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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 seriesRecursive function: 3 Marks | (3) |
| 2 |  | Draw a circular doubly linked list. Give the advantage.Diagram: 2 MarksAdvantage: 1 markThe 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 reasonAns: True -1 MarkBig-*O*: 2 MarksLet f(n) and g(n) be two real function then, *f*(*n*)=*O*(*g*(*n*))is equivalent towhere, *c**≥*0lim*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 MarksEach 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 MarksInserts at front: 3 Marks | (6) |
| 6 | a) | Explain algorithmDescription: 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 listAny 3 applications: 3 Marks1) Sparse Matrix Manipulation2) Polynomial representation and their manipulations-Polynomial addition-Polynomial multiplication3) 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 L1ii) Adds a given value K to each element in L1Algorithm to find number of non zero elements: 3 MarksAlgorithm 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 stringAlgorithm: 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 MarksExample: 1 Mark | (3) |
| 11 |  | Write a recursive algorithm for preorder traversal in a binary treeRecursive 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 marksAfter PUSH(S,4): Index 1 will have value 4After PUSH(S,1): Index 2 will have value 1After PUSH(S,3): Index 3 will have value 3After POP(S): Value 3 will be popped outAfter PUSH(S,8): Index 3 will have value 8After 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 MarksAns: \* - A /BC - \* DEF | (3) |
|  | b) | Write an algorithm to evaluate a postfix expressionAlgorithm: 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 treeExpression: 3 MarksNumber 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: 2Marks412K is put in 700K partition617K is put in 800K partition112K is put in 288K partition (new partition 288K = 700K - 412K)626K must waitBest-fit: 2 Marks412K is put in 500K partition617K is put in 700K partition112K is put in 300K partition626K is put in 800K partitionWorst-fit: 2 Marks412K is put in 800K partition617K is put in 700K partition112K is put in 500K partition626K 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 9Diagram: 6 marksIndex 0 will have value 32Index 1 will have value 28Index 2 will have value 20Index 3 will have value 12Index 5 will have value 5Index 6 will have value 15Index 7 will have value 33Index 8 will have value 17 | (6) |
| 16 | a) | Give the heap sort algorithm. Write the complexity of your algorithmHeap sort Algorithm: 3 MarksComplexity: 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 MarksHeap 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 probingDiagram: 6 MarksWhen five elements are inserted the load factor=5/10=0.5, then rehashing occursAfter rehashing table size will be 20Then hash function h(X) = X mod 20Final hash table isIndex 1 will have value 1Index 3 will have value 3Index 4 will have value 23Index 5 will have value 4Index 9 will have value 9Index 10 will have value 29Index 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 searchSteps for linear search: 3 MarksSteps for binary search: 3 Marks | (6) |
| 19 | a) | Give the different types of representation of graphsAdjacency Matrix: 2 MarksAdjacency 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 arrayAlgorithm: 4 Marks | (4) |
|  | b) | Using the above selection sort algorithm, sort the input file [25, 7, 46, 11, 85]. Sorting: 6 Marks | (6) |