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PES University, Bengaluru
(Established under Karnataka Act No. 16 of 2013)

UE16CS251

DECEMBER 2021: END SEMESTER ASSESSMENT (ESA) B TECH 4th SEMESTER

UE16CS251—Design and Analysis of Algorithms

Time: 3 Hrs Answer All Questions Max Marks: 100

1	a)	Fill in the Blanks: i) Indicate order of growth $3n^2 \log n + n =$ _____ ii) if $t1(n) \in \Omega(g1(n))$ and $t2(n) \in \Omega(g2(n))$, then $t1(n) + t2(n) \in$ _____ Describe: iii) "Stable" and "In Place" keyword with respect to sorting algorithm	4

	b)	i) Setup recurrence equation for given algorithm and solve the equation for time complexity
		. int fun1(int n) {
		if (n == 1)
		return n;
		else
		return(fun1(n-1) + fun1(n-1));
		}
		
		ii) Compare order of growth using limits: n^2 (n-1) and $3n^3$
			6

	c)	Solve $T(n) = 2T(n^{1/2}) + 1$, given $T(1)=0$	4
	d)	Write algorithm to check whether all the elements in a given array are distinct, set up the relation and find efficiency.	6
2	a)	Write Naïve string matching algorithm, Identify the basic operation, Analyze the best, worst and average case time efficiency of the algorithm.	6
	b)	i) Time taken by improved bubble sort in the best case _____ ii) Time taken by Strassen's matrix multiplication algorithm _____ iii) $T(n) = 4T(n/2) + n^3 \Rightarrow T(n) \in$ _____ iv) Time taken by Knapsack solved by Exhaustive search technique is _____	4
	c)	Write Quick Sort partition algorithm.	6
	d)	Write an algorithm to compute the number of leaves in a binary tree.	4
3	a)	Apply heap sort on the given input to sort only for 3 iterations (Show the steps neatly) 3,7,1,8,2,5,9,4,6	6
	b)	Derive best, average and worst-case time complexity of the Insertion Sort.	4
	c)	Construct AVL tree for the following input 5,7,1,15,3,2,6,8,4,9	6

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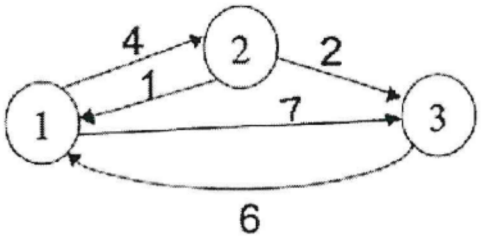
	d)	What is the next 4 permutation generated for the following sequence using Jhonson trotter? 4 ←, 3→,2→,1←	4
4	a)	List the properties of B-Tree	5
	b)	Apply Floyd Warshall's algorithm on the given graph  	4
	c)	Apply Horspool's string matching algorithm for the text: A C G T T A G C A G C G C A G C G C and Pattern: AGCGC	6
	d)	Decode the binary bits "01100100100101110010011111 1001" using Huffman coding and probabilities are A=11, B=6, C=2, D=10, E=7, __=10	5
5	a)	Find solution for Knapsack problem using dynamic programming where the W=8 is the capacity of the knapsack, weights and values of items are w= {2,3,4,5} V= {1,2,5,6} respectively.	7
	b)	Explain the concept of backtracking with the help of a state space tree. Find out all 3-bit binary numbers for which the sum of all 1's is greater than or equal to 2 using backtracking algorithm. (Represent solution in terms of state space tree)	7
	c)	Define the following with an example: i) Class P ii) Class NP iii) NP-Complete.	6