21BCE1646

Vishal

Vellore Institute of Technology

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

Continuous Assessment Test I - September 2022

Programme	:	B.Tech. CSE	Semester	:	Fall 2022-2023
Course	:	Data Structures and Algorithms	Code	:	BCSE202L
Faculty	:	Srinivasa Rao, Ramesh, Kavya, Manimegalai, Sangeetha, Abinaya, Suguna, Mercy, Vijayalakshmi, Rishikeshan, Muthukumaran, Pavithra	Class No	:	CH2022231001052, 1057, 1056, 1055, 1068, 1066, 1053, 1069, 1054, 1064, 1065, 1067
			Slot	:	D1+TD1
Time	:	90 minutes	Max.Marks	:	50

- **Anwer ALL Questions.**
- **Answer the Questions with your Intelligence Only.**
- **If some information is required for answering any question, assume the same.**

Q.No	sub Q.No	Question Description	Marks
1		Give asymptotic upper and lower bounds for $T(n)$ in each of the following recurrences. Assume that $T(n)$ is constant for $n \leq 2$. Make your bounds as tight as possible , and justify your answers. 1. $T(n) = \sqrt{2} \quad T(n/2) + log\, n$. (5 marks) 2. $T(n) = 0.7 \quad T(n/2) + \frac{1}{n}$. (5 marks)	10
2		Let A be a two-dimensional array of size $m \times n$. The array A have $mn - 1$ positive numbers and one negative number. Write an algorithm to identify the index of the negative number in the array A. Illustrate your algorithm for any sample input.	10

$a_n = 1 + \frac{1}{f(n-1)}$ $= 1+\frac{1}{1}$ $n=2$ $ans = 1 + \frac{1}{f(n)}$ $1+\frac{1}{1+\frac{1}{1}}$

$1+\frac{1}{f(1)}$ $1+\frac{1}{f(2)}$ $1+\frac{1}{1+\frac{1}{1}}$

if $n==1$ $\quad f(=1$ else $ans = 1 + 1/fun(n-1)$

$a_n = 1 + \frac{1}{n f(n-1, n)}$

3			A sequence is an ordered list of numbers. A sequence is defined as follows: $a_1=1+\frac{1}{1}$, $a_2=1+\cfrac{1}{1+\cfrac{1}{2}}$, $a_3=1+\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{3}}}$, $a_4=1+\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{4}}}}$, and so on. For a given a positive integer n, write a recursive algorithm to compute a_n and also compute the running time of your algorithm with justification.	10
4			Let α be an operator that denotes an inequality between two values. The operator α is typically placed between two values being compared and signifies that sum of digits of the first number is less than or equal to sum of the digits of the second number. For example, $1111\alpha 199$ is true, because $4(=1+1+1+1) \leq 19(=1+9+9)$, but $98\alpha 111$ is not true, because $17(=9+8) \leq 3(=1+1+1)$. **Alpha Sort problem**: Let S be an array of n positive integers. Sort the elements of S based on the α operator. For example,let $S=[22,1111,11,9]$. The resultant output should be $[11,22,1111,9]$ or $[11,1111,22,9]$. Write an algorithm for the Alpha Sort problem and illustrate your algorithm for any sample input.	10
5			A polynomial of degree n (in one variable, with real coefficients) is an expression of the form: $a_nx^n+a_{n-1}x^{n-1}+a_{n-2}x^{n-2}+\cdots+a_2x^2+a_1x+a_0$ where $a_n \neq 0, a_{n-1}, a_{n-2}, \cdots, a_2, a_1, a_0$ are real numbers. It is denoted by $P(x)$. For example, $P(x)=3x^4-2x^2+1$ is a polynomial of degree 4 and the value of polynomial $P(x)$ at $x=2$ is $P(2)=48-8+1=41$. **Polynomial Sort problem**: Let $S=\{P_1(x), P_2(x), \cdots, P_n(x)\}$ be a set of polynomials of different degrees. For a given constant k, sort the elements of S based on the value of polynomials at $x=k$. The values of polynomials at $x=k$ are smaller appear in the beginning and those with highest values appear at the end. For example, let $S=\{P_1(x)=1+2x, P_2(x)=200, P_3(x)=4-2x+5x^2, P_4(x)=1+4x^4\}$ and $k=2$. The resultant output should be $S=\{P_1(x), P_3(x)P_4(x), P_2(x)\}$. Write an algorithm to solve the Polynomial Sort problem and illustrate your algorithm for any sample input.	10

$4-2+5$

12