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| **Scheme of Valuation/Answer Key**  (Scheme of evaluation (marks in brackets) and answers of problems/key) | | | |
| **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 | | | |
| **PART A** | | | |
|  |  | ***Answer all questions, each carries3 marks.*** | Marks |
| 1 |  | Write a recursive function to find the fibonacci series  Recursive function: 3 Marks | (3) |
| 2 |  | Draw a circular doubly linked list. Give the advantage.  Diagram: 2 Marks  Advantage: 1 mark  The aim of circular doubly linked list is to simplify the insertion and deletion operations performed on doubly linked list | (3) |
| 3 |  | Check whether the following is true or not  Is 2n+1ε O(2n). Give reason  Ans: True -1 Mark  Big-*O*: 2 Marks  Let f(n) and g(n) be two real function then, *f*(*n*)=*O*(*g*(*n*))  is equivalent to  where, *c**≥*0  lim*n*→∞*f*(*n*)/*g*(*n*) = lim*n*→∞( 2n+1 )/(2n) = 2 | (3) |
| 4 |  | How will you represent a polynomial 3x2 +2xy2 +5y3 +7yz using singly linked list?  Diagram: 3 Marks  Each node can be represented as   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Power x | Power y | Power z | coef | next | | (3) |
| **PART B** | | | |
| ***Answer any two full questions, each carries9 marks.*** | | | |
| 5 | a) | Explain the Big O asymptotic notation used for specifying the growth rate of functions.  Definition: 3 Marks  Given f, g:N→R+, we say that f(n) ∈ O(g(n)) if there exists some constants c >0, n0 ≥ 0 such that for every n ≥ n0, f(n) ≤ cg(n). | (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.  Algorithm:  To remove node: 3 Marks  Inserts at front: 3 Marks | (6) |
| 6 | a) | Explain algorithm  Description: 3 Marks | (3) |
|  | b) | Complexity for finding minimum value with steps: 3 Marks(1 mark complexity+2 marks for steps)  Complexity for finding find maximum value: 3 Marks (1 mark complexity+2 marksfor steps) | (6) |
| 7 | a) | Give any three applications of linked list  Any 3 applications: 3 Marks  1) Sparse Matrix Manipulation  2) Polynomial representation and their manipulations  -Polynomial addition  -Polynomial multiplication  3) Dynamic Storage Management etc. | (3) |
|  | b) | Let L1 be a singly linked list in memory. Write an algorithm  i) Finds the number of non zero elements in L1  ii) Adds a given value K to each element in L1  Algorithm to find number of non zero elements: 3 Marks  Algorithm to add value K to each element: 3 Marks | (6) |
| **PART C** | | | |
| ***Answer all questions, each carries3 marks.*** | | | |
| 8 |  | Write an algorithm to find a substring in a given string  Algorithm: 3 Marks | (3) |
| 9 |  | With the help of an example, explain how a binary tree can be represented using an array.  Array Representation of binary trees: 3 Marks | (3) |
| 10 |  | How can you reverse a string using stack? Give one example and show how you can reverse a given string using stack.  Explanation: 2 Marks  Example: 1 Mark | (3) |
| 11 |  | Write a recursive algorithm for preorder traversal in a binary tree  Recursive Algorithm: 3 Marks | (3) |
| **PART D** | | | |
| ***Answer any two full questions, each carries9 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]  Diagram: 3 marks  After PUSH(S,4): Index 1 will have value 4  After PUSH(S,1): Index 2 will have value 1  After PUSH(S,3): Index 3 will have value 3  After POP(S): Value 3 will be popped out  After PUSH(S,8): Index 3 will have value 8  After POP(S): Value 8 will be popped out.  The remaining elements in the array will be Index 1 will have value 4 and Index 2 will have value 1 | (3) |
|  | b) | Write an algorithm to insert an element into a binary search tree.  Algorithm: 6 Marks | (6) |
| 13 | a) | Convert the following infix expression into prefix expression  (A-B/C) \* (D\*E-F)  Prefix Expression: 3 Marks  Ans: \* - A /BC - \* DEF | (3) |
|  | b) | Write an algorithm to evaluate a postfix expression  Algorithm: 6 Marks | (6) |
| 14 | a) | In a complete binary tree of depth d, give an expression to find the number of leaf nodes in the binary tree  Expression: 3 Marks  Number of leaf nodes: 2d | (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)?  First-fit: 2Marks  412K is put in 700K partition  617K is put in 800K partition  112K is put in 288K partition (new partition 288K = 700K - 412K)  626K must wait  Best-fit: 2 Marks  412K is put in 500K partition  617K is put in 700K partition  112K is put in 300K partition  626K is put in 800K partition  Worst-fit: 2 Marks  412K is put in 800K partition  617K is put in 700K partition  112K is put in 500K partition  626K must wait | (6) |
| **PART E** | | | |
| ***Answer any four full questions, each carries10 marks.*** | | | |
| 15 | a) | What are the characteristics of a good hash function?  Any 4 characteristics: 4 Marks | (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 mod 9  Diagram: 6 marks  Index 0 will have value 32  Index 1 will have value 28  Index 2 will have value 20  Index 3 will have value 12  Index 5 will have value 5  Index 6 will have value 15  Index 7 will have value 33  Index 8 will have value 17 | (6) |
| 16 | a) | Give the heap sort algorithm. Write the complexity of your algorithm  Heap sort Algorithm: 3 Marks  Complexity: O(nlogn) 1 Mark | (4) |
|  | b) | Using the above heap sort algorithm sort the input file [35 15 40 1 60].  Diagram:  Making heap: 3 Marks  Heap Adjusment: 3 Marks | (6) |
| 17 | a) | What is Primary Clustering?  Explanation: 4 Marks | (4) |
|  | b) | Given input keys {1, 3, 23, 9, 4, 29, 19} and a hash function  h(X) = X mod 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  Diagram: 6 Marks  When five elements are inserted the load factor=5/10=0.5, then rehashing occurs  After rehashing table size will be 20  Then hash function h(X) = X mod 20  Final hash table is  Index 1 will have value 1  Index 3 will have value 3  Index 4 will have value 23  Index 5 will have value 4  Index 9 will have value 9  Index 10 will have value 29  Index 19 will have value 19 | (6) |
| 18 | a) | Give a non recursive algorithm for binary search.  Non recursive algorithm: 4 Marks | (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  Steps for linear search: 3 Marks  Steps for binary search: 3 Marks | (6) |
| 19 | a) | Give the different types of representation of graphs  Adjacency Matrix: 2 Marks  Adjacency List: 2 Marks | (4) |
|  | b) | Write a procedure to do DFS in a graph.  Algorithm: 6 Marks | (6) |
| 20 | a) | Write an algorithm to perform selection sort in an array  Algorithm: 4 Marks | (4) |
|  | b) | Using the above selection sort algorithm, sort the input file  [25, 7, 46, 11, 85].  Sorting: 6 Marks | (6) |