INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

INFORMATION TECHNOLOGY

DEFINITIONS AND TERMINOLOGY QUESTION BANK

Course Name	:	DATA STRUCTURES
Course Code	:	ACSB03
Program	:	B.Tech
Semester	:	III
Branch	:	CSE | IT | ECE | CE | ME
Section	:	A & B
Academic Year	:	2019 - 2020
Course Faculty	:	Mrs. K Laxmi Narayanamma, Assistant Professor Mr. Ch Suresh Kumar Raju, Assistant Professor

COURSE OBJECTIVES:

The course should enable the students to:	
I	Learn the basic techniques of algorithm analysis.
II	Demonstrate searching and sorting algorithms and analyze their time complexities.
III	Implement linear data structures viz. stack, queue and linked list.
IV	Demonstrate non-linear data structures viz. tree and graph traversal algorithms.
V	Study and choose appropriate data structure to solve problems in real world.

DEFINITIONS AND TERMINOLOGY QUESTION BANK

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
			MODULE-I			
1	What is data structure?	A data structure is a way of organizing data that considers not only the items stored, but also their relationship to each other.	Remember	CO 1	CLO 1	ACSB03.01
2	What are the major data structures used in the following areas: RDBMS, Network data model and Hierarchical data model.	1. RDBMS = Array (i.e. Array of structures) 2. Network data model = Graph 3. Hierarchical data model = Trees	Understand	CO 1	CLO 1	ACSB03.01
3	List out the areas in which data structures are applied extensively?	Compiler Design, Operating System, Database Management System, Statistical analysis package, Numerical Analysis, Graphics, Artificial Intelligence, Simulation.	Understand	CO 1	CLO 3	ACSB03.03

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4	What is an internal sorting algorithm?	A sorting technique which uses internal main memory.	Remember	CO 1	CLO 1	ACSB03.01
5	What is the worst case complexity of bubble sort?	$O(n^2)$. Bubble sort works by starting from the first element and swapping the elements if required in each iteration.	Understand	CO 1	CLO 4	ACSB03.04
6	What is an external sorting algorithm?	A sorting technique which uses external memory like tape or disk.	Remember	CO 1	CLO 1	ACSB03.01
7	What is the advantage of bubble sort over other sorting techniques?	Bubble sort detects whether the input is already sorted	Understand	CO 1	CLO 1	ACSB03.01
8	What is the average case running time of an insertion sort algorithm?	$O(N^2)$. On average, a call to insert on a subarray of k elements would slide k/2 of them. The running time would be half of the worst-case running time.	Understand	CO 1	CLO 4	ACSB03.04
9	What is the advantage of selection sort over other sorting techniques?	Selection sort requires no additional storage space	Understand	CO 1	CLO 1	ACSB03.01
10	What is the best case and worst case complexity of ordered linear search?	Best case complexity is $O(1)$. Worst case complexity is $O(n)$	Understand	CO 1	CLO 4	ACSB03.04
11	What is the advantage of recursive approach than an iterative approach?	Recursive approach needs less code and easy to implement.	Understand	CO 1	CLO 3	ACSB03.03
12	What is the worst case complexity of binary search using recursion?	$O(\log n)$. Binary search using recursion uses divide and conquer master theorem.	Understand	CO 1	CLO 4	ACSB03.04
13	What are the applications of binary search?	a. To find the lower/upper bound in an ordered sequence b. Union of intervals c. Debugging	Understand	CO 1	CLO 2	ACSB03.02
14	What type of strategy does binary search algorithm uses to search an element?	Divide and conquer, since 'mid' is calculated for every iteration or recursion, we are diving the array into half and then try to solve the problem.	Understand	CO 1	CLO 3	ACSB03.03
15	Which sorting algorithm is best suited if the elements are already sorted?	The best case running time of the insertion sort is $O(n)$. The best case occurs when the input array is already sorted. As the elements are already sorted, only one comparison is made on each pass, so that the time required is $O(n)$.	Understand	CO 1	CLO 4	ACSB03.04

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		MODULE-II				
1	What is a queue?	A queue is a sequential organization of data. A queue is a first in first out type of data structure. An element is inserted at the last position and an element is always taken out from the first position.	Understand	CO 2	CLO 5	ACSB03.05
2	What method is used to place a value onto the top of a stack?	push() method, Push is the direction that data is being added to the stack. push() member method places a value onto the top of a stack.	Remember	CO 2	CLO 5	ACSB03.05
3	What method removes the value from the top of a stack?	The pop() member method removes the value from the top of a stack, which is then returned by the pop() member method to the statement that calls the pop() member method.	Understand	CO 2	CLO 5	ACSB03.05
4	How is the front of the queue calculated?	The front of the queue is calculated by front = (front+1) % size.	Understand	CO 2	CLO 5	ACSB03.05
5	Convert the expression ((A + B) * C - (D - E) ^ (F + G)) to equivalent Prefix and Postfix notations.	a) Prefix Notation: - * +ABC ^ - DE + FG b) Postfix Notation: AB + C * DE - FG + ^ -	Understand	CO 2	CLO 6	ACSB03.06
6	Define overflow condition.	Pushing an element into stack already having 'n' elements and stack size of 'n', then stack encounters overflow condition.	Understand	CO 2	CLO 5	ACSB03.05
7	What are the applications of stack?	a) A parentheses balancing program b) Tracking of local variables at run time c) Compiler Syntax Analyzer	Remember	CO 2	CLO 6	ACSB03.06
8	What is a dequeue?	A data structure in which elements can be inserted or deleted at/from both the ends but not in the middle is called as dequeue.	Remember	CO 2	CLO 7	ACSB03.07
9	What does 'stack underflow' refer to?	Removing items from an empty stack is called stack underflow.	Understand	CO 2	CLO 5	ACSB03.05
10	What is the time complexity of pop() operation when the stack is implemented using an array?	O(1) because pop() accesses only one end of the structure, and hence constant time	Understand	CO 2	CLO 5	ACSB03.05
11	What is the advantage of priority scheduling in operating systems?	Interrupt handling because interrupts should be given more priority than the task at hand so that the interrupt can be serviced.	Remember	CO 2	CLO 6	ACSB03.06

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12	What are the advantages of priority queues?	a) Easy to implement b) Processes with different priority can be efficiently handled c) Applications with differing requirements	Remember	CO 2	CLO 6	ACSB03.06
13	What the applications are of dequeue?	a) Scheduling algorithm b) Can be used as both stack and queue c) To find the maximum of all sub arrays of size k	Remember	CO 2	CLO 6	ACSB03.06
14	To implement a stack using queue (with only enqueue and dequeue operations), how many queues will you need? Explain	Two queues are used to implement a stack using queue. Either the push or the pop has to be a costly operation, and the costlier operation requires two queues.	Remember	CO 2	CLO 7	ACSB03.07
15	In a circular queue, how do you increment the rear end of the queue?	(rear+1) % CAPACITY. Ensures rear takes the values from 0 to (CAPACITY-1)	Understand	CO 2	CLO 7	ACSB03.07
MODULE-III						
1	What is Linked List?	A linked list is a self-referential data type because it contains a pointer or link to another data of the same type. Linked lists permit insertion and removal of nodes at any point in the list in constant time, but do not allow random access.	Remember	CO 3	CLO 08	ACSB03.08
2	What type of memory allocation is referred for Linked lists?	Dynamic memory allocation is referred for Linked lists.	Understand	CO 3	CLO 09	ACSB03.09
3	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.	Remember	CO 3	CLO 09	ACSB03.09
4	What are the applications of Linked Lists?	Both stacks and queues are often implemented using linked lists, other applications are skip list, binary tree, unrolled linked list, hash table, heap, self-organizing list.	Understand	CO 3	CLO 08	ACSB03.08
5	How many pointers are required to implement a simple Linked list?	Generally 3 pointers engaged: a) A head pointer, pointing to the start of the record. b) A tail pointer, pointing on the last node of the list. The key property in the	Understand	CO 3	CLO 09	ACSB03.09

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		last node is that its subsequent pointer points to nothing at all (NULL). c) A pointer in every node, pointing to the next node element.				
6	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.	Understand	CO 3	CLO 08	ACSB03.08
7	What is a Doubly Linked list?	A doubly linked list has two pointers 'left' and 'right' which enable it to traverse in either direction. Compared to singly liked list which has only a 'next' pointer, doubly linked list requires extra space to store this extra pointer. Every insertion and deletion requires manipulation of two pointers; hence it takes a bit longer time.	Remember	CO 3	CLO 10	ACSB03.10
8	What is a Circular Linked list?	In the last node of a singly linear list, the link field often contains a null reference. A less common convention is to make the last node to point to the first node of the list; in this case the list is said to be 'circular' or 'circularly linked'.	Remember	CO 3	CLO 10	ACSB03.10
9	What is a memory efficient double linked list?	Memory efficient doubly linked list has been proposed recently which has only one pointer to traverse the list back and forth. The implementation is based on pointer difference.	Understand	CO 3	CLO 10	ACSB03.10
10	What is the application of circular linked lists?	Circular linked lists are used to allocate CPU to resource.	Understand	CO 3	CLO 10	ACSB03.10
11	How do you calculate the pointer difference in a memory efficient double linked list?	The pointer difference is calculated using pointer to previous node xor pointer to next node	Understand	CO 3	CLO 10	ACSB03.10
12	What is the time complexity of inserting a node in a doubly linked list?	O(n), in the worst case, the position to be inserted maybe at the end of the list, hence you have to traverse through the entire list to get to the correct position, hence O(n).	Understand	CO 3	CLO 10	ACSB03.10
13	What differentiates a circular linked list from a normal linked list?	The 'next' pointer points to null only when the list is empty, otherwise it points to the head of the list in a circular linked list.	Understand	CO 3	CLO 10	ACSB03.10

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14	What is a sparse matrix?	Sparse Matrix is a matrix in which most of the elements are Zero. Identity Matrix is a matrix in which all principle diagonal elements are 1 and rest of the elements are Zero. Unit Matrix is also called Identity Matrix. Zero Matrix is a matrix in which all the elements are Zero.	Remember	CO 3	CLO 08	ACSB03.08
15	What is the time complexity of inserting a new node at the head of a circular linked list?	Time complexity of inserting a new node at the head of the list is O(n) because you have to traverse through the list to find the tail node.	Understand	CO 3	CLO 10	ACSB03.10

			MODULE-IV			
1	What is binary tree?	A Binary tree is a tree where each node is having at most two children. A property of a binary tree is that the depth of an average binary tree is smaller than N.	Remember	CO 4	CLO 11	ACSB03.11
2	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.	Understand	CO 4	CLO 11	ACSB03.11
3	List out few of the application of tree data-structure	a) The manipulation of Arithmetic expression b) Symbol Table construction c) Syntax analysis.	Understand	CO 4	CLO 12	ACSB03.12
4	What is the disadvantage of using array representation for binary trees is?	The array is fixed size (may be dynamic array or static array) but size is fixed.	Understand	CO 4	CLO 11	ACSB03.11
5	Define complete binary tree?	A binary tree in which every non leaf node has exactly two children not necessarily on the same level. It is also called as strictly binary tree.	Remember	CO 4	CLO 11	ACSB03.11
6	What are the children for node 'w' of a complete-binary tree in an array representation?	2w and 2w+1. Since each node has 2 children and so counting from beginning, a particular node will have children as option a.	Understand	CO 4	CLO 11	ACSB03.11
7	What is breadth first traversal?	Breadth first traversal, also known as level order traversal is the traversal strategy used in a binary tree. It involves visiting all the nodes at a given level.	Remember	CO 4	CLO 12	ACSB03.12
8	What is depth first traversal?	Depth first traversal is a recursive algorithm that uses the idea of backtracking. It involves	Remember	CO 4	CLO 12	ACSB03.12

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		exhaustive searches of all the nodes by going ahead, if possible, else by backtracking.				
9	How many orders of traversal can be applied to a binary tree?	The three orders of traversal that can be applied to a binary tree are in-order, pre-order and post order traversal.	Understand	CO 4	CLO 12	ACSB03.12
10	If binary trees are represented in arrays, what formula can be used to locate a left child, if the node has an index i?	If binary trees are represented in arrays, left children are located at indices 2i+1 and right children at 2i+2.	Understand	CO 4	CLO 11	ACSB03.11
11	What is a graph?	A graph is a 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.	Remember	CO 4	CLO 11	ACSB03.11
12	Define Minimum Spanning Tree?	A minimum Spanning Tree of an undirected graph G is a tree formed from graph edges that connects all the vertices of G at lowest total cost.	Remember	CO 4	CLO 11	ACSB03.11
13	List out the Applications of Minimum Spanning Tree?	a) Networking of computers in the lab for minimizing the length of wire. b) Telephone exchanges. c) In provides a reasonable way for clustering points in space in to natural groups.	Understand	CO 4	CLO 11	ACSB03.11
14	What are the different ways a tree can be represented?	Adjacency List, Adjacency Matrix as well as Incidence Matrix	Understand	CO 4	CLO 12	ACSB03.12
15	Define regular graph?	A graph with all vertices having equal degree is known as a regular graph.	Remember	CO 4	CLO 11	ACSB03.11
MODULE-V						
1	What is a binary search tree?	A binary search tree stores data in such a way that they can be retrieved very efficiently. The left subtree contains nodes whose keys are less than the node's key value, while the right subtree contains nodes whose keys are greater than or equal to the node's key value. Moreover, both subtrees are also binary search trees.	Remember	CO 5	CLO 13	ACSB03.13
2	How do you insert a new item in a binary	Assuming that the data to be inserted is a unique value (that is, not an existing entry in the	Understand	CO 5	CLO 13	ACSB03.13

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	search tree?	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.				
3	What is the specialty about the inorder traversal of a binary search tree?	As a binary search tree consists of elements lesser than the node to the left and the ones greater than the node to the right, an inorder traversal will give the elements in an increasing order.	Understand	CO 5	CLO 13	ACSB03.13
4	What are the worst case and average case complexities of a binary search tree?	Worst case arises when the tree is skewed(either to the left or right) in which case you have to process all the nodes of the tree giving O(n) complexity, otherwise O(logn) as you process only the left half or the right half of the tree.	Understand	CO 5	CLO 13	ACSB03.13
5	What are the conditions for an optimal binary search tree and what is its advantage?	The tree should not be modified and you should know how often the keys are accessed, it improves the lookup cost	Remember	CO 5	CLO 13	ACSB03.13
6	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.	Remember	CO 5	CLO 13	ACSB03.13
7	In an AVL tree, at what condition the balancing is to be done?	If the pivotal value (or the Height factor) is greater than 1 or less than 1.	Understand	CO 5	CLO 13	ACSB03.13
8	Define M – way search trees.	A binary search tree has one value in each node and two subtrees. This notion easily generalizes to an M-way search tree, which has (M-1) values per node and M subtrees. M is called the degree of the tree.	Remember	CO 5	CLO 14	ACSB03.14
9	What is the advantage of balanced binary search tree, like AVL tree, compared to binary heap?	Insertion and deletion, in both the binary heap and balanced binary search tree takes O(log n). But searching in balanced binary search tree requires O(log n) while binary heap takes O(n). Construction of balanced binary search tree takes O(nlog n) time while binary heap takes O(n).	Understand	CO 5	CLO 13	ACSB03.13
10	Define a hash function.	A hash function is a function which when given a key,	Remember	CO 5	CLO 15	ACSB03.15

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		generates an address in the table. The example of a hash function is a book call number.				
11	Define collision.	A collision or clash is a situation that occurs when two distinct pieces of data have the same hash value, checksum, fingerprint, or cryptographic digest.	Remember	CO 5	CLO 16	ACSB03.16
12	What are the applications of hashing?	a) Message Digest b) Password Verification c) Data Structures (Programming Languages) d) Compiler Operation e) Rabin-Karp algorithm f) Linking File name and path together	Remember	CO 5	CLO 15	ACSB03.15
13	Classify the hashing functions based on the various methods by which the key value is found.	a) Direct method b) Subtraction method c) Modulo-Division method d) Digit-Extraction method e) Mid-Square method f) Folding method g) Pseudo-random method	Remember	CO 5	CLO 15	ACSB03.15
14	What is the bucket size, when the overlapping and collision occur at same time?	One. If there is only one entry possible in the bucket, when the collision occurs, there is no way to accommodate the colliding value. This results in the overlapping of values.	Remember	CO 5	CLO 16	ACSB03.16
15	What are the types of collision resolution techniques and the methods used in each of the type?	a) Open addressing (closed hashing): The methods used include: Overflow block. b) Closed addressing (open hashing): The methods used include: Linked list, Binary tree.	Remember	CO 5	CLO 16	ACSB03.16

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