Define a function

$$f(x) = \begin{cases} \frac{|x-3|}{x-3} & \text{if } x \neq 3 \\ 1 & \text{if } x = 3 \end{cases}$$

Which of the following options is/are true?

Options :

6406531963657. ✔ $\lim_{x \to 3^+} f(x) = f(3).$

6406531963658. ✖ $\lim_{x \to 3^-} f(x)$ does not exist.

6406531963659. ✔ f is not continuous at $x = 3.$

6406531963660. ✖ f is differentiable at $x = 3.$

6406531963661. ✖ $f'(7) = 1.$

PDSA

Section Id :	64065339807
Section Number :	14
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	17
Number of Questions to be attempted :	17
Section Marks :	50
Display Number Panel :	Yes
Group All Questions :	No
Enable Mark as Answered Mark for Review and	Yes

Clear Response :

Maximum Instruction Time : 0

Sub-Section Number : 1

Sub-Section Id : 64065385013

Question Shuffling Allowed : No

Is Section Default? : null

Question Number : 238 Question Id : 640653588761 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 0

Question Label : Multiple Choice Question

THIS IS QUESTION PAPER FOR THE SUBJECT "DIPLOMA LEVEL : PROGRAMMING, DATA STRUCTURES AND ALGORITHMS USING PYTHON (COMPUTER BASED EXAM)"

ARE YOU SURE YOU HAVE TO WRITE EXAM FOR THIS SUBJECT?
CROSS CHECK YOUR HALL TICKET TO CONFIRM THE SUBJECTS TO BE WRITTEN.

(IF IT IS NOT THE CORRECT SUBJECT, PLS CHECK THE SECTION AT THE TOP FOR THE SUBJECTS REGISTERED BY YOU)

Options :

6406531963662. ✔ YES

6406531963663. ✖ NO

Sub-Section Number : 2

Sub-Section Id : 64065385014

Question Shuffling Allowed : Yes

Is Section Default? : null

Question Number : 239 Question Id : 640653588762 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3

Question Label : Multiple Choice Question

Consider the following strategy to solve the single source shortest path problem with positive integer edge weights from a source vertex s:

Replace each edge with weight w by w edges of weight 1 connected by new intermediate nodes. Run BFS(s) on the modified graph to find the shortest path to each of the original vertices in the graph.

Which of the following statement is true?

Options :

6406531963664. ✖ This strategy will not solve the problem correctly.

6406531963665. ✖ This strategy will only work if the graph is acyclic.

6406531963666. ✖ This strategy will solve the problem correctly and is as efficient as Dijkstra's algorithm.

6406531963667. ✔ This strategy will solve the problem correctly, but is not as efficient as Dijkstra's algorithm.

Sub-Section Number :	3
Sub-Section Id :	64065385015
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 240 Question Id : 640653588763 Question Type : MSQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3 Max. Selectable Options : 0

Question Label : Multiple Select Question

Which of the following statements is **true** about Dijkstra's algorithm to find the shortest path?

Options :

6406531963668. ✔ Dijkstra's algorithm may fail for graphs with negative weights because it does not reconsider a node once it marks it as visited, even if a shorter path exists than the previous one.

6406531963669. ✖ The shortest path between two vertices *u* and *v* in a graph *G* always remains unaltered when all the edges of *G* are incremented by an equal amount.

6406531963670. ✔ The shortest path between two vertices *u* and *v* in a graph *G* always remains unaltered when all the edges of *G* are multiplied by a positive integer.

6406531963671. ✔ To decide which node to visit next, Dijkstra's algorithm selects the node with the smallest known distance.

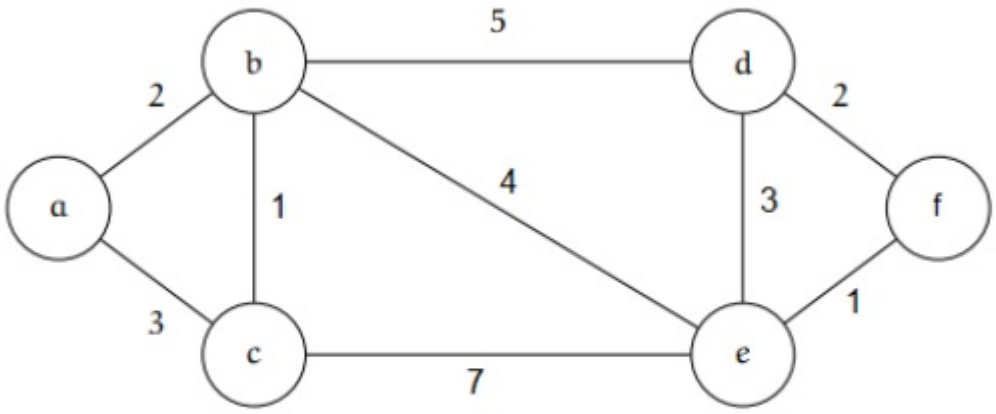
Sub-Section Number :	4
Sub-Section Id :	64065385016
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 241 Question Id : 640653588764 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3

Question Label : Short Answer Question

Consider the graph *G* given below.



Let α denote the number of minimum spanning trees of G and β denote the weight of such a minimum spanning tree.

The value of $\alpha + \beta$ is _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

11

Sub-Section Number : 5

Sub-Section Id : 64065385017

Question Shuffling Allowed : Yes

Is Section Default? : null

Question Number : 242 Question Id : 640653588765 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3

Question Label : Multiple Choice Question

Let G = (V, E) be an undirected graph having distinct positive edge weights. Let V be partitioned into two non-empty sets X and Y. Let e = (s, t) be the minimum cost edge, with s belonging to X and t belonging to Y. Which of the following statement(s) is/are true?

1. The edge e must definitely belong to each path from s to t.
2. The edge e must definitely belong to the minimum cost spanning tree of G.

Options :

6406531963673. ✖ Only 1

6406531963674. ✔ Only 2

6406531963675. ✖ Both 1 and 2

6406531963676. ✖ Neither 1 nor 2

Sub-Section Number : 6

Sub-Section Id : 64065385018

Question Shuffling Allowed : Yes

Is Section Default? : null

Question Number : 243 Question Id : 640653588766 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 4

Question Label : Multiple Choice Question

Consider a max-heap represented as the following list:

[30, 20, 25, 5, 15, 23, 10, 3, 2]

What are the leaf nodes of the resultant max-heap after the following operations are done on it?

1. delete_max()
2. Insert(24)

Options :

6406531963677. ✔ 2, 3, 5, 10, 15

6406531963678. ✖ 2, 3, 10, 15, 23

6406531963679. ✖ 2, 3, 5, 10, 20

6406531963680. ✖ 2, 3, 5, 10, 23

Sub-Section Number : 7

Sub-Section Id : 64065385019

Question Shuffling Allowed : Yes

Is Section Default? : null

Question Number : 244 Question Id : 640653588767 Question Type : MSQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3 Max. Selectable Options : 0

Question Label : Multiple Select Question

Which of the following operation can be performed in $O(log\ n)$ time on min-heap? Consider the size of min-heap is n and implemented using an array.

Options :

6406531963681. ✔ Inserting a new element

6406531963682. ✔ Deleting the smallest element

6406531963683. ✔ Update the value at the known index

6406531963684. ✖ Finding the largest element

Sub-Section Number : 8

Sub-Section Id : 64065385020

Question Shuffling Allowed : Yes

Is Section Default? : null

Question Number : 245 Question Id : 640653588768 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3

Question Label : Multiple Choice Question

The maximum element of a BST is always guaranteed to be_____.

Options :

6406531963685. ✖ a leaf node

6406531963686. ✖ the root node

6406531963687. ✔ a node without a right child

6406531963688. ✖ a node without a left child

Sub-Section Number : 9

Sub-Section Id : 64065385021

Question Shuffling Allowed : Yes

Is Section Default? : null

Question Number : 246 Question Id : 640653588769 Question Type : MSQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3 Max. Selectable Options : 0

Question Label : Multiple Select Question

Define the height of a binary search tree to be the number of nodes in the longest path from root to leaf. Suppose we have a binary search tree T of height h. Note that T need not be balanced. Which of the following statements is true?

Options :

6406531963689. ✖ The number of elements is at most 2^{h-1}.

6406531963690. ✔ The number of elements is at least h.

6406531963691. ✖ The number of elements is at least $h + 1$.

6406531963692. ✖ The number of elements is at most $h \ log \ h$.

6406531963693. ✔ The number of elements is at most $2^h - 1$.

Sub-Section Number :	10
Sub-Section Id :	64065385022
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 247 Question Id : 640653588770 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3

Question Label : Multiple Choice Question

Define the **height balance factor** or **slope** of a node as the absolute difference in height of the left subtree and the right subtree of the node.

Create a binary search tree by inserting the following elements in the given order one at a time (Do not perform any rotations on this tree as you insert the items. It's just a binary search tree, not necessarily a balanced BST)

3, 1, 2, 4, 6, 5, 7, 8

What is the height balance factor or slope of the root node of this tree? Consider that the height of the empty tree is 0.

Options :

6406531963694. ✖ 0

6406531963695. ✖ 1

6406531963696. ✔ 2

6406531963697. ✖ 3

Sub-Section Number :	11
Sub-Section Id :	64065385023
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 248 Question Id : 640653588771 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 4

Question Label : Short Answer Question

Create an AVL tree by inserting the following elements in the given order (one at a time):

4, 7, 1, 3, 5, 6, 2, 8

What would be the sum of elements stored in leaf nodes of the resultant AVL tree?

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

17

Sub-Section Number :	12
Sub-Section Id :	64065385024
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 249 Question Id : 640653588772 Question Type : SA Calculator : None

Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3

Question Label : Short Answer Question

An entire message is created using characters from the set S = {A, B, C, D, E}. The probability of occurrence of each character is given in the table below.

A	B	C	D	E
0.22	0.21	0.16	0.30	0.11

How many bits will be used to encode the message `ABCDE` using Huffman codes?

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

12

Sub-Section Number : 13

Sub-Section Id : 64065385025

Question Shuffling Allowed : Yes

Is Section Default? : null

Question Number : 250 Question Id : 640653588773 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3

Question Label : Multiple Choice Question

Meetings M1, M2, ..., M10 are to be conducted in a single available meeting room. The table below gives the start and end times of these meetings. If any activity finishes at time `T`, then other activities can be started at time `T` or afterward.

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
start	3	2	8	4	10	1	12	3	1	6
end	6	3	11	6	11	2	13	5	3	9

How many meetings can be scheduled at most by following the timing constraints given above?

Options :

6406531963700. ✖ 4

6406531963701. ✖ 5

6406531963702. ✔ 6

6406531963703. ✖ 7

Sub-Section Number : 14

Sub-Section Id : 64065385026

Question Shuffling Allowed : Yes

Is Section Default? : null

Question Number : 251 Question Id : 640653588774 Question Type : SA Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3

Question Label : Short Answer Question

In a list `L`, two elements `L[i]` and `L[j]` form an inversion if `L[i] > L[j]` and `i < j`. Consider a list `L` of length `n` in which all elements are distinct. List `L` has exactly 21 inversions. The minimum possible value of `n` is ___.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

7

Sub-Section Number :	15
Sub-Section Id :	64065385027
Question Shuffling Allowed :	Yes
Is Section Default? :	null

Question Number : 252 Question Id : 640653588775 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3

Question Label : Multiple Choice Question

Maximum subarray sum:- Given an array of integers, the goal is to find a contiguous subarray (i.e., a subarray with elements positioned adjacent to each other in the original array) that has the largest possible sum.

Consider the following implementation `max_subarray_sum` to find the maximum subarray sum in an array:

```
def max_crossing_sum(arr, low, mid, high):
    left_sum = float('-inf')
    curr_sum = 0
    for i in range(mid-1, low - 1, -1):
        curr_sum += arr[i]
        if curr_sum > left_sum:
            left_sum = curr_sum

    right_sum = float('-inf')
    curr_sum = 0
    for i in range(mid, high):
        curr_sum += arr[i]
        if curr_sum > right_sum:
            right_sum = curr_sum
    return left_sum + right_sum

# In First call low = 0, high = len(arr)
def max_subarray_sum(arr, low, high):
    if high - low <= 1:
        return arr[low]

    mid = (low + high) // 2

    left_sum = max_subarray_sum(arr, low, mid)
    right_sum = max_subarray_sum(arr, mid, high)
    cross_sum = max_crossing_sum(arr, low, mid, high)

    return max(left_sum, right_sum, cross_sum)
```

What is the worst-case time complexity of this algorithm when applied to an array of size n?

Options :

6406531963705. ✖ $O(n)$

6406531963706. ✖ $O(log\ n)$

6406531963707. ✔ $O(n\ log\ n)$

6406531963708. ✖ $O(n^2)$

Sub-Section Number : 16

Sub-Section Id : 64065385028

Question Shuffling Allowed : Yes

Is Section Default? : null

Question Number : 253 Question Id : 640653588776 Question Type : MSQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3 Max. Selectable Options : 0

Question Label : Multiple Select Question

Consider the following statements and choose the correct ones.

Options :

6406531963709. ✖ The worst case running time of Quick select algorithm to find the kth largest number is $O(n)$

6406531963710. ✔ The time taken to find the median in an unsorted list using Median of Medians(MoM) algorithm is $O(n)$

6406531963711. ✔ Quick select algorithm is an example of the divide-and-conquer approach to solving problems

6406531963712. ✔ Using Fast Select (Quick Select using MoM for pivot selection) strategy, the worst-case running time will be $O(n)$.

Sub-Section Number : 17

Sub-Section Id : 64065385029

Question Shuffling Allowed : Yes

Is Section Default? : null

Question Number : 254 Question Id : 640653588777 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 3

Question Label : Multiple Choice Question

Consider the following recurrences and choose the correct option.

1. $T_1(n) = 3T_1(n/3) + O(n)$
2. $T_2(n) = 2T_2(n/4) + O(n^2)$

Base Case:- $T_1(1) = T_2(1) = 1$

Options :

6406531963713. ✖ $T_1 = O(n)$ and $T_2 = O(n^2)$

6406531963714. ✔ $T_1 = O(n\ log\ n)$ and $T_2 = O(n^2)$

6406531963715. ✖ $T_1 = O(n)$ and $T_2 = O(n\ log\ n)$

6406531963716. ✖ $T_1 = O(n^2)$ and $T_2 = O(n^2)$