begin{bmatrix} 9 & 2 & 7 & 1 \\ 0 & 7 & 2 & 1 \\ 0 & 0 & 11 & 6 \\ 0 & 0 & -5 & 0 \end{bmatrix}$



Now

$$8I - A = \begin{bmatrix} 8 & 0 & 0 & 0 \\ 0 & 8 & 0 & 0 \\ 0 & 0 & 8 & 0 \\ 0 & 0 & 0 & 8 \end{bmatrix}$$

$$= \begin{bmatrix} 9 & 2 & 7 & 1 \\ 0 & 7 & 2 & 1 \\ 0 & 0 & 11 & 6 \\ 0 & 0 & -5 & 0 \end{bmatrix}$$

$$\Rightarrow |8I - A| = \begin{vmatrix} -1 & -2 & -7 & -1 \\ 0 & 1 & 2 & 1 \\ 0 & 0 & -3 & -6 \\ 0 & 0 & 5 & 8 \end{vmatrix}$$

$$\Rightarrow |(8I - A)^T| = \begin{vmatrix} -1 & 0 & 0 & 0 \\ -2 & 1 & 0 & 0 \\ -7 & 2 & -3 & 5 \\ -1 & 1 & -6 & 8 \end{vmatrix}$$

$$\therefore |8I - A| = |(8I - A)^T|$$

$$\Rightarrow |8I - A| = -1 \begin{vmatrix} 1 & 0 & 0 \\ 2 & -3 & 5 \\ 1 & -6 & 8 \end{vmatrix}$$

$$= -1 \times 1 \times (6) = -6$$

$$\therefore \det(A^n) = \det(a)^n$$

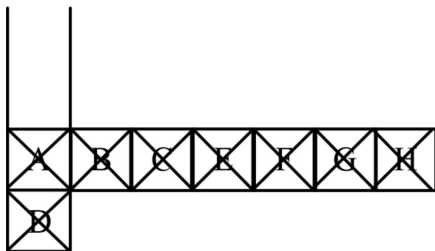
\Rightarrow

$$|(8I - A)^3| = |8I - A|^3 = (-6)^3 = -216$$

$$\therefore |\det(8I - A)^3| = |-216| = 216$$

Q61 Text Solution:

• D A B C E F G H



Stack Size = 2 unit.

Q62 Text Solution:

$$S = \frac{1}{2} - \frac{1}{6} + \frac{1}{24} - \frac{1}{120} + \dots$$

$$= \frac{1}{2!} - \frac{1}{3!} + \frac{1}{4!} - \frac{1}{5!} + \dots$$

$$= 1 - \frac{1}{1!} + \frac{1}{2!} - \frac{1}{3!} + \frac{1}{4!} - \frac{1}{5!} + \dots$$

$$= e^{-x} \Big|_{x=1} = e^{-1} = 0.3678 \approx 0.368$$

Q63 Text Solution:

M = The misplaced item is a magazine

B = the event that the item is misplaced

$$P(M/B) = \frac{P(B/M) \times P(M)}{P(B)}$$

$$P(B) = P(B/F) P(F) + P(B/NF) \cdot P(NF) + P(B/M) \times P(M)$$

$$P(F) = \text{Probability of misplaced fiction book} = \frac{1500}{4500} = \frac{1}{3}$$

$$P(NF) = \text{Probability of misplaced non fiction book} = \frac{2000}{4500} = \frac{4}{9}$$

$$P(M) = \text{Probability of a misplaced magazine} = \frac{1000}{4500} = \frac{2}{9}$$

$$P(B/F) = 0.02, P(B/NF) = 0.01 \text{ and } P(B/M) = 0.03$$

$$P(B) = 0.02 \times \frac{1}{3} + 0.01 \times \frac{4}{9} + 0.03 \times \frac{2}{9}$$

$$P(M/B) = \frac{0.03 \times \frac{2}{9}}{0.02 \times \frac{1}{3} + 0.01 \times \frac{4}{9} + 0.03 \times \frac{2}{9}} = \frac{\frac{6}{9}}{\frac{2}{3} + \frac{4}{9} + \frac{6}{9}} = \frac{\frac{6}{9}}{\frac{6}{9} + \frac{4}{9} + \frac{6}{9}} = \frac{6}{16} = \frac{3}{8}$$

Q64 Text Solution:

Given: Rank $\rho(A_{n \times n}) = m$

'm' depends on the cofactors and minors of M.

Since $|A^2|$ also depends on $|A|$

$$\Rightarrow \rho(A^2) = \rho(A) = m$$

If the rank of a $n \times n$ matrix A is m where $1 \leq m \leq n$.

Then the rank of matrix A^2 is also 'm'.

Q65 Text Solution:

Given:

x	2	4	6
P(x)	0.2	0.5	0.3

$$V = E(x^2) - (E(x))^2$$

$$= \sum x^2 \cdot P(x) - (\sum x \cdot P(x))^2$$

$$= (2^2 \times 0.2 + 4^2 \times 0.5 + 6^2 \times 0.3) - (2 \times 0.2 + 4 \times 0.5 + 6 \times 0.3)^2$$

$$= 19.6 - 4.2^2$$

$$= 19.6 - 17.64$$

$$= 1.96$$

Standard deviation

$$\sigma = \sqrt{\text{Var}} = \sqrt{1.96} = 1.4$$

option 'd' is correct





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