Name :

VIT

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

Continuous Assessment Test II – October 2022

Programme	:	M.Tech: CSE(BA)	Semester	:	FS 2022-23
Course	:	Design and Analysis of Algorithms	Code	:	CSE3037
			Class Nbr	:	CH2022231000982, CH2022231000983
Faculty	:	Dr. Ashoka Rajan R, Dr. Smrithy G S	Slot	:	A1+TA1
Time	:	**90 Minutes**	Max. Marks	:	**50**

Answer ALL the questions

Q.No.	Sub. Sec.	Questions	Marks
1.		A sequence is generated using a recurrence relation f as shown below: $f(n) = \begin{cases} f(n-1) + f(n-2) + f(n-3) & \text{if } n > 2 \\ 5 & \text{if } n = 0, 1, 2 \end{cases}$ Generate a sequence for n = 6 using the above recurrence relation. i. Design a dynamic programming (DP) algorithm to generate the sequence using above recurrence relation. **(6 Marks)** ii. How many times the function 'f' will be called in the DP algorithm designed when n=5? **(2 Marks)** iii. Analyse the time complexity of the designed DP algorithm. **(2 Marks)**	10
2.		Given two integer arrays profit [0..N-1] and weight[0..N-1] which represent profits and weights associated with N items respectively. Also given an integer W which represents knapsack capacity, find out the maximum profit subset of profit [] such that sum of the weights of this subset is smaller than or equal to W. You cannot break an item, either pick the complete item or don't pick it (0-1 property). Consider the following table where number of items N=4 and knapsack capacity W=40	10

items	1	2	3	4
weight	10	20	30	40
profit	30	10	40	20

Illustrate least cost branch and bound strategy to solve the above problem.
(10 marks) (40,70)

3. In N queens problems we intend to place N queens on an N×N chessboard so that no two queens attack each other. A specialized version of the problem is columnized 6 queens where we place 6 queens on a 6×6 chessboard column wise. That is, first queen (Q1) can be placed on any row of 1st column, second queen (Q2) can be placed on any row of 2nd column, similarly Q3 in 3rd column, Q4 in 4th column, Q5 in 5th column and Q6 in 6th column without any attack.

Note: Queen can move diagonal, vertical or horizontal direction.

(i) Design a backtracking algorithm to solve the given problem. **(4 Marks)**

(ii) Show all the possible safe queen positions for columnized 6 queens problem. **(4 Marks)**

(iii) Analyse the time complexity of the designed algorithm. **(2 Marks)**

4. Consider the following Text 'T' and pattern 'P'

T : bacbababababacaca

P : ababaca

(i) Compute the longest prefix suffix function for the pattern P in T **(3 marks)**

(ii) Illustrate the step-by-step procedure of pattern (P) matching for the above text (T) using KMP algorithm. **(5 marks)**

(iii) Analyse the best case and worst case time complexity of KMP algorithm **(2 Marks)**

5. Consider the text T= "abccddaefg" and pattern P = "cdd". Let the alphabet size $\sum$ = 10 (i.e. Base =10). Illustrate Rabin-Karp algorithm,

i. To find the valid shift positions when you are scanning the text from left to right with modulo q=13. **(5 Marks)**

ii. Similarly, illustrate the valid shift positions when you are scanning the text from right to left without using the same modulo function. **(5 Marks)**