

Reg. No. \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

THIRD SEMESTER B.TECH DEGREE EXAMINATION, JANUARY 2017

Course Code: **CS 205**Course Name: **DATA STRUCTURES (CS, IT)**

Max. Marks:100

Duration: 3 Hours

**PART A***(Answer ALL Questions)*

1. Compare and contrast singly linked list and doubly linked list. (3)
2. What do you understand by complexity of an algorithm? Write worst case and best case complexity of linear search. (3)
3. Let *LIST* be a singly linked list in memory. Write an algorithm to find number of times a given data item called *ITEM* occurs in *LIST*. (3)
4. Define the terms
  - a) Frequency count.
  - b) Stepwise refinement technique. (3)

**PART B***(Answer Any Two Questions)*

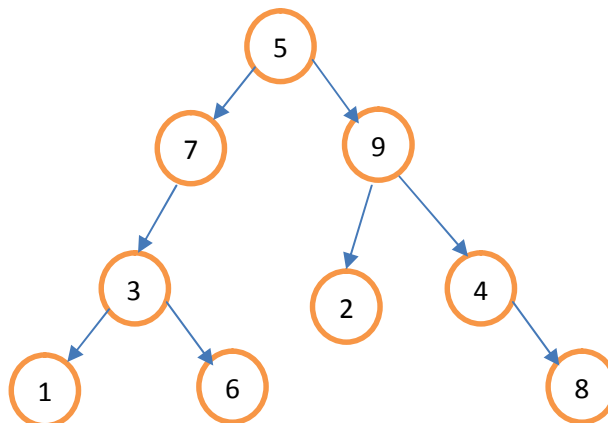
5. Describe the different notations used to describe the asymptotic running time of an algorithm. (9)
6. How a linked list can be used to represent a polynomial  $5x^3+4x^2+3x+2$ ? Give an algorithm to perform addition of two polynomials using linked list. (9)
7. Give an algorithm to perform following operations in a singly linked list.
  - (a) Insert a new node after a given node. (3)
  - (b) Delete last node. (3)
  - (c) Count the number of elements in the list. (3)

**PART C**  
(Answer ALL Questions)

8. What is a circular queue? How it is different from normal queue? (3)
9. Free memory blocks of size 60K, 25K, 12K, 20K, 35K, 45K and 40K are available in this order. Show the memory allocation for a sequence of job requests of size 22K, 10K, 42K, and 31K (in this order) in First Fit, Best Fit and Worst Fit allocation strategies. (3)
10. How a stack can be implemented using linked list? (3)
11. Write an algorithm to perform concatenation of two strings. (3)

**PART D**  
(Answer Any Two Questions)

12. Write an algorithm for evaluating a postfix expression and evaluate the following postfix expression using the algorithm  $AB+CD/AD-EA^{\wedge} + *$  where  $A=2, B=7, C=9, D=3, E=5$  (9)
13. List the properties of binary search tree. Write an algorithm to search an element from a binary search tree. (9)
14. a) Write the non recursive preorder traversal algorithm. (4.5)  
b) What is the output obtained after preorder, inorder and postorder traversal of the following tree. (4.5)



**PART E**  
(Answer Any Four Questions)

15. Write an algorithm for merge sort technique. Illustrate with an example. Give its complexity. (10)

16. Give any two representations of graph. Give algorithm for DFS. Demonstrate DFS using suitable example. (10)
17. Give an algorithm to perform binary search. Using the algorithm, search for elements 23 and 47 in the given set of elements[12 23 27 35 39 42 50]. (10)
18. a) Write algorithm for (i) Insertion sort (ii) Bubble sort (6)
- b) Illustrate the insertion sort algorithm and bubble sort algorithm on input [30,20,10,60,70,40] (4)
19. Define hashing. What are the properties of a good hash function? With necessary examples explain four different hashing techniques. (10)
20. Define collision. What is linear probing? The following keys 10, 16, 11, 1, 3, 4,23 and 15 are inserted into an initially empty hash table of length 10 using open addressing with hash function  $h(k) = k \text{ mod } 10$  and linear probing. What is the resultant hash table? (10)

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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**THIRD SEMESTER B.TECH DEGREE EXAMINATION, JULY 2017**

**CS205: DATA STRUCTURES (CS, IT)**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions.*

1. Derive the Big O notation for  $f(n) = n^2 + 2n + 5$ . (3)
2. Write a recursive function(C / pseudocode) for linear search. (3)
3. What are the applications of a linked list? (3)
4. Compare a linked list and an array implementation of a general list. (3)

**PART B**

*Answer any two questions.*

5. a. Write a function(C / pseudocode) to delete a node in a singly linked list. (4.5)  
b. Derive the Big O notation using the step count for the function. (4.5)
6. Write a recursive algorithm to insert an element into a linked list in which elements are stored in ascending order. (9)
7. a. What do you mean by abstract and concrete data structures? (4.5)  
b. Compare vectors and arrays in detail. (4.5)

**PART C**

*Answer all questions.*

8. What is a double ended queue? (3)
9. Explain any two applications of a Stack. (3)
10. What is a Binary Tree? (3)
11. What is the purpose of studying graphs as a data structure? (3)

**PART D**

*Answer any two questions.*

12. a. Write a function(C / pseudocode) to delete a sub-string in a given string. (4.5)  
b. Give the DFS algorithm for graph traversal. (4.5)
13. a. Write a function(C / pseudocode) to insert an element into a BST. (4.5)

- b. How are strings represented in a C program? (4.5)
14. a. Explain the array implementation of a binary tree? Why it is not a good representation for Binary Trees in general? (4.5)
- b. Write a function(C / pseudocode) to delete a node from a Binary Search Tree. (4.5)

**PART E**

*Answer any four questions.*

15. a. Write a program to perform Quick Sort on a set of 'n' values given as input. (5)
- b. Explain Best Fit strategy with an example. (5)
16. a. Write a function(C / pseudocode) to insert an element into a Heap. (5)
- b. Derive the worst case and average case complexity of Quick Sort. (5)
17. a. Explain mid-square method in hashing with an example. (5)
- b. Derive the complexity of Heap sort. (5)
18. a. What is hashing and what is its importance. (5)
- b. Write a program to perform insertion sort on a set of 'n' values given as input. (5)
19. a. Write a function(C / pseudocode) to perform merge sort. (5)
- b. Compare selection sort and bubble sort. (5)
20. a. Write a function(C / pseudocode) to perform binary search. (5)
- b. What is garbage collection? (5)

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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

**Course Code: CS205**

**Course Name: DATA STRUCTURES (CS, IT)**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions, each carries 3 marks.*

- |   |   | Marks |
|---|---|-------|
| 1 | Differentiate between abstract and concrete data structure. | (3)   |
| 2 | $N^2 + N = O(N^3)$ Justify your answer.                     | (3)   |
| 3 | What is frequency count? Explain with an example.           | (3)   |
| 4 | How can we represent a linked list in memory using arrays?  | (3)   |

**PART B**

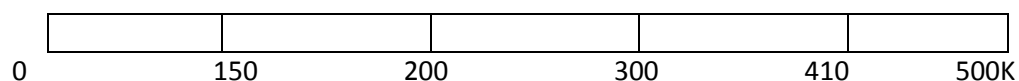
*Answer any two full questions, each carries 9 marks.*

- |   |  |     |
|---|--|-----|
| 5 | Describe Big O notation used to represent asymptotic running time of algorithms. Give the asymptotic analysis of any one iterative algorithm.  | (9) |
| 6 | a) Consider a singly linked list having n nodes. The data items d1, d2, ..., dn are stored in the n nodes. Let X be a pointer to the jth node ( $1 \leq j \leq n$ ) in which dj is stored. A new data item d stored in a node with address Y is to be inserted in the list. Give an algorithm to insert d into the list after dj to obtain a list having items d1, d2, ....., dj, d, dj+1, .....dn in that order without using the header. | (5) |
|   | b) Explain about the use and representation of header node in linked list  | (4) |
| 7 | a) What are the application of vectors.  | (3) |
|   | b) Write an algorithm for deleting a node from a specified position in a circular queue  | (6) |

**PART C**

*Answer all questions, each carries 3 marks.*

- |   |   |     |
|---|---|-----|
| 8 | How will you check the validity of an arithmetic expression using stack | (3) |
| 9 | Let take initial memory as -  | (3) |



Do the following things with first fit approach and show the memory status:

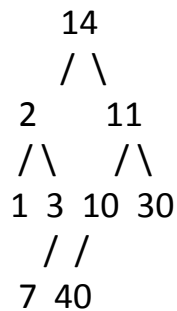
1. Allocate process C of size 90K
  2. Allocate process D of size 70K
- |    |   |     |
|----|---|-----|
| 10 | Write a program in C to concatenate two strings using string function.  | (3) |
| 11 | If a full binary tree is of height 5, give the positions of left child and right child of the second node in level 2. | (3) |

**PART D**

*Answer any two full questions, each carries 9 marks.*

- |    |   |     |
|----|---|-----|
| 12 | Convert the following expression into its corresponding post fix form using the prescribed algorithm:<br>$(300+23)*(43-21)/(84+7)$ . Do the evaluation of resultant postfix expression. | (9) |
|----|---|-----|

- 13 a) Here is a small binary tree: (4.5)



What is the output obtained after preorder, inorder and postorder traversal of the following tree.

- b) Write the non-recursive algorithm for post order traversal of tree. (4.5)
- 14 a) Write a function( C/ pseudo code ) to insert an element into BST. (4)
- b) Write a program in C to check a particular sub string is present in a given string or not? If found print its location. (5)

### PART E

*Answer any four full questions, each carries 10 marks.*

- 15 a) Draw the directed graph that corresponds to this adjacency matrix: (5)
- |   |       |       |       |       |  |
|---|-------|-------|-------|-------|--|
|   | 0     | 1     | 2     | 3     |  |
| 0 | true  | false | true  | false |  |
| 1 | true  | false | false | false |  |
| 2 | false | false | false | true  |  |
| 3 | true  | false | true  | false |  |
- b) Give the algorithm for BFS graph traversal. (5)
- 16 a) Show all the passes using insertion sort for the following list (5)  
54,26,93,17,77,31,44,55,20
- b) Write a function (C/ pseudo code) of heap sort using min heap. (5)
- 17 Write a program to do the partition of a list using quick sort and then use insertion sort for sorting sub lists. Explain it with example. (10)
- 18 a) Write a program of binary search which tells how many comparisons it did to search an element given as user input. (7)
- b) Do the performance comparisons of Linear search and Binary search. (3)
- 19 Consider a hash table of size 7 and hash function  $h(k) = k \bmod 7$ . Draw the table that results after inserting in the given order, the following values. 19,26,13,48.17 for each of the three scenarios. (4)
- a) When collisions are handled by separate chaining. (3)
- b) When collisions are handled by linear probing. (3)
- c) When collisions are handled by double hashing using second hash function  $h' = 5 - (5 \bmod k)$ . (4)
- 20 a) Get the hash index in table of size 7 for the following list. 56,43,27,32,3. (3)
- b) Do the rehashing when the inserted elements are more than 4. (3)
- c) Briefly explain any 2 hashing functions. (4)

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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**THIRD SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018**

**Course Code: CS205**

**Course Name: DATA STRUCTURES (CS, IT)**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions, each carries 3 marks*

Marks

- |   |   |     |
|---|---|-----|
| 1 | Write an algorithm to perform backward traversal of a doubly linked list.   | (3) |
| 2 | Define the following terms, with examples:<br>i) Header linked list    ii) Circular linked list   | (3) |
| 3 | What is the purpose of calculating frequency count? Compute the frequency count of the following code fragment.<br><pre>for(i=0;i&lt;n;i++)   for(j=0;j&lt;n;j++)     printf("%d",a[i][j]);</pre> | (3) |
| 4 | What is stepwise refinement technique?  | (3) |

**PART B**

*Answer any two full questions, each carries 9 marks*

- |   |  |       |
|---|--|-------|
| 5 | a) What is the difference between recursive and iterative algorithms?              | (4.5) |
|   | b) Write recursive and iterative algorithm to traverse a singly linked list.       | (4.5) |
| 6 | a) Write an algorithm to add two polynomials.                                      | (6)   |
|   | b) Write about top down and bottom up programming methodologies.                   | (3)   |
| 7 | a) Write an algorithm to insert a node after a given node in a doubly linked list. | (4.5) |
|   | b) What is asymptotic notation? Describe about Big O notation.                     | (4.5) |

**PART C**

*Answer all questions, each carries 3 marks*

- |    |  |     |
|----|--|-----|
| 8  | Write an algorithm to perform substring searching.   | (3) |
| 9  | Evaluate the following expressions written in reverse polish notation. Assume single digit operands and ^ represents exponentiation operator<br>i) $123*+42/^$ ii) $63/45-*$ | (3) |
| 10 | Define the properties of circular queue. How will you check whether the circular queue is<br>i) Full    ii) Empty  | (3) |
| 11 | Write a recursive algorithm to perform preorder traversal.   | (3) |

**PART D**

*Answer any two full questions, each carries 9 marks*

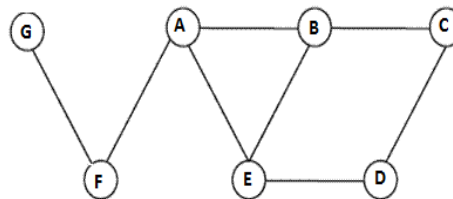
- |    |   |       |
|----|---|-------|
| 12 | a) Write an algorithm to convert an infix expression to postfix.  | (4.5) |
|    | b) Show the structure of the binary search tree after adding each of the following values in that order: 10, 1, 3, 5, 15, 12, 16. What is the height of the created | (4.5) |

- binary search tree?
- 13 a) Given five memory partitions of 100Kb, 500Kb, 200Kb, 300Kb, 600Kb (in order), (4.5)  
how would the first-fit and best-fit algorithms place processes of 212 Kb, 417 Kb,  
112 Kb, and 426 Kb (in order)? Which algorithm makes the most efficient use of  
memory?
- b) Develop an algorithm to add an element into a binary search tree. (4.5)
- 14 a) Write a C Program/algorithm to implement two stacks using a single array. (7)
- b) What are the applications of trees? (2)

### PART E

*Answer any four full questions, each carries 10 marks*

- 15 Write an algorithm/ C program to perform merge sort. Given the following list of (10)  
numbers: [21, 1, 26, 45, 29, 28, 2] find the output obtained after each recursive call  
of merge sort algorithm.
- 16 Write C program/algorithm to perform linear search. Find the time complexity for (10)  
best, worst and average case for a linear search in an array of n elements.
- 17 a) Write algorithm to perform Breadth First Search. Write one possible order of (5)  
visiting the nodes of the following graph starting at vertex A.



- b) What is hash table? What are the properties of hash function? (5)
- 18 What is max heap? Write an algorithm to perform heap sort. Give example. (10)
- 19 Write C program/algorithm to perform selection sort. Perform selection sort on an (10)  
array [5,3,1,7,9].
- 20 What is double hashing? Suppose size of the hash table is 11. Open addressing (10)  
and double hashing is used to resolve collisions. The hash function used is  $H(k) = k \text{ mod } 11$ . The second hash function is  $H_2(k) = 5 - (k \text{ mod } 5)$   
What values will be in the hash table after the following sequence of insertions?  
16, 23, 9, 34, 12, 56

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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018**

**Course Code: CS205**

**Course Name: DATA STRUCTURES (CS,IT)**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions, each carries 3 marks.*

Marks

- |   |   |     |
|---|---|-----|
| 1 | Write a recursive function to find the fibonacci series                                   | (3) |
| 2 | Draw a circular doubly linked list. Give an advantage of circular doubly linked list.     | (3) |
| 3 | Check whether the following is true or not.<br>$2^{n+1}$ is in $O(2^n)$ . Give reason.    | (3) |
| 4 | How will you represent a polynomial $3x^2 + 2xy^2 + 5y^3 + 7yz$ using singly linked list? | (3) |

**PART B**

*Answer any two full questions, each carries 9 marks.*

- |   |  |     |
|---|--|-----|
| 5 | a) Explain the Big O asymptotic notation used for specifying the growth rate of functions.   | (3) |
|   | b) Given a doubly linked list, write an algorithm that removes a node with a particular value from the list and inserts it in the front. | (6) |
| 6 | a) What is an algorithm? How is its complexity analysed?   | (3) |
|   | b) What is the complexity of finding maximum and minimum value from an array of n values? Explain the steps of deriving complexity.      | (6) |
| 7 | a) Give any three applications of linked list.   | (3) |
|   | b) Let L1 be a singly linked list in memory. Write an algorithm  | (6) |
|   | i) Finds the number of non zero elements in L1   |     |
|   | ii) Adds a given value K to each element in L1   |     |

**PART C**

*Answer all questions, each carries 3 marks.*

- |    |   |     |
|----|---|-----|
| 8  | Write an algorithm to find a substring in a given string.   | (3) |
| 9  | With the help of an example, explain how a binary tree can be represented using an array.                           | (3) |
| 10 | How can you reverse a string using stack? Give one example and show how you can reverse a given string using stack. | (3) |
| 11 | Write a recursive algorithm for pre-order traversal in a binary tree.   | (3) |

**PART D**

*Answer any two full questions, each carries 9 marks.*

- 12 a) Illustrate the result of each operation in the sequence PUSH(S,4), PUSH(S,1), PUSH(S,3), POP(S), PUSH(S,8) and POP(S) on an initially empty stack S stored in array S[1..6] (3)
- b) Write an algorithm to insert an element into a binary search tree. (6)
- 13 a) Convert the following infix expression into prefix expression (A-B/C) \* (D\*E-F) (3)
- b) Write an algorithm to evaluate a postfix expression. (6)
- 14 a) In a complete binary tree of depth d (complete including last level), give an expression to find the number of leaf nodes in the binary tree. (3)
- b) Given five memory partitions of 300Kb, 700Kb, 400Kb, 500Kb, 800Kb (in order), how would the first-fit, best-fit, and worst-fit algorithms place processes of 412 Kb, 617 Kb, 112 Kb, and 626 Kb (in order)? (6)

**PART E**

*Answer any four full questions, each carries 10 marks.*

- 15 a) What are the characteristics of a good hash function? (4)
- b) Demonstrate the insertion of the keys 5, 28, 15, 20, 33, 12, 17, 32 into a hash table with collisions resolved by linear probing. Let the table have 9 slots, with the starting index 0. Let the hash function be  $h(k) = k \bmod 9$  (6)
- 16 a) Give the heap sort algorithm. Write the complexity of your algorithm. (4)
- b) Using the above heap sort algorithm sort the input file [35 15 40 1 60]. (6)
- 17 a) What is Primary Clustering? (4)
- b) Given input keys {1, 3, 23, 9, 4, 29, 19} and a hash function  $h(X) = X \bmod \text{tablesize}$ . The initial hash table contains 10 slots, with starting index 0. Show the resulting table after rehashing when the load factor= 0.5, using linear probing (6)
- 18 a) Give a non recursive algorithm for binary search. (4)
- b) Suppose an array contains elements {10, 13, 21, 32, 35, 44, 55}. Give the steps to find an element "35" using i) linear search ii) binary search (6)
- 19 a) Give two different types of representation for graphs. (4)
- b) Write a procedure to do DFS in a graph. (6)
- 20 a) Write an algorithm to perform selection sort in an array. (4)
- b) Using the above selection sort algorithm, sort the input file [25, 7, 46, 11, 85]. (6)

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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**THIRD SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019**

**Course Code: CS205**

**Course Name: DATA STRUCTURES (CS,IT)**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions, each carries 3 marks.*

- |   |  | Marks |
|---|--|-------|
| 1 | Define Big Oh, Big Omega and Big Theta Notations.  | (3)   |
| 2 | Compare structured approach and object oriented approach of programming.                   | (3)   |
| 3 | Represent the following matrix using row major order and column major order.               | (3)   |
|   | $\begin{matrix} 10 & 20 & -32 & 44 \\ 3 & 99 & 12 & -20 \\ 21 & -4 & 33 & 89 \end{matrix}$ |       |
| 4 | Write an algorithm to count the number of nodes in a singly linked list.                   | (3)   |

**PART B**

*Answer any two full questions, each carries 9 marks.*

- |   |  |     |
|---|--|-----|
| 5 | a) Define recursive function. What are the essential conditions to be satisfied by a recursive function?       | (4) |
|   | b) Write a recursive function to find the factorial of a given number. Write its time complexity.              | (5) |
| 6 | Write algorithms to perform the following operations on a doubly linked list.                                  |     |
|   | (i) Insert a node with data 'y' after a node whose data is 'x'.  | (3) |
|   | (ii) Delete a node whose data is 's'.  | (3) |
|   | (iii) Insert a node with data 'a' as the 1 <sup>st</sup> node of the list.                                     | (3) |
| 7 | a) Explain structured approach to problem solving.   | (3) |
|   | b) Write an algorithm to add 2 polynomials (single variable polynomials) represented using singly linked list. | (6) |

**PART C**

*Answer all questions, each carries 3 marks.*

- |    |   |     |
|----|---|-----|
| 8  | Write an algorithm to reverse a string using stack.   | (3) |
| 9  | What are the disadvantages of representing a linear queue using array? How are they overcome? | (3) |
| 10 | Define (i) Tree (ii) Binary Tree  | (3) |

11 Draw the binary tree whose sequential representation is given below.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
A	B	C	D	-	E	F	-	G	-	-	H	-	-	I	(3)

**PART D**

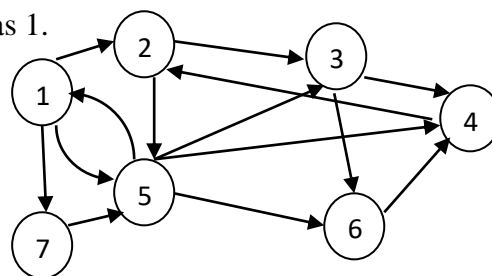
*Answer any two full questions, each carries 9 marks.*

- 12 a) What is a binary search tree (BST)? Give an example of a BST with five nodes. (3)
- b) Assume that a stack is represented using linked list. Write algorithms for the following operations:-
- (i) Push
- (ii) Pop (6)
- 13 Write an algorithm to evaluate postfix expression. Trace the algorithm on the following input
- 623+-84/+23^+ (all numbers are single digits) (9)
- 14 a) Write an algorithm to search for a substring in a given string. (4)
- b) Write an iterative algorithm to perform in order traversal of a binary tree. (5)

**PART E**

*Answer any four full questions, each carries 10 marks.*

- 15 a) Explain the various ways in which a graph can be represented bringing out the advantages and disadvantages of each representation. (6)
- b) Write an algorithm to perform bubble sort on a collection of 'n' numbers. (4)
- 16 a) Write algorithms for DFS and BFS traversal on a graph. (6)
- b) Write the output of DFS and BFS traversals on the following graph considering starting vertex as 1. (4)



- 17 a) Write an algorithm for Quick sort. (5)
- b) Trace the working of the algorithm on the following input (5)
- 38, 8, 0, 28, 45, -13, 89, 66, 42
- 18 a) Compare Binary Search and Linear Search. (3)
- b) Write an algorithm to perform binary search on a given set of 'n' numbers. Using the algorithm search for the element 23 in the set [12, 23, 34, 44, 48, 53, (7)

87, 99]

- 19 a) What is meant by collision? Give an example. (2)
- b) Explain the four different hashing functions with an example for each. (8)
- 20 Given the values {2341, 4234, 2839, 430, 22, 397, 3920} a hash table of size 7 and a hash function  $h(x) = x \bmod 7$ , show the resulting table after inserting the values in the given order with each of the following collision strategies.
- (i) separate chaining
- (ii) linear probing
- (iii) double hashing with second hash function  $h_1(x) = (2x - 1) \bmod 7$ . (10)

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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**THIRD SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019**

**Course Code: CS205**

**Course Name: DATA STRUCTURES**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions, each carries 3 marks.*

- |   |   | Marks |
|---|---|-------|
| 1 | Calculate the run-time efficiency of the following program segment using frequency count analysis.<br><pre>for (i = 1; i &lt;= n; i++) for (j = 1; j &lt;= n; j++) printf ("%d %d \n", i, j);</pre> | (3)   |
| 2 | Let $F(n) = n^2 + n$ . Can you say $F(n)$ is $O(n^3)$ ? Justify your answer.  | (3)   |
| 3 | Why a doubly linked list is known as two way list? Draw a doubly linked list with data values 25, 45, 15.   | (3)   |
| 4 | Let <i>LIST</i> be a singly linked list in memory. Write an algorithm to find the number of times a given data item <i>X</i> occurs in <i>LIST</i> .  | (3)   |

**PART B**

*Answer any two full questions, each carries 9 marks.*

- |   |  |       |
|---|--|-------|
| 5 | a) Write an algorithm/pseudo code to find the sum of two square matrices and find the time complexity of the algorithm using frequency count method. | (6)   |
|   | b) Compare recursive and iterative algorithms.   | (3)   |
| 6 | a) Explain stepwise refinement technique with the help of an example.  | (4.5) |
|   | b) Write an algorithm/pseudo code to add a new element in a particular position of an array.   | (4.5) |
| 7 | a) Represent the polynomial $4x^3y + 5xy^2 + 8$ using a singly linked list.  | (1)   |
|   | b) Write an algorithm/pseudo code to perform addition of two single variable polynomials using singly linked lists.                                  | (8)   |

**PART C**

*Answer all questions, each carries 3 marks.*

- |    |   |     |
|----|---|-----|
| 8  | Perform the following operations in the given order on an empty stack of size 5. Display the stack after each operation. Mention TOP of the stack.<br>POP(), PUSH(5), PUSH(8), POP(), PUSH(4), PUSH(2), POP() | (3) |
| 9  | What is a Binary tree? Give an example. Give its array representation.  | (3) |
| 10 | How is a circular queue represented using an array. Write down the QUEUE FULL condition for a circular queue.   | (3) |
| 11 | What is a complete binary tree and full binary tree? Give example for each.   | (3) |

**PART D**

*Answer any two full questions, each carries 9 marks.*

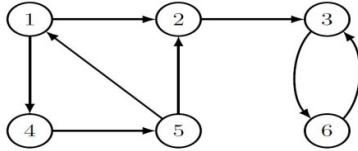
- |    |   |     |
|----|---|-----|
| 12 | a) Trace the infix to postfix algorithm (clearly showing the status of stack) to find the equivalent postfix expression for the following infix expression.<br>$A + (B * C - (D / E \wedge F) * G)$ | (5) |
|    | b) Write a non recursive (iterative) algorithm/pseudo code to perform preorder traversal of a binary tree .   | (4) |
| 13 | a) Write an algorithm/pseudo code to insert an element in a circular queue using array.   | (3) |

- b) Create a Binary Search tree (BST) using the following data entered sequentially. (6)  
 10, 5, 14, 7, 12, 18, 15, 13  
 i) Perform in order traversal of the created BST.  
 ii) Delete 7, 18 and 10 from the created BST.
- 14 a) Write an algorithm/pseudo code for postfix evaluation using stack. (5)  
 b) Write an algorithm/pseudo code to search for a given element in a binary search tree. (4)

### PART E

*Answer any four full questions, each carries 10 marks.*

- 15 a) How a graph is represented using adjacency matrix? Give example. (4)  
 b) Explain BFS with the help of an algorithm/pseudo code. Perform BFS on the given graph, starting from node 5. (6)



- 16 a) Design an iterative binary search algorithm. (5)  
 b) An array contains the elements shown below. Using the Binary search algorithm, trace the steps followed to find 88. After each iteration, show the contents of variables used. What is the number of comparisons required?  
 13, 17, 18, 26, 44, 56, 88, 97, 100
- 17 a) Write an algorithm/pseudo code for performing linear search in an array of n elements and find the time complexity for the best, worst and average case. (5)  
 b) Write down the algorithm/pseudo code for insertion sort. (5)
- 18 a) Write an algorithm/ pseudo code for performing merge sort on an array of n elements. (5)  
 b) Where is a hash table data structure used? Explain any two commonly used hash functions with examples. (5)
- 19 a) Define a max heap. Construct a max heap with the following set of numbers entered sequentially. (5)  
 10, 5, 14, 7, 12, 18, 15, 13  
 b) Let the size of a hash table be 7. The index of the hash table varies from 0 to 6. Consider the keys 89, 18, 49, 58, 25 in the order. Show how the keys are stored in the hash table (use linear probing). (5)
- 20 a) Write an algorithm/ pseudo code for performing Quick sort on an array of n elements. (5)  
 b) Let the size of the hash table be 10. The index of the hash table varies from 0 to 9. Consider the keys 43, 24, 57, 12, 10, 64, 19, 82, 36, 39 in the order. Show how the keys are occupied. Use chaining method. (5)

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Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Third semester B.Tech examinations (S) September 2020

**Course Code: CS205****Course Name: DATA STRUCTURES (CS,IT)**

Max. Marks: 100

Duration: 3 Hours

**PART A***Answer all questions, each carries 3 marks.*

Marks

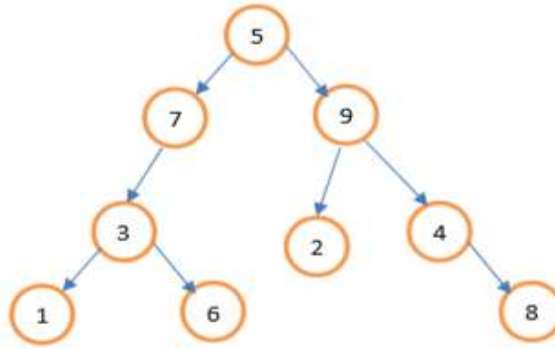
- 1 Differentiate between top down and bottom up approach of problem solving? (3)
- 2 What is frequency count? With the help of an example, explain how frequency count is used to calculate the running time of an algorithm? (3)
- 3 Compare a Singly linked list and Doubly Linked List. (3)
- 4 Write an algorithm/pseudocode to delete a given element k from an array A of n elements? Assume that the element k is always present in A. (3)

**PART B***Answer any two full questions, each carries 9 marks.*

- 5 a) What do you mean by space complexity and time complexity of an algorithm? Write an algorithm/pseudo code for linear search and mention the best case and worst case time complexity of Linear Search algorithm? (6)
- b) Explain modular programming with suitable example. (3)
- 6 a) Write an algorithm/pseudocode to delete a node at the end of a doubly linked list. (4.5)
- b) Define Big-O notation. Derive the Big – O notation for  $5n^3+2n^2+3n$ . (4.5)
- 7 a) Write an algorithm/pseudocode to count the number of nodes in a Singly Linked List? (6)
- b) How will you represent header node in a Linked List? (3)

**PART C***Answer all questions, each carries 3 marks.*

- 8 What is Polish and Reverse polish notation? Give examples for each? (3)
- 9 How can you represent a Binary Tree in memory using array? (3)
- 10 Write down the inorder, preorder and postorder traversal of the following binary tree (3)



- 11 Evaluate the following postfix expression  $ABC*D/+$  where  $A=2$   $B=3$   $C=4$   $D=6$  (3)

#### PART D

*Answer any two full questions, each carries 9 marks.*

- 12 a) Write an algorithm/pseudocode to convert a given infix expression to postfix expression? Trace the steps involved in converting the given infix expression  $((A+B)^C)-((D*C)/F)$  to postfix expression. (7)
- b) What is DEQUEUE? (2)
- 13 a) Write a non recursive algorithm/pseudocode for pre-order traversal of a Binary Tree. (3)
- b) Write an algorithm/pseudocode to perform the following operations on a binary search tree (6)
- insert an element  $k$
  - search for an element  $k$
- 14 a) What is a Binary Search Tree (BST)? Show the structure of the binary search tree after adding each of the following values in that order: 10, 25, 2, 4, 7, 13, 11, 22. What is the height of the created binary search tree? (5)
- b) How can you represent a multiple stack using array? (4)

#### PART E

*Answer any four full questions, each carries 10 marks.*

- 15 a) Give any two representations of graphs? What do you mean by in-degree and out-degree of a graph? (4)
- b) Give algorithm/pseudocode for DFS. Demonstrate DFS using suitable example? (6)
- 16 a) Design an algorithm/ pseudocode for selection sort. Illustrate the working of selection sort on the following array with 7 elements : 30,45,25,32,55,60,49 (6)
- b) What you mean by Open Addressing and Closed Addressing? (4)

- 17 a) Explain Merge Sort algorithm/pseudocode with the help of an example? (6)  
Mention the best case and worst case time complexity of Merge sort algorithm?
- b) Why Binary Search algorithm is more efficient than linear search? Depict your answer with suitable example? Mention the time complexity level of two algorithms. (4)
- 18 a) Write an algorithm/pseudocode to sort elements using Heap sort technique? (7)  
Illustrate the working of Heap sort algorithm on the following input :  
35,15,0,1,60
- b) Define hashing, hash function and collision. (3)
- 19 a) List any three applications of BFS algorithm. (3)
- b) A hash table contains 7 buckets and uses linear probing to solve collision. The key values are integers and the hash function used is  $key \% 7$ . Draw the table that results after inserting in the given order the following values:  
16,8,4,13,29,11,22. (7)
- 20 a) With the help of an algorithm/pseudocode and suitable example, explain how would you perform binary search on an array of n elements. Find the time complexity of binary search algorithm. (7)
- b) Write short notes on separate chaining. (3)

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