Question Paper

Exam Date & Time: 04-May-2019 (02:00 PM - 05:00 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES IV SEMESTER B.Sc. (APPLIED SCIENCES) IN ENGINEERING END SEMESTER THEORY **EXAMINATION-APRIL/MAY 2019**

DESIGN AND ANALYSIS OF ALGORITHMS [ICS 244 - S2]

Marks: 100

Duration: 180 mins.

Answer 5 out of 8 questions.

Missing data may be suitably assumed

- 1) (6) Write a recursive function to find the number of binary digits in n's binary representation,
 - A) where n is a positive decimal integer. Also obtain its efficiency.
 - B) (10)Explain how limits are used for comparing the order of growth of any two functions. Compare the orders of growth of the following using limits.

$$\frac{1}{2}n(n-1)$$
 and n^2

 $\log_2 n$ and \sqrt{n} .

n! and 2ⁿ

C) Give the general plan for analyzing efficiency of recursive Algorithm. (4)

2)

- (6) With a neat diagram explain the algorithm design and analysis process. A)
- B) (10)Explain the procedure of generating prime numbers using "Sieve of Eratosthenes" method and write the algorithm. Also illustrate the same for generating all the prime numbers between 2 to 25.
- C) Use the informal definitions of O, Θ , and Ω to determine whether the (4) following assertions are true or false. i) $n(n + 1)/2 \in O(n^3)$ ii) $n(n + 1)/2 \in O(n^2)$

iii) $n(n + 1)/2 \in \Theta(n^3)$ iv) $n(n + 1)/2 \in \Omega(n)$

3) (10) Find the optimal solution for the assignment problem shown in Table 3 a. using Brute force method. What is its time complexity? A) Table 3 a.

	Job1	Job2	Job3	Job4
Person1	10	3	8	9
Person2	7	5	4	8
Person3	6	9	2	9
Person4	8	7	10	5

- B) Show all the steps to sort the numbers { 89, 45,68,90,29,34,17 } using (10) selection sort and insertion sort. Also obtain the Time efficiency of selection sort. Mention the efficiency class for number of comparisons and the no. of swaps needed to sort n numbers in case of selection sort.
- A) Show that Strassen's matrix multiplication is more efficient than (10) conventional multiplication for sufficiently large values of n. Also calculate its efficiency.
 - ^{B)} State the Merge Sort algorithm and analyze its complexity using Master ⁽¹⁰⁾ Theorem.
- ⁵⁾ Explain decrease-and-conquer technique with its variations and examples. ⁽⁵⁾

A)

- ^{B)} Generate all permutations of {1, 2, 3, 4} by the bottom-up minimal-change ⁽⁵⁾ algorithm.
- Construct Maximum (descending) heap for the numbers (10)
 {2,9,7,6,5,8,10,3,6,9} using bottom up approach. Also write the algorithm for the same.
- When does Transform and Conquer technique used? Write an algorithm to ⁽⁵⁾ find the mode of a given set of numbers using presorting .
 - B) For the graph shown in Figure 6 b. construct the DFS forest starting from (8) vertex 'a', indicating the back edges with dotted lines and tree edges with solid lines. Also show the DFS traversal stack contents with the first subscript number indicating the order in which a vertex was visited, i.e., pushed onto the stack; the second one indicating the order in which it became a dead end, i.e., popped off the stack.

Page #2



Figure 6 b.

- C) (7) Construct a 2-3 tree for the list 9, 5, 8, 3, 2, 4, 7
- 7) Write Horspool's algorithm and trace it to search for a patternBARBER in (8) the text

A) JIM_SAW_ME_IN_A_BARBERSHOP

B) (7) Apply the bottom-up dynamic programming algorithm to the following instance of the knapsack problem and find the optimal subset. Knapsack Capacity W=5. (Neatly show all the steps).

Ta	ble	7	b.

Item	Weight	Value
1	2	12
2	1	10
3	3	20
4	2	15

- C) (5) Write the algorithm for distribution counting. Explain with an example.
- 8) What is dynamic programming? Show how the binomial coefficient is found ⁽⁵⁾ with an example for solving C(12,5). A)
 - - B)
 - (8) What is transitive closure? Apply Warshall's algorithm to find transitive closure of the graph shown in Figure 8 b.



Figure 8 b.

C) Construct Huffman encoding tree for the following and decode the word (7) 10011011011101

Character	А	В	С	D	_
Probability	0.35	0.1	0.2	0.2	0.15

-----End-----