Sample Paper
FINALTERM EXAMINATION
Fall 2022
CS301 - Data Structures

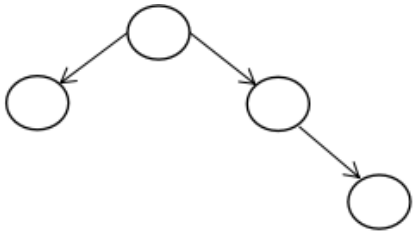
Time: 90 min
Marks: 60

Question No: 1 (Marks: 01) - Please choose the correct option

AVL Tree is invented in the year _____.

A. 1960
B. 1961
C. 1962
D. 1963

Question No: 2 (Marks: 01) - Please choose the correct option



Inserting a node at the right most place would make root's balance factor _____.

A. -1
B. -2
C. 1
D. 2

Question No: 3 (Marks: 01) - Please choose the correct option

As compared to BST, the root node in AVL tree is _____.

A. 0
B. Null
C. Constant
D. Changeable

Question No: 4 (Marks: 01) - Please choose the correct option

In AVL Tree, _____ traversal gives sorted sequence in ascending order.

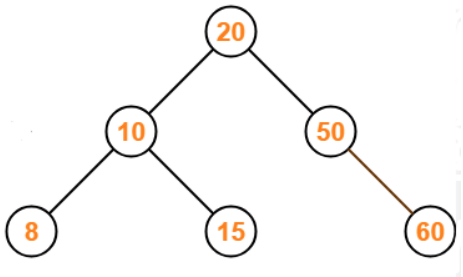
A. Inorder
B. Pre-order
C. Post-order
D. Level order Traversal

Question No: 5 (Marks: 01) - Please choose the correct option

_____ converts assembly language code into machine code i.e. 0s & 1s.

A. Interpreter
B. Compiler
C. Converter
D. Assembler

Question No: 6 (Marks: 01) - Please choose the correct option



After deleting node 15 from above tree, how many rotations do we need to balance the AVL tree?

A. One Single Rotation
B. One Double Rotation
C. No Rotation
D. Two Single Rotations

Question No: 7 (Marks: 01) - Please choose the correct option

Compiler converts the C++ code into _____.

A. Assembly language
B. Visual Basic
C. Java
D. Bytecode

Question No: 8 (Marks: 01) - Please choose the correct option

Which one of the following is the application of an Expression Tree?

A. MS Word
B. 2D Paint
C. Spreadsheets
D. Outlook

Question No: 9 (Marks: 01) - Please choose the correct option

What is the height balancing factor in AVL tree?

A. Difference between left and right subtree heights
B. Sum of left and right subtree heights
C. Product of left and right subtree heights
D. Log of left and right subtree heights

Question No: 10 (Marks: 01) - Please choose the correct option

The technique of using binary trees in data compression is referred to as _____.

A. Huffman encoding
B. Heap
C. Graph
D. BST

Question No: 11 (Marks: 01) - Please choose the correct option

What will be the number of external nodes in a binary tree that has 31 internal nodes?

A. 30
B. 31
C. 32
D. 33

Question No: 12 (Marks: 01) - Please choose the correct option

What type of nodes are found in an expression tree?

A. Operators and operands
B. Functions and variables
C. Numbers and symbols
D. Numbers and operands

Question No: 13 (Marks: 01) - Please choose the correct option

What is the maximum number of nodes that a complete binary tree of height 'h' can have?

A. 2^h
B. 2^(h+1) - 1
C. 2^(h-1)
D. 2^h+1

Question No: 14 (Marks: 01) - Please choose the correct option

A max-heap is stored in an array as H = [49, 39, 36, 31, 27, 21, 35, 12].
What is the result of deleting 49 from this heap?

A. [39, 31, 36,12, 27, 21, 35]
B. [39, 36, 31, 27, 21, 35, 12]
C. [39, 36, 12, 31, 27, 35, 21]
D. [39, 35, 31, 36, 12, 27, 21]

Question No: 15 (Marks: 01) - Please choose the correct option

How many types of heap are there?

A. 2
B. 3
C. 4
D. 5

Question No: 16 (Marks: 01) - Please choose the correct option

Heap can be used as _____

E. Priority queue
F. Stack
G. A decreasing order array
H. Normal Array

Question No: 17 (Marks: 01) - Please choose the correct option

Suppose Min heap is implemented by using an array. Which one of the following array cannot be a Min heap?

A. 17, 19, 21, 23, 25, 29, 31
B. 17, 21, 19, 25, 23, 31, 29
C. 17, 25, 19, 29, 31, 21, 23
D. 17, 25, 21, 31, 29, 19, 23

Question No: 18 (Marks: 01) - Please choose the correct option

In deletMin method, before calling the percolatedown method( ) the ____ element of the array will be placed as the root element of the tree.

A. first
B. second
C. third
D. last

Question No: 19 (Marks: 01) - Please choose the correct option

In union operation, the _____ can be used to name the set.

A. Root
B. Left child
C. Right child
D. Leaf node

Question No: 20 (Marks: 01) - Please choose the correct option

Which of the following method takes an array along with its size as an argument and constructs a heap out of it?

A. Insert( )
B. Buildheap( )
C. Percolatedown()
D. IncreaseKey( )

Question No: 21 (Marks: 01) - Please choose the correct option

How many properties will an equivalent relationship satisfy?

A. 1
B. 2
C. 3
D. 4

Question No: 22 (Marks: 01) - Please choose the correct option

The _____ method constructs a heap using a single item while maintaining heap order.

A. Insert( )
B. Buildheap( )
C. Percolatedown()
D. IncreaseKey( )

Question No: 23 (Marks: 01) - Please choose the correct option

Inside the insert method of min heap, we will call the _____ method.

A. isFull()
B. isEmpty()
C. getmin()
D. IncreaseKey( )

Question No: 24 (Marks: 01) - Please choose the correct option

Suppose a relation R = {(2, 2), (5, 5), (5, 2), (5, 5), (6, 6)} on S = {2, 5, 6}. Here R is known as _____

A. equivalence relation
B. reflexive relation
C. symmetric relation
D. transitive relation

Question No: 25 (Marks: 01) - Please choose the correct option

Which part of the code performs the union of two sets in Union by Size method?

A. The find operation
B. The loop in the find operation
C. The union operation
D. The comparison in the if-condition

Question No: 26 (Marks: 01) - Please choose the correct option

What happens to the number of levels in the trees after a union operation in Union by Size method?

A. The number of levels increases
B. The number of levels decreases
C. The number of levels remains the same
D. The number of levels cannot be determined

Question No: 27 (Marks: 01) - Please choose the correct option

How is the root node identified in Union by Size method?

A. By setting its parent to -1
B. By setting its parent to the number of nodes in the tree in negative form
C. By finding the node with negative parent
D. By finding the node with positive parent

Question No: 28 (Marks: 01) - Please choose the correct option

How is a raw digital image stored in numbers?

A. Between 0 and 255
B. Between 0 and 4
C. Between 0 and 10
D. Between 0 and 100

Question No: 29 (Marks: 01) - Please choose the correct option

What does the number 0 in the matrix example represent?

A. Gray color
B. Black color
C. White color
D. Red color

Question No: 30 (Marks: 01) - Please choose the correct option

What is the purpose of threshold value in image segmentation?

A. To determine the color of the pixels
B. To group the pixels based on their intensity
C. To calculate the texture of the image
D. To determine the size of the image

Question No: 31 (Marks: 01) - Please choose the correct option

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What is a symbol table in compilers?

A. A data structure used to store information about identifiers in the source code.
B. A tool used to debug the code.
C. A technique for compressing the code.
D. A way to generate machine code from the source code.

Question No: 32 (Marks: 01) - Please choose the correct option

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What is the function of the union/find algorithm in image segmentation?

A. To convert an image into a binary form
B. To combine pixels into sets based on their values
C. To divide an image into different parts
D. To make a program for image processing

Question No: 33 (Marks: 01) - Please choose the correct option

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Suppose a hash table already contains some numbers using the key "K" and hash function **K % 13**. If the number 37 is already in the hash table, then adding which of the following number will cause a collision?

A. 1141
B. 1142
C. 1143
D. 1144

Question No: 34 (Marks: 01) - Please choose the correct option

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In open addressing to resolve the collision in hashing we _____.

A. Check next position one by one to find an empty place
B. Check odd positions to find an empty place
C. Check even positions to find an empty place
D. Open addressing is not a collision resolution technique

Question No: 35 (Marks: 01) - Please choose the correct option

Which of the following technique is/are used by compiler to construct a symbol table?

A. Hashing
B. Linked List
C. Binary Search Tree
D. All Hashing, Linked list and BST are used

Question No: 36 (Marks: 01) - Please choose the correct option

Data structure which is used to search an element in constant time is called _____.

A. Linked List
B. Binary Search Tree
C. AVL Tree
D. Hashing

Question No: 37 (Marks: 01) - Please choose the correct option

Which of the following is not a collision avoidance technique?

A. Linear Probing
B. Rehashing
C. Linked list
D. Increase the size of table

Question No: 38 (Marks: 01) - Please choose the correct option

Selecting a card from deck of cards and arranging them in an order is an example of _____.

A. Insertion sort
B. Selection sort
C. Merge sort
D. Heapsort

Question No: 39 (Marks: 01) - Please choose the correct option

Which of the following sorting algorithm do not use swapping technique while sorting the data?

A. Insertion sort
B. Selection sort
C. Merge sort
D. Quicksort

Question No: 40 (Marks: 01) - Please choose the correct option

Which of the following sorting algorithm uses pivot value to split the array?

A. Selection sort
B. Insertion sort
C. Merge sort
D. Quicksort

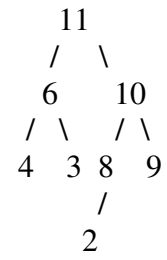
Question No: 41 (Marks: 03)

Explain the scenario with the help of a diagram, in which balance factor of an AVL Tree root node comes out to be -1.

Answer

Question No: 42 (Marks: 03)

Consider the following heap:



(a) Is it a heap? Justify with solid reason
(b) Show the array representation of this tree.

Answer

Question No: 43 (Marks: 03)

Define and explain the disjoint set with examples.

Answer

Question No: 44 (Marks: 03)

What is the purpose of Image Segmentation?

Answer

Question No: 45 (Marks: 03)

How does the union/find algorithm work in image segmentation?

Answer

Question No: 46 (Marks: 03)

Consider the C++ code of "hashFunc" given below, if fruit name "**banana**" is passed to this function as an argument then what will be **return value** of "hashFunc"?

Note: The ASCII code of a = 97, b = 98 and n = 110.

```
int hashFunc(char* s) {
        int i, sum = 0;

        for(i=0; i<strlen(s); i++) {
                sum = sum + s[i];
        }
        return sum % 11;
}
```

Answer

Question No: 47 (Marks: 05)

Construct AVL tree by inserting the following data (read the from left to right):
14,17,11,7,53,4,13,12,8,60,19,16,20
Just show the final tree, you don't need to show all steps.

Answer

Question No: 48 (Marks: 05)

Construct Huffman tree from the following data:

Character	Frequency
r	5
v	1
y	1
SP	3

Answer

Question No: 49 (Marks: 05)

In case of implementing minimum heap, write down the code of perculateDown() method.

Answer

Question No: 50 (Marks: 05)

Consider the C++ code of a sort algorithm given below. If array showing in table is passed to sorting algorithm, then what will be the index of "29" after execution of code?

```
void mySort(int *arr, int N) {

        int temp;

        for (int i = 0; i < N - 1; i++) {
                int min = i;

                for (int j = i + 1; j < N; j++) {
                        if (arr[j] < arr[min])
                                min = j;
                }

                temp = arr[min];
                arr[min] = arr[i];
                arr[i] = temp;

                if(i == 3)
                        break;
        }
}
```

29	27	18	13	87	66	52	51	12	36
0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**

Give only one index, giving more than one indexes will be considered incorrect solution.

Answer

Best of Luck ☺