PES University, Bangalore
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UE16CS202

Dec 2017: END SEMESTER ASSESSMENT (ESA) B.TECH.

UE16CS202- Data Structures

Time: 3 Hrs   Answer all questions in the same order   Max Marks: 100

NOTE: Detailed algorithm or C code is acceptable. State any assumptions made. Calculator needed

1	a)	Write a recursive method to determine whether a singly linked list is sorted in descending order or not. Assume NODE contains data and next pointer. Declare NODE structure and write the method. The method should return 1 if list is sorted and 0 otherwise. int isLinkListSorted (NODE *linklist) // write this recursive method and declare NODE	6
	b)	Given an integer doubly linked list, with Head and Tail pointers, print the list so that alternate elements from the beginning and end of the list are printed. Example: 12345 should print 15243 and 123456 should print 162534. The method should handle border conditions. void AlternatePrint(DNODE *Head,, DNODE *Tail); // write this method and declare DNODE	6
	c)	X and Y are two singly linked lists containing integer document ids. Write a function (or algorithm) called "Merge" that takes X and Y and returns a third list Z which contains only doc ids that are in X and NOT in Y. Eg. X = {1,3,5,6,7} and Y = {1,2,3,4,6} then Z should be {5,7}	8
2.	a)	Convert the following infix expression to its equivalent postfix and prefix expressions. The symbol (^) denotes the exponent operator. ((A+B) /C) ^ (D*(E-F))	6
	b)	Write a method in C to print individual digits of a number separated by hyphen. Eg. 17852 should print 1-7-8-5-2. You can use a stack with the standard stack operations (push, pop, top, isEmpty, size). DO NOT write the Stack methods. void digitizer(int decimal) // should print individual digits of decimal separated by hyphen	6
	c)	Implement enqueue and dequeue operations of a circular queue using an array of size N. Assume f is the index to the front element of the queue and r is index where the next element gets inserted into the queue.	8
3.	a)	Write a method called AlternateSplit to split an integer Queue into two queues which contain alternate elements of the original queue. Use only queue methods that are usually defined in the queue ADT (enqueue, dequeue etc) For eg. if original queue is (1,2,3,4,5) then Q1 is (1,3,5) and Q2 is (2,4). DO NOT write enqueue and dequeue methods.	6
	b)	Draw a Binary Search Tree with these numbers. 14, 17, 7, 11, 23, 4, 13, 16 Redraw after 7 is removed from the BST.	6

	c)	Suppose that you have a binary search tree data structure declared as follows: ```\nstruct tree {\n int key;\n int value;\n struct tree *left, *right;\n};\n``` Write a function called sumTree that computes the sum of the value fields of all nodes in the tree, (given a pointer to the root of the tree).	8

4.	a)	Given a integer array S[MAX], use a heap data structure to sort the elements in S in descending order. Declare the HEAP data structure and write the function called Sort_Descend(), using the following heap functions. DO NOT write Insert and RemoveMin methods.
		
		void Insert (HEAP *h, int i); // inserts element i into a heap h and heapify.
		int RemoveMin(HEAP *h); // returns the minimum element of heap h and heapify.
			6

	b)`	In a min-Heap, the data value of the parent node is smaller than that of its children. Draw a min-heap with the following data values. Redraw the min-heap after RemoveMin() operation is performed. 40,30,70,20,50,60,10,90	6
	c)	Insert the following elements into an initially empty AVL tree. Show the rotations and all the in between trees. 73,11,56,97,88,45,55,61	8
5.	a)	Insert the following letters into what is originally an empty B-tree of order 5: C N G A H E K Q M F W L T Z D P R X Y S Order 5 means that a node can have a maximum of 5 children and 4 keys. All nodes other than the root must have a minimum of 2 keys. Assume keys are in alphabetical order A<B<C...<Z	8
	b)	Let us consider a simple hash function as "key mod 7" and sequence of keys as 50, 700, 76, 85, 92, 73, 101. Give the hash table contents resulting from Linear Probing.	6
	c)	Give the contents of the hash table that results when you insert items with the keys R E P U B L I C A N in that order into an initially empty table of $N = 5$ lists, using separate chaining with unordered lists. Use the hash function 11* k mod N to transform the kth letter of the alphabet into a table index, e.g., I is 9th letter of alphabet, hence hash(I) = hash(9) = 99 % 5 = 4.	6