Cipher Schools -Java Assignment 2

1. What do you mean by Data Structure?

solution: A data structure is a specialized format for organising, processiong, retrieving and storing data. While there are several basic and advanced structure types, any data structure types, any data structure is designed to arrange data to suit a specific purpose so that it can be accessed and worked with in appropriate ways.

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2. What are some applications of data structures?

solution: Arrays, Stack , Queue, Linked list, Set, Graph, Tree , Hash table

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3. what are the advantages of a Linked list over an Array?

solution: 1. Linked list dynamic in size where as for array it is fixed size.

2. Less memory consumption as only that many nodes are consumed as many values are to be stored.

3. Easy of Insertion/deletion only modification of pointers required.

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4. Write the syntax in C to create a node in the singly linked list?

solution:

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struct node
{
    int num;
    struct node *nextptr
}*stnode;
```

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5. What is the use of doubly-linked list when compared to that of a singly linked list?

solution: Doubly linked list allows element two traversal. It can also be used to implement stacks as well as heaps and binary trees. If we need better performance while searching and memory is not a limitation in this case DLL is more preferred.

6. What is difference between an array and stack?

solution:

| Stack | Array |
|---|---|
| Stack are based on **Last In First Out** principle | In the array the elements belong to indexes, i.e., if you want to get into the fourth element you have to write the variable name with its index or location within the square bracket. |
| Insertion and deletion in stacks takes place only from one end of the list called the top. | Insertion and deletion in array can be done at any index in the array. |
| Stack has a dynamic size. | Array has a fixed size. |
| Stack can contain elements of different data type. | Array contains elements of same data type. |

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7. What are the minimum number of Queues needed to implement the priority queue?

solution: We need two queues for implementation of priority queue, one to

store data and another to store priority.

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8. What are the different types of traversal techniques in a tree?

solution: There are three types of traversal techniques in tree

1. In order traversal (left →Root →Right)
2. Pre order traversal (Root →Left → Right)
3. Post order traversal (Left→ Right→ Root)

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9. Why it is said that searching a node in a binary search tree is efficient than that of a simple binary tree?

solution: Binary Search Tree allows for fast retrieval of elements stored in the tree as each node key is thoroughly compared with the root node, which discards half of the tree. It is already sorted as all element in left tree is smaller than root element and all element in right tree is greater than root element.

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10. What are the applications of Graph DS?

solution: Social networks(Facebook), Google map, WWW(World Wide Web, biological networks, product recommendation graphs, neural networks, road networks, blockchains, and bitcoin transaction graphs.

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11. Can we apply Binary search algorithm to a sorted Linked list?

Solution: Yes, we can implement in in java language with the use of Array List.

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12. When can you tell that a Memory Leak will occur?

Solution: Memory leak occurs when programmers create a memory in heap and forget to delete it.

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13. How will you check if a given Binary Tree is a Binary Search Tree or not?

Solution: 1. If a node is a left child, then its key and the keys of the nodes in its right subtree are less than its parent's key.

2. If a node is a right child, then its key and the keys of the nodes in its left subtree are greater than its parent's key

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14. Which data structure is ideal to perform recursion operation and why?

Solution: Stacks are used to perform recursion as function on the top of the stack can executed, the function can be popped and the data can be passed to the next function, this cycle continues until the required data is passed to the original function.

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15. What are some of the most important applications of a Stack?

Solution: Stacks are used to implement recursion, can be used to balance parenthesis and is used to implement calculations following BODMAS rule.

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16. Question Incomplete.

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23. Check if a given graph is a tree or not?

Solution: To check if a given graph is a tree or not, we have to check if the graph contains a cycle. A graph is a tree if it doesn't contain a cycle. Since it is not mentioned if it is a directed or un-directed graph, a particular cycle detection algorithm can't be prescribed but techniques used to detect cycle are BFS or DFS cycle detection algorithm and Topological sorting.

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25. How to find the shortest path between two vertices

Solution: Shortest path between two vertices is determined by using a shortest path algorithm called Dijkstra's Algorithm. Dijkstra's Algorithm is also called single source shortest path algorithm.

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