**Data Structure Assignments \_2**

**1. Differentiate between file and structure storage structure.**

**Storage Structure:**

* The representation of a particular data structure in the memory of a computer is called a storage structure.
* The memory that is allocated to a variable or a constant is stored in the main memory of the computer that is RAM which gets deleted as soon as the function ends. This representation of allocating the memory is called Storage Structure

**File Structure:**

* A storage structure representation in auxiliary memory is often called a file structure.
* If you write the data in a file and save that file in the hard disk or any other external device like Pen Drive then the data will remain intact till it is deleted manually by the user. This representation of saving the file in an auxiliary or secondary memory is called File Structure.

**2. When is a binary search best applied?**

* A binary search is an algorithm that is best applied to search a list when the elements are already in order or sorted
* The list is search starting in the middle, such that if that middle value is not the target search key, it will check to see if it will continue the search on the lower half of the list or the higher half.
* The split and search will then continue in the same manner.

1. **What is a linked list?**

A linked list is a data structure that consists of individual entities called nodes. These nodes have the capability to connect to other nodes and create a chain in the process. This continuous chain structure forms a linked list, as the name suggests.

1. **How do you reference all the elements in a one-dimension array?**

To do this, an indexed loop is used, such that the counter runs from 0 to the array size minus one.

In this manner, we are able to reference all the elements in sequence by using the loop counter as the array subscript. (i=0,i<(array\_size),i++)

1. **In what areas do data structures are applied?**

[Data structures](https://intellipaat.com/community/53575/what-are-some-important-topics-of-data-structure-for-interview) are very much needed in almost all of the fields that you can think of. Algorithms are the primary requirement in every data handling situation. Following are some of the scenarios where data structures are widely used:

* Numerical computation
* Operating system design
* Artificial Intelligence
* Compiler design
* Database handling
* Graphical processing
* Lexical analysis
* Statistics

1. **What is LIFO?**

LIFO stands for the Last in, First out access order. It is directly corresponding to how the data can be worked on and modified. The data entity that is stored or pushed in last is the first one to be worked on at any point in time. If there is a requirement to access the very first element stored, then first you have to retrieve all of the data that came in after that element.

1. **What is a queue?**

A queue is a widely used data structure that is used to denote the ordered access and manipulation of an element. The operation of this data structure is exactly the same as a literal queue in the real world. Elements are added one after the other and are processed on the front end.

Queue is a linear data structure where the first element is inserted from one end called REAR and deleted from the other end called as FRONT. Front points to the beginning of the queue and Rear points to the end of the queue. Queue follows the FIFO (First - In - First Out) structure. According to its FIFO structure, element inserted first will also be removed first.

In a queue, one end is always used to insert data (enqueue) and the other is used to delete data (dequeue), because queue is open at both its ends

1. **What are binary trees?**

A binary tree, as the name suggests, is a tree data structure with two nodes, which are the nodes on the left and the right sides of the root note. In usage, binary trees are considered to be an extended linked list

**9. Which data structures are applied when dealing with a recursive function?**

Recursion, is a function that calls itself based on a terminating condition, makes use of the stack. Using LIFO, a call to a recursive function saves the return address so that it knows how to return to the calling function after the call terminates.

**10. What is a stack?**

A stack is widely used data structure that provides users with the ability to work with data at one point only. As the name suggests, this can literally correspond to the working of a stack of cards.

Stack is linear data structure, which follows order of "LIFO". Here, the element which is placed (inserted or added) last, is accessed first. In stack terminology, insertion operation is called PUSH operation and removal operation is called POP operation.

ex:- wellness of brackets,each function calls create stack.

A stack can be implemented by means of Array, Structure, Pointer, and Linked List. Stack can either be a fixed size one or it may have a sense of dynamic resizing. Here, we are going to implement stack using arrays, which makes it a fixed size stack implementation.

**11. Explain Binary Search Tree**

A binary search tree is a data structure that stores data in a very efficient manner. It consists of two primary nodes from the root node. The main thing here is that the values of the nodes in the left sub-tree are less in number than the value of the root node, and the values of the nodes on the right of the root node are correspondingly higher than the root. Also, individually both of these left and right sub-trees are their own binary search trees at all points of time.

**12. What are multidimensional arrays?**

### Multi-dimensional arrays are arrays that span across more than one dimension. This means that they will have more than one index variable for every point of storage. This is primarily used in cases where data cannot be represented or stored using only one dimension.

**13. Are linked lists considered linear or non-linear data structures?**

Linked lists are considered to be the best of both worlds here. Based on usage, if it is a storage policy, then it can be considered as non-linear. Whereas, if a person is considering it based on retrieval strategies, then it can be considered linear.

1. **How does dynamic memory allocation help in managing data?**

Apart from being able to store simple structured data types, dynamic memory allocation can combine separately allocated structured blocks to form composite structures that expand and contract as needed.

**15. What is FIFO?**

FIFO, also known as First in, First out, is a way of representing a data operation on factors such as how data is accessed and in what order. Here, the data that is first put into the list will be the first entity to exit from the ordered data structure.

**16. What is an ordered list?**

An ordered list is a list in which each node’s position in the list is determined by the value of its key component, so that the key values form an increasing sequence, as the list is traversed

**17. What is merge sort?**

Merge sort is a method of sorting, which is based on the divide and conquer technique. Here, data entities adjacent to each other are first merged and sorted in every iteration to create sorted lists. These smaller sorted lists are combined at the end to form the completely sorted list.

**18. Differentiate NULL and VOID**

Null is a value, whereas Void is a data type identifier. A variable that is given a Null value indicates an empty value. The void is used to identify pointers as having no initial size..

**19. What is the primary advantage of a linked list?**

A linked list is an ideal data structure because it can be modified easily. This means that editing a linked list works regardless of how many elements are in the list..

****20. What is the difference between a PUSH and a POP?****

Pushing and popping applies to the way data is stored and retrieved in a stack. A push denotes data being added to it, meaning data is being “pushed” into the stack. On the other hand, a pop denotes data retrieval, and in particular, refers to the topmost data being accessed.

****21. What is a linear search?****

A linear search refers to the way a target key is being searched in a sequential data structure. In this method, each element in the list is checked and compared against the target key. The process is repeated until found or if the end of the file has been reached.

****22. How does variable declaration affect memory allocation?****

The amount of memory to be allocated or reserved would depend on the data type of the variable being declared. For example, if a variable is declared to be of integer type, then 32 bits of memory storage will be reserved for that variable.

****23. What is the advantage of the heap over a stack?****

The heap is more flexible than the stack. That’s because memory space for the heap can be dynamically allocated and de-allocated as needed. However, the memory of the heap can at times be slower when compared to that stack.

****24. What is a postfix expression?****

A postfix expression is an expression in which each operator follows its operands. The advantage of this form is that there is no need to group sub-expressions in parentheses or to consider operator precedence.

****25. What is Data abstraction?****

Data abstraction is a powerful tool for breaking down complex data problems into manageable chunks. This is applied by initially specifying the data objects involved and the operations to be performed on these data objects without being overly concerned with how the data objects will be represented and stored in memory.

1. ****How do you insert a new item in a binary search tree?****

Assuming that the data to be inserted is a unique value (that is, not an existing entry in the tree), check first if the tree is empty. If it’s empty, just insert the new item in the root node. If it’s not empty, refer to the new item’s key. If it’s smaller than the root’s key, insert it into the root’s left subtree, otherwise, insert it into the root’s right subtree.

****27. How does a selection sort work for an array?****

The selection sort is a fairly intuitive sorting algorithm, though not necessarily efficient. In this process, the smallest element is first located and switched with the element at subscript zero, thereby placing the smallest element in the first position.

The smallest element remaining in the subarray is then located next to subscripts 1 through n-1 and switched with the element at subscript 1, thereby placing the second smallest element in the second position. The steps are repeated in the same manner till the last element.

****28. How do signed and unsigned numbers affect memory?****

In the case of signed numbers, the first bit is used to indicate whether positive or negative, which leaves you with one bit short. With unsigned numbers, you have all bits available for that number. The effect is best seen in the number range (an unsigned 8-bit number has a range 0-255, while the 8-bit signed number has a range -128 to +127.

1. ****What is the minimum number of nodes that a binary tree can have?****

A binary tree can have a minimum of zero nodes, which occurs when the nodes have NULL values. Furthermore, a binary tree can also have 1 or 2 nodes.

****30. What are dynamic data structures?****

Dynamic data structures are structures that expand and contract as a program runs. It provides a flexible means of manipulating data because it can adjust according to the size of the data.

****31. In what data structures are pointers applied?****

Pointers that are used in linked list have various applications in the data structure. Data structures that make use of this concept include the Stack, Queue, Linked List and Binary Tree.

****32. Do all declaration statements result in a fixed reservation in memory?****

Most declarations do, with the exemption of pointers. Pointer declaration does not allocate memory for data, but for the address of the pointer variable. Actual memory allocation for the data comes during run-time.

****33. What are ARRAYs?****

When dealing with arrays, data is stored and retrieved using an index that refers to the element number in the data sequence. This means that data can be accessed in any order. In programming, an array is declared as a variable having a number of indexed elements.

****34. What is the minimum number of queues needed when implementing a priority queue?****

The minimum number of queues needed in this case is two. One queue is intended for sorting priorities while the other queue is used for actual storage of data.

****35. Which sorting algorithm is considered the fastest?****

There are many types of sorting algorithms: quick sort, bubble sort, balloon sort, radix sort, merge sort, etc. Not one can be considered the fastest because each algorithm is designed for a particular data structure and data set. It would depend on the data set that you would want to sort.

****36. Differentiate STACK from ARRAY.****

Stack follows a LIFO pattern. It means that data access follows a sequence wherein the last data to be stored when the first one to be extracted. Arrays, on the other hand, does not follow a particular order and instead can be accessed by referring to the indexed element within the array.

****37. Give a basic algorithm for searching a binary search tree.****

1. if the tree is empty, then the target is not in the tree, end search  
   2. if the tree is not empty, the target is in the tree  
   3. check if the target is in the root item  
   4. if a target is not in the root item, check if a target is smaller than the root’s value  
   5. if a target is smaller than the root’s value, search the left subtree  
   6. else, search the right subtree

****38. What is a dequeue?****

A dequeue is a double-ended queue. This is a structure wherein elements can be inserted or removed from either end.

****39. What is a bubble sort and how do you perform it?****

A bubble sort is one sorting technique that can be applied to data structures such as an array. It works by comparing adjacent elements and exchanges their values if they are out of order. This method lets the smaller values “bubble” to the top of the list, while the larger value sinks to the bottom.

****40. What are the parts of a linked list?****

A linked list typically has two parts: the head and the tail. Between the head and tail lie the actual nodes. All these nodes are linked sequentially.

****41. How does selection sort work?****

Selection sort works by picking the smallest number from the list and placing it at the front. This process is repeated for the second position towards the end of the list. It is the simplest sort algorithm.

****42. What is a graph?****

A graph is one type of data structure that contains a set of ordered pairs. These ordered pairs are also referred to as edges or arcs and are used to connect nodes where data can be stored and retrieved.

****43. Differentiate linear from a nonlinear data structure.****

The linear data structure is a structure wherein data elements are adjacent to each other. Examples of linear data structure include arrays, linked lists, stacks, and queues. On the other hand, a non-linear data structure is a structure wherein each data element can connect to more than two adjacent data elements. Examples of nonlinear data structure include trees and graphs.

****44. What is an AVL tree?****

An AVL tree is a type of binary search tree that is always in a state of partially balanced. The balance is measured as a difference between the heights of the subtrees from the root. This self-balancing tree was known to be the first data structure to be designed as such.

****45. What are doubly linked lists?****

Doubly linked lists are a special type of linked list wherein traversal across the data elements can be done in both directions. This is made possible by having two links in every node, one that links to the next node and another one that connects to the previous node.

****46. What is Huffman’s algorithm?****

Huffman’s algorithm is used for creating extended binary trees that have minimum weighted path lengths from the given weights. It makes use of a table that contains the frequency of occurrence for each data element.

****47. What is Fibonacci search?****

Fibonacci search is a search algorithm that applies to a sorted array. It makes use of a divide-and-conquer approach that can significantly reduce the time needed in order to reach the target element.

****48. Briefly explain recursive algorithm.****

Recursive algorithm targets a problem by dividing it into smaller, manageable sub-problems. The output of one recursion after processing one sub-problem becomes the input to the next recursive process.

****49. How do you search for a target key in a linked list?****

To find the target key in a linked list, you have to apply sequential search. Each node is traversed and compared with the target key, and if it is different, then it follows the link to the next node. This traversal continues until either the target key is found or if the last node is reached.