QUESTION-1—MCQ

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

(a) Join
(b) Selection
(c) Set union
(d) Projection

SOLUTION: (a)

If a decomposition is not dependency-preserving, we need to reconstruct the original relation by joining the decomposed tables to verify and enforce functional dependencies.

Since joins are expensive in terms of computation, this increases the query execution time.

QUESTION-2—MCQ

Consider 3 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 given year, with serial number and a color. A tuple in make specifies that a maker of company makers of car and model. Own represents the owner of the model with serial number keys are underlined; (owner, serial) together form key for won. (⋈ denotes natural join)

π_{owner} (O_{wn} ⋈ ($\sigma_{color = \text{'red'}}$(Car ⋈ ($\sigma_{maker = \text{'ABC'}}$ make))))

Which of the following option describes what above expression compounds?

(a) All owner of a red car, a car made by ABC, or a red car made by ABC
(b) All owners of a red car made by ABC
(c) All red cars made by ABC
(d) All owners of more than one car, where at least one car is red and made by ABC.

SOLUTION: (b)

π_{owner} (O_{wn} ⋈ ($\sigma_{color = \text{'red'}}$(Car ⋈ ($\sigma_{maker = \text{'ABC'}}$ make))))

All owners of a red car made by ABC

QUESTION-3—NAT

Consider the following pseudocode create empty stack S

Set x = 0, Flag = 0, Sum = 0

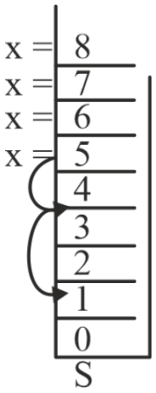
Push × Onto S

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 _____ (in integer)

SOLUTION: (24)
Sum = 8 + 7 + 5 + 3 + 1 = 24



QUESTION-4—MSQ

Suppose that insertion sort is applied to the array [1, 3, 5, 7, 9, 11, x, 15, 13] and takes exactly two swaps to sort the array.

select all possible values of x.

(a) 14 (b) 16
(c) 12 (d) 10

SOLUTION: (a, d)

For 14, two swaps.

For 16, three swaps

For 12, one swaps

For 10, two swaps

QUESTION-5—MSQ

For which of the following inputs does binary search take O(logn) time in worst case

(a) A linked list of n integer in increasing order
(b) An array of n integer in increasing order
(c) An array of n integer in any order
(d) Link list of n integer in any order

SOLUTION: (b)

Arrays allow random access, meaning we can access the middle element in O(1) time.

Binary search works by repeatedly dividing the search space by half, leading to a worst-case time complexity of O(log n).

QUESTION-6—MCQ

The number of additional and multiplications involved in performing gaussian elimination on any n × n upper triangular matrix is of the order

(a) $O(n^3)$
(b) $O(n^2)$
(c) O(n)
(d) $O(n^4)$

SOLUTION: (a)

$O(n^3)$ number of additional and multiplications involved in performing gaussian elimination on any n × n upper triangular matrix

QUESTION-7—NAT

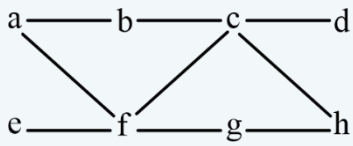
Consider a directed graph G = (V, E) where V= {0, 1, 2, …. 100} and E = {(i, j); 0 <j – i ≤ 2, for all i, j ∈ V}. Suppose the adjacency list of each vertex is in decreasing order of vertex number, and DFS is performed at vertex 0, the number of vertices that will be discovered after vertex 50 is _____.

SOLUTION: (75)

75 vertices that will be discovered after vertex 50.

QUESTION-8—MSQ

Let G be a simple undirected and un-weighted graph. A subset of the vertices and edges of are shown below.



It is given that a–b–c–d is a shortest path between a and d ; e–f–g–h is 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 edge of G?

(a) (e, g)
(b) (b, d)
(c) (b, g)
(d) (b, h)

SOLUTION: (a, b, d)

- If (e, g) existed, then the path e–g–h would be a potential alternative.
- The given shortest path from e to his e–f–g–h, meaning that e - g cannot exist; otherwise, the given shortest path would not be the shortest.

Step 2: Checking (b, d)

- The given shortest path between a and d is:
  a – b – c – d
- If (b, d) existed, then the path a – b – d would be a shorter alternative.
- Since a – b – c – d is given as the shortest path, (b, d) cannot exist.

QUESTION-9—MCQ

Suppose X and Y are random variable the conditional expectation of X given Y is denoted by E[X/Y]. Then E(E[X/Y]) equal?

(a) E(x) (b) E(y)

(c) E(x/y) (d) $\frac{E(x)}{E(y)}$

SOLUTION: (a)

We know that, $f(x/y)=\frac{f(x,y)}{f(y)}$ & $f(x)=\int_{-\infty}^{\infty} f(x,y)dy$

Now, $E\{x/y\}=\int_{-\infty}^{\infty} xf(x/y)dx=\varphi(y).(let)$

Now, $E\{E(x/y)\}=E\{\varphi(y)\}=\int_{-\infty}^{\infty}\varphi(y).f(y)dy$

$$=\int_{-\infty}^{\infty}\left\{\int_{-\infty}^{\infty} xf(x/y)dx\right\}f(y)dy$$

$$=\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} xf(x/y).f(y).dxdy=\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} x.f(x,y)dxdy$$

$$=\int_{-\infty}^{\infty} x\left(\int_{-\infty}^{\infty} f(x,y)dy\right)dx=\int_{-\infty}^{\infty} x.f(x)dx=E(x)$$

Hence, answer is option (a).

QUESTION-10—MCQ

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

(a) Gibbs sampling is an exact inference algorithm

(b) Rejection sampling is an approximate inference algorithm

(c) Variable elimination is an approximate inference algorithm

(d) Variable elimination is used to determine conditional probabilities.

SOLUTION: (b, d)

Rejection sampling generates samples from a prior distribution and rejects samples that do not satisfy the given evidence. Since it relies on sampling rather than exact computation, it is an approximate inference algorithm.

Variable elimination is an exact inference method used in Bayesian networks to compute conditional probabilities by marginalizing out irrelevant variables.

QUESTION-11—MCQ

It is given that $P(X \geq 2) = 0.25$ for an exponential distribute random variable X with $E[X]=\frac{1}{\lambda}$ where $E[X]$ denoted Expectation of X. What is the value of λ? (in denotes natural algorithm)

(a) ln 0.2
(b) ln 3
(c) ln 4
(d) ln 2

SOLUTION: (d)

$$\int_2^{\infty} \lambda e^{-\lambda x} dx = \frac{1}{4} \Rightarrow \lambda \left(\frac{e^{-\lambda x}}{-\lambda} \right)_2^{\infty} = \frac{1}{4} \Rightarrow \left(0 - e^{-2\lambda}\right) = \frac{1}{4}$$

$$e^{-2\lambda} = \frac{1}{4} \Rightarrow e^{2\lambda} = 4 \Rightarrow 2\lambda = \ln 4 \Rightarrow \lambda = \ln 2$$

QUESTION-12—MSQ

Let C_1 and C_2 be two sets of object. 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

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

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

is/are correct

(a) Single linkage clustering uses DIS-1
(b) Single linkage clustering uses DIS -2
(c) Complete linkage clustering uses DIS -1
(d) Complete linkage clustering uses DIS -2

SOLUTION: (a, d)

Single linkage clustering merges clusters based on the minimum distance between any two points in different clusters, which matches DIS-1.

Complete linkage clustering merges clusters based on the maximum distance between any two points in different clusters, which corresponds to DIS-2.

QUESTION-13—NAT

Given data {(–1, 1), (2, –5), (3, 5)} of the form (X, Y), we want to fit the model y = wx using linear least square regression then optimal value of w is ____ ?

SOLUTION: (0.286)

$$u = e_i^2 = (y_i - wx_i)^2$$

$$u = e_i^2 = (y_i - wx_i)^2 \Rightarrow \frac{\partial u}{\partial w} = 0 \Rightarrow w = \frac{\sum x_i y_i}{\sum x_i^2}$$

$$\text{So, } w = \frac{x_1y_1 + x_2y_2 + x_3y_3}{x_1^2 + x_2^2 + x_3^2} = \frac{-1\times1 + 2\times(-5) + 3\times5}{(-1)^2 + (2)^2 + (3)^2} = \frac{4}{14} = 0.286$$

QUESTION-14—MCQ

Given that Z = (Standard Normal Random Variable) & x = az + b : a, b constant also its given that E[X] = 1, E[(X–E(X)Z)] = –2, & E[(X–E(X))^2] = 4

Then, (a,b)= ?

(a) (2, –1) (b) (1,1)

(c) (–2,1) (d) (–2, –1)

SOLUTION: (c)

Given that,

E(X) =1

E (az + b) =1

A (0) + b = 1 $\Rightarrow$ b = 1

Now, Var (z) =1

E(z^2) – E^2 (z) = 1

E(z^2) – 0 =1

E(z^2) =1

Now, E{X– E(x)^2} = 4

E{(az + b –1)^2 } = 4

E(a^{2}z^2) = 4

a^2 E(z^2) = 4 $\Rightarrow$ a^2 (1) = 4

Or $a = \pm 2$

Now, E {(x – E(x)).z} = –2

E{(az + b –1)z} = –2

E (az^2) = –2

A(E(z^2)) = –2 $\Rightarrow$ a = –2

QUESTION-15—MSQ

Which of the following statements is/are correct

(a) R^n has a unique set of Orthonormal basis

(b) R^n does not have a unique set of Orthonormal basis

(c) Linearly independent vector is R^n are orthonormal

(d) Orthonormal vector R^n are linearly independent

SOLUTION: (b, d)

• R^n does not have a unique set of Orthonormal basis

• Orthonormal vector R^n are linearly independent

Hence, options 'b' & 'd' are correct.

QUESTION-16—NAT

$\lim_{t\to\infty}\sqrt{t^2+t}-t=$ ____ .

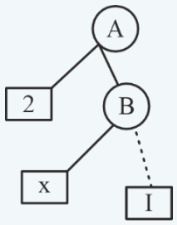
SOLUTION: (0.5)

$$=\lim_{x\to\infty}\left(\frac{t^2+t-t^2}{\sqrt{t^2+t}+t}\right)=\lim_{x\to\infty}\frac{1}{\sqrt{1+\frac{1}{t}}+1}=0.5$$

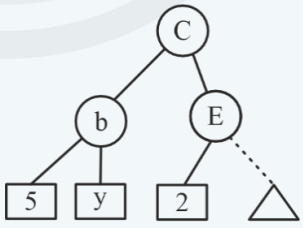
QUESTION-17—NAT

Consider gave tree-1 and tree-2. The first level is a max agent and second is a min agent max.

For what range of randy the right add of node B and the right child of note E will be pruned by α,β algorithm.



Tree – 1



Tree – 2

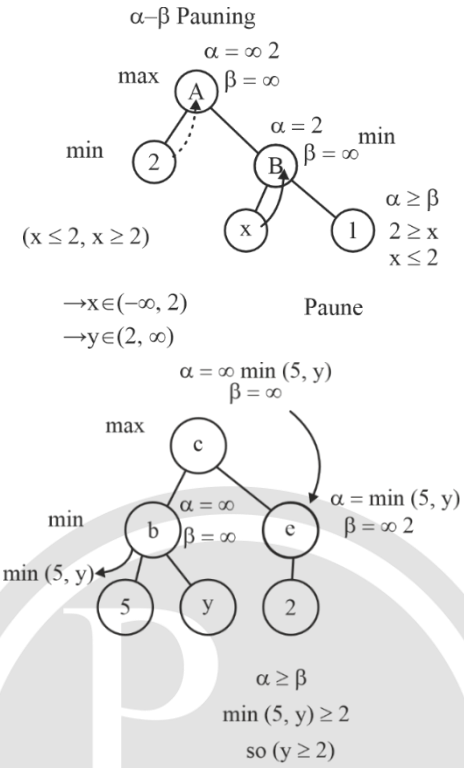
X E [–∞, 2] and y E(–∞, S)

xE [1, ∞], - ∞5

xE –∞, 2 2, ∞

1, ∞ –∞2

SOLUTION: (2)



QUESTION-18—MSQ

Correct about Relu actives F^n defined

Relu (x) = max (x, o) when E R

(a) Relu is continue every where

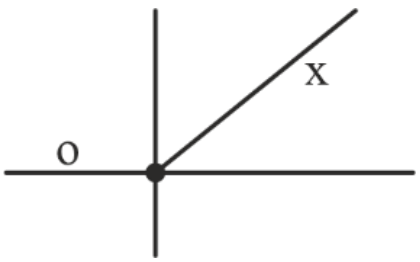
(b) Relu is differentiable every where

(c) Relu is not differentiable afx = 0

(d) Rule (x) = ReLV (ox) ∀ace

SOLUTION: (a, c)

Relu (x) = max(o, x)



Contevery where

Not differentiable at O

Differentiable-everywhere

Relu(x) = Relu(ax)$^{a=3}$

Max(o, x) ≠ max(o, ax)

Relu(5) ≠ Relu (3 × 5)

Max (0, 5) ≠ max (0, 15)

QUESTION-19—MCQ

Consider the cumulative distribution function (CDF)

$$F_x(x)=\begin{cases}0 & x\le -1\\ \frac{1}{4}(x+1)^2 & -1\le x\le 1\\ 1 & x\ge 1\end{cases}$$

Value of $P(x^2 \le 0.25)$

(a) 0.25 (b) 0.625

(c) 0.5 (d) 0.565

SOLUTION: (c)

$$F_x(0.5)=\frac{1}{4}\left(\frac{1}{2}+1\right)^2=\frac{9}{16}=0.5625$$

$$F_x(-0.5)=\frac{1}{4}\left(-\frac{1}{2}+1\right)^2=\frac{1}{16}=0.0625$$

$$P\left(x^2\le 0.25\right)=P(-0.25\le x\le 0.25)=P(-0.5\le x\le 0.5)$$

$$=P(-\infty<x\le 0.5)-P(-\infty<x\le -0.5)$$

$$=F(0.5)-F(-0.5)=0.5625-0.0625=0.5$$

QUESTION-20—MCQ

For x ε R, the floor P[h] is denoted by F(x) = ⌊4⌋

$\lfloor x\rfloor = k,\ k\le x<k+1;$

where k is an integer.

Let y = ⌊x⌋ x is an exponential distribution random variable with mean $\frac{1}{\ln 10}$, where ln denotes natural Algorithm for any positive integer *l*, one can write the probability of the event

y = *l* as follow

$P(y=l)=q^l(1-q)$

The value of q is

(a) 0.434 (b) 0.1

(c) 0.01 (d) 0.5

SOLUTION: (a)

To find P(y = l), we calculate:

$$P(y = l) = P(l \le x < l + 1)$$

For an exponential distribution, the cumulative distribution function (CDF) is:

$$F_x(x) = 1 - e^{-x/\lambda}$$

Thus, the probability that x lies between l and l + 1 is:

$$P(y = l) = P(l \le x < l + 1) = F_x(l + 1) - Fx(l)$$

Substituting the CDF:

$$P(y = l) = (1 - e^{-(l+1)}) - (1 - e^{-l/\lambda})$$

$$= e^{-l/\lambda} - e^{-(l+1)/\lambda}$$

$$= e^{-l/\lambda}\,(1 - e^{-1/\lambda})$$

$q = e^{-1/1} = e^{-1} \approx 0.3679$

(a) 0.434 (closest to actual value $e^{-1} \approx 3679$

QUESTION-21—MCQ

Let x be a continuous random variable whose (CDF) $F_x(x)$ for some t is given as follows.

$$F_x(x) = \begin{cases} 0 & x \le t \\ \dfrac{x - t}{4 - t} & t \le x \le 4 \\ 1 & x \ge 4 \end{cases}$$

The median of x is 3, the value of t is

(a) 1 (b) 0

(c) 2 (d) –1

SOLUTION: (c)

If x is Median then C.D.F. at x i.e. $F(x) = \dfrac{1}{2}$

ATQ, $F(3) = \dfrac{1}{2} \Rightarrow \dfrac{3-t}{4-t} = \dfrac{1}{2} \Rightarrow 6 - 2t = 4 - t \Rightarrow t = 2$

QUESTION-22—MCQ

Let $f(x) = \frac{e^x - e^{-x}}{2}$, $x \varepsilon R$, let $f^{(k)}(a)$ denote the k^{th} derivation of F evaluated at a. What is the value of $f^{(10)}(0)$?

(a) $\frac{1}{10!}$ (b) 0

(c) 1 (d) $\frac{2}{10!}$

SOLUTION: (b)

$$f(x) = \frac{e^x - e^{-x}}{2} = \sinh x$$

$$f'(x) = \cosh x, f''(x) = \sinh x, f'''(x) = \cos\ hx$$

$$....f^{10}(x) = \sinh\ x = \frac{e^x - e^{-x}}{2} = \frac{1-1}{2} = 0$$

QUESTION-23—MCQ

The sum of elements of each row of A is 1 & $B = A^3 - 2A^2 + A$ then $BX = 0$ has

(a) has ∞ many solution (b) No solution

(c) unique solution (d) Exactly two solutions

SOLUTION: (a)

For A, $\lambda = 1$

Hence, for $B = A^3 - 2A^2 + A$

$\lambda = 1 - 2 + 1 = 0$

i.e. $|B| = 0$ So, $BX = 0$ has ∞ solution

QUESTION-24—MSQ

Consider two function $F: R \rightarrow R$ and $g: R \rightarrow (1, \infty)$.

Both functions are differentiable at point C. Which of the following functions are always differentiable at C?

(a) fog + gof (b) f/g

(c) $f \pm g$ (d) $f \cdot g$

SOLUTION: (a, b, c, d)

As both function f & g are differentiable, so all options are correct.

QUESTION-25—MCQ

S_1 : p⟶ q

S_2 : p'∨ q'

S_3 : p'∨ q

S_4 : p'∧ q

(a) $S_2 = S_4$ (b) $S_1 = S_4$

(c) $S_2 = S_3$ (d) $S_1 = S_3$

SOLUTION: (a)

S1: P ⟶ 2

This can be rewritten using implication:

P ⟶ 2 = ¬PV2

S2: P's2 (Possible interpretation: ¬P ∧ s2)

S3: P'*v*2 (Possible interpretation: ¬P ∨ 2)

S4: P'*v*q' (Possible interpretation: ¬P ∨ ¬q)

S1 and S3:

S1 = ¬ P ∨ 2

S3 = ¬P ∨ 2

S1 = S3

QUESTION-26—NAT

Select L1 · Loan +1

From Loan L1

Where L1 amount > (Select max (L2 · amount

From L2

Where L2 branch = SRNag name)

Laon		
LN	**BN**	**Amount**
L11	Banjara hills	90K
L14	Konda	50K
L15	SR	40K
L22	SRN	25K
L23	Balanagar	80K
L25	Kondapur	70K
L19	SR Nagar	65K

#Row _____.

SOLUTION: (3)

Select L1 Loan-number

From Loan L1

Where L1 amount > Select max (L2 amount)

From Loan L2

Where,

L2 Branch name = SRnagar

QUESTION-27—MCQ

Consider a hash table of size 10 with indices {0,1,…….,9} with the hash function n(x) = 3x(mod 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 key 14 and 15 are stored are respectively.

(a) 2 and 5 (b) 2 and 6

(c) 4 and 6 (d) 4 and 5

SOLUTION: (c)

Hash table [0 …9]

		4	1	14	5	15		6	
0	1	2	3	4	5	6	7	8	9

h(x) = 3 ×% 10 14, 15 store in which in which index

1, 4, 5, 6, 14, 15

Linear probing

3%10 = 3

4 ×3 %10= 2

5 ×3 % 10 =5

3 ×6% 10 = 8

14 ×3% 10 = 2

15 ×3%10 =5

QUESTION-28—MCQ

Consider the following python declaration of two lists:

[1, 2, 3]

[4, 5, 6]

Which of the following statements result in A [1,2,3,4,5,]?

(a) A. opened (B)
(b) A. update (B)
(c) A. Insert (B)
(d) A. Extend (B)

SOLUTION: (d)

he extend() method appends elements from another iterable (like a list) to A.

QUESTION-29—NAT

Consider the all 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)
printf(f(15, 10))
```

The value printed because above code is_____.(in int.) 0

SOLUTION: (160)

$f(15, 10)$

$\sqrt{2 * f(7, 10)}$

$\sqrt{2 * f(3, 10)}$

$\sqrt{2 * f(1, 10)}$

$\sqrt{2 * f(0, 10)}$

10

$\Rightarrow 2^4 \times 10$

$\Rightarrow 160$

QUESTION-30—MCQ

Consider the following python code snippet.

A = {"this" , "that"}

B = {"this" , "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

At the end which of the following sets contain "this"?

(a) only A (b) A and C

(c) only C (d) Only B

SOLUTION: (d)

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

A = A – B = {"this"}

B = B – C = {"that"}

C = C – A = {"other"}

A = C : A = {“other”, “this”}

B = A : B = {“this”, “that”}

C = B : C = {“that”, “other”}

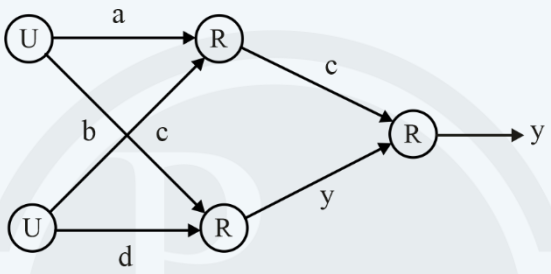
$A_{A-B} = \{\text{"other"}\}$

$B_{B-C} = \{\text{"this"}\}$

$C_{C-A} = \{\text{"that"}\}$

QUESTION-31—NAT

Weight a, b, c, d, e, d, f / R denote his the Rule fn R(x) = max (0, x) 0/8?



Given, u = 2

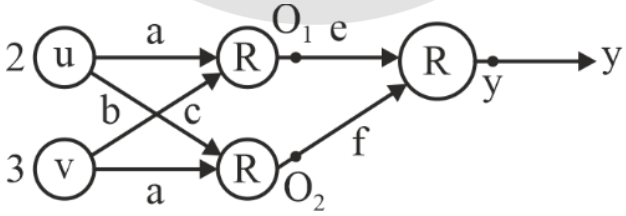
u = 3

a = 1, b = 1, c = 1, d = –1, e = 4, f =1

Which one is correct?

$\frac{\partial y}{\partial a} = \frac{\partial y}{\partial f} = 0$

SOLUTION: (8)



$y = eO_1$

y = e(au + cv)

y = eau + ecv

Relu max (O, x)

a = b = c = 1

d = –1

e = 4

$f = -1$

$O_1 = \max(O, au + cv) = \max(0, 7) = 7$

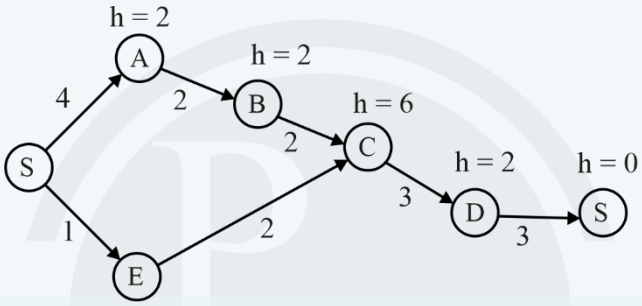
$O_2 = \max(O, bu + dv) = \max(0, -1) = 0$

$y = \max(O, eO_1 + fO_2) = \max(0, 28) = 28$

$$\frac{\partial y}{\partial a} = eu = 8 \Rightarrow \frac{\partial u}{\partial f} = 0$$

QUESTION-32—MCQ

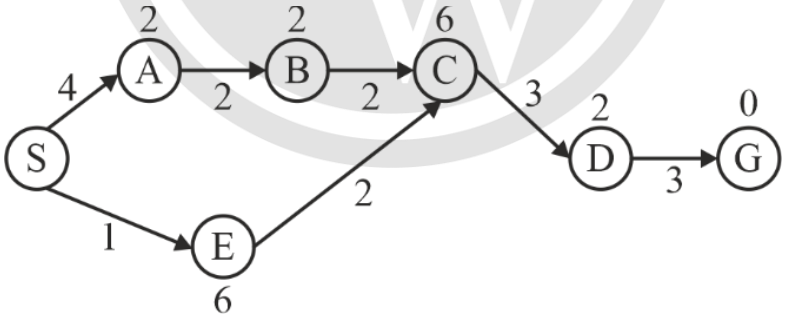
The state graph shows the action cost along the edges and heartsick of h associated with each state. Suppose A* algorithm is applied on this state graph using priority quiets to store the porosities in what sequence node expand it.



(a) SEACBOB (b) SABECDG

(c) SAEBCDG (d) SAECBDG

SOLUTION: (c)



Sequence of expanded node

$\Rightarrow$ SAEBCDG

	S	A	E	B	C	D	G
S	0	0	0	0	0	0	
A	6	6	6	6	6	6	
B	–	8	8	8	8	8	
C	–	–	9	9	9	9	
D	–	–	–	–	8	8	
E	7	7	7	7	7	7	
G	–	–	–	–	–	9	

QUESTION-33—MSQ

Consider designing a linear binary classifier $f(x) = \text{sign}(w^T x + b)$, $x \in R^2$ on following training data?

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

Hard margin support vector machine (SVM) Formulation is solved to obtain w a and b is/are correct.

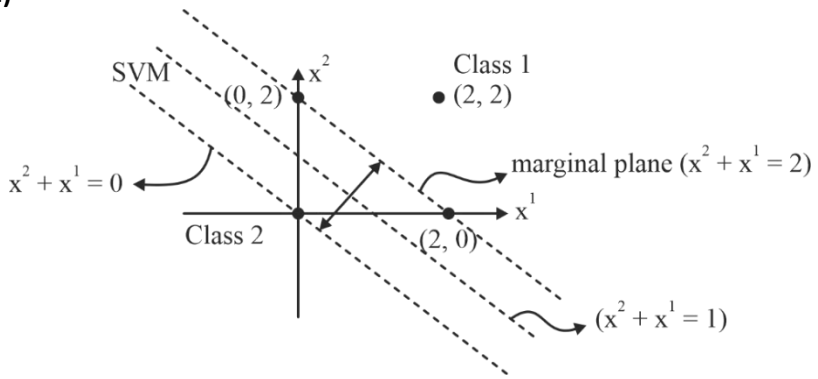
(a) $w = \begin{pmatrix}4\\0\end{pmatrix}$ and b=1

(b) # support vector = 3

(c) margin $\sqrt{2}$

(d) Training occurs

SOLUTION: (a, d)



* 3 support vectors

* $x^2 + x^1 = 1$

* margin $= \frac{2}{\|\omega\|} = \frac{2}{\sqrt{1+1}} = \sqrt{2}$

QUESTION-34—MCQ

$3^{x^2} = 27 \times 9^x$, value of $\frac{2^{x^2}}{(2^x)^2}$

(a) 2^{15} (b) 2^3

(c) 0 (d) 1

SOLUTION: (b)

$3^{x^2} = 27 \times 9^x$, Final the value $\frac{2^{x^2}}{(2x)^2}$

$\frac{2^9}{2^6} = 2^{9-6} = 2^3$

$\Rightarrow 3^{x^2} = 3^3 \times \left(3^2\right)^x$

$\Rightarrow 3^{x^2} = 3^{3+2x}$

$\Rightarrow x^2 = 3 + 2x$

$\Rightarrow x^2 - 2x - 3 = 0$

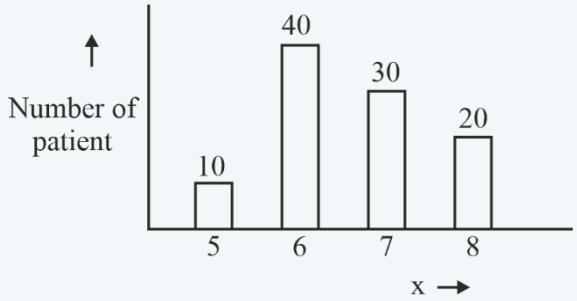
$\Rightarrow x^2 - 3x + x - 3 = 0$

$\Rightarrow x(x-3) + 1(x-3) = 0$

$\Rightarrow (x-3)(x+1) = 0$

$\therefore x = 3 \mid x = -1$

QUESTION-35—MCQ



Formula: 1000 (x – 0.2) rupees. Find average earning.

(a) 6500 (b) 6300

(c) 6200 (d) 6000

SOLUTION: (b)

$$= \frac{\left[1000 \times (4.8+5.8+6.8+7.8)\right]}{4}$$

$$\Rightarrow 6300$$

QUESTION-36—MCQ

Consider a fact table is an OLAP application:

Facts (D_1, D_2, Val), where D_1 and D_2 are its dimension attributes and val is a dependent attribute. Suppose attribute D_1 takes 3 values and D_2 takes Q value and all combinations of these values are present in the table facts. How many tuples are there in the result of following query?

SELECT D_1, D_2 and Sun (Val)

FROM Facts

Group by CUBE (D_1, D_2)

(a) 1 (b) 12

(c) 6 (d) 9

SOLUTION: (c)

Facts (D1, D2, val)

D1	D2	Value
1	x	-
2	x	-
3	x	-
1	y	-
2	y	-
3	y	-

Select D1, D2 sum (val) from facts group by CUBE (D1, D2)

Output

1	x	✓	$3x$	✓
1	y	✓	$3y$	✓
1	NULL	Sum	3 NULL	✓
2	x	✓	NULL x	✓
2	y	✓	NULL y	✓
2	NULL	✓	NULL NULL	✓

QUESTION-37—MCQ

If $y = z^2, z = \frac{x-\mu}{\sigma}$ then var y = ?

(a) 1 (b) 2

(c) 3 (d) 4

SOLUTION: (b)

$$\begin{cases} E(z)=0 \\ Var(z)=1 \end{cases}$$

$$E\left(z^2\right)-\left(E(z)^2\right)=1$$

$$E\left(z^2\right)-1+0=1$$

$$E\left\{Z^{2K}\right\}=\frac{(2k)!}{2^k.k!}$$

At k = 1

$$E\left(z^2\right)=\frac{2!}{2^1\times 1!}=1$$

Similarly, For k =2

$$E\left(z^4\right)=\frac{(2\times 2)!}{2^2\times 2!}=\frac{24}{8}=3$$

$$Var(y)=E\left(y^2\right)-\left(E(y)\right)^2$$

$$=E\left(z^4\right)-\left(E(z)^2\right)^2 = 3 - (1)^2 = 2$$

QUESTION-38—MCQ

Let $A \in R^{n\times n}$ such that $A^3 = A$ then which is True?

(a) A is invertible (b) Sum of Diagonal elements is 1

(c) $\rho(A) = \rho(A^2)$ (d) $|A| = 0$

SOLUTION: (c)

Given that

$A^3 = A$

$\Rightarrow |A|^3 = |A|$

$|A|\left(|A|^2-1\right)=0$

i.e. $|A|=0$ or $|A|=1$ or $|A|=-1$

These are possible value of determinant

Again, if λ is an eigen value of then $A^3 = A \Rightarrow \lambda^3 = \lambda \Rightarrow \lambda = 0, 1, -1$ these are the possible eigen value of A.

Now, considering the metrics

$$A=\begin{bmatrix}1 & 0\\ 0 & -1\end{bmatrix}, A=\begin{bmatrix}1 & 0\\ 0 & 0\end{bmatrix}, A=\begin{bmatrix}1 & 0 & 0\\ 0 & -1 & 0\\ 0 & 0 & 0\end{bmatrix}$$

$$A^2=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}, A^2=\begin{bmatrix}1 & 0\\ 0 & 0\end{bmatrix}, A^2=\begin{bmatrix}1 & 0 & 0\\ 0 & 1 & 0\\ 0 & 0 & 0\end{bmatrix}$$

& $A^3 = A$ & $A^3 = A$ & $A^3 = A$

In all the case we have $\rho(A)=\rho\left(A^2\right)$

Hence, 'c' is correct

QUESTION-39—MCQ

A Random Experiment consisting of throwing 100 fair dice, each dice having 6 faces (number 1 to 6). An event A represent the set of all out comes where at least one of the dice shows 1 then P(A)=?

(a) 0

(b) 1

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

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

SOLUTION: (c)

Getting 1 = success,

So, P(success) = $\frac{1}{6}$, $q=\frac{5}{6}$

X = {number of dice shows 1}, n = 100

$$P(x\geq 1)=1-P(x=0)=1-{}^{100}C_0\left(p^0q^{100}\right)=1-\left(\frac{5}{6}\right)^{100}$$

QUESTION-40—NAT

F: R⟶ R such that $|f(x) - f(y)| \le (x-y)^2$, $\forall x,y \in R$ then f(1) – f(0) = ?

SOLUTION: (0)

$$\frac{|f(x)-f(y)|}{x-y} \le x-y \qquad \left|\frac{f(x)-f(y)}{x-y}\right| \le x-y$$

$$\lim_{x\to y}\left|\frac{f(x)-f(y)}{x-y}\right| \le \lim_{x\to y}(x-y) \qquad |f'(y)| \le 0 \Rightarrow f'(y)=0$$

$\because f'(y)=0$

$\Rightarrow f(x)$ is constant function

So, $f(x)$ = c (let)

Hence, $f(1) - f(0)$ = c – c = 0

❐❐❐