



# United International University (UIU)

Dept. of Computer Science & Engineering (CSE)

Midterm Exam Total Marks: **30** Fall-2023

Course Code: CSE2217

Course Title: Data Structure and Algorithms II

Time: 1 hour 45 minutes

**Any examinee found adopting unfair means will be expelled from the trimester / program as per UIU disciplinary rules.**

There are **Four** questions. **Answer all of them.** Show all the calculations/steps, where applicable. Figures in the right-hand margin indicate full marks.

1	<p>(a) Given an array <math>A = \{-2, 3, -1, 3, -4, 4\}</math>, find the <b>maximum-sum continuous subarray</b> using divide-and-conquer approach. You must show the recursion tree and clearly mention left, right and crossing sum for each tree node. [3]</p> <p>(b) Find out a good asymptotic upper bound on the following recurrence: <math>T(n) = 3T(n/4) + O(n^2)</math>. [2] You may use <b>Recursion-tree</b> or <b>Master method</b> to solve the recurrence.</p> <p>(c) Given an array of integers <math>A = \{1, 3, -5, 2, -3, -2\}</math>, find the <b>Maximum</b> and <b>Minimum</b> using divide-and-conquer. Show the necessary steps to support your answer. [2]</p>													
2	<p>(a) After obtaining your BSCSE degree, you embarked on an entrepreneurial journey and established your own thriving software company. You've been consistently successful in securing projects from a variety of clients, ensuring a steady flow of profits. However, suddenly a situation arises where your decision-making and leadership skills are put to the test. [4]</p> <p>You have just received <b>5 project offers</b> from different clients, but you have only <b>7 days</b> to complete the projects. Your project manager prepares the following estimates for each of the projects and presents them to you for your decision.</p> <table><tr><td><b>Net Profit (In Million Dollars)</b></td><td>200</td><td>150</td><td>100</td><td>50</td><td>300</td></tr><tr><td><b>Duration (In Days)</b></td><td>3</td><td>2</td><td>1</td><td>2</td><td>5</td></tr></table> <p>Being an adept CSE graduate, you decide to approach the problem using <b>dynamic programming</b>. Determine which of the projects can be taken to <b>maximize the net profit</b>.</p> <p><i>Note that you cannot partially complete a project. Also, you are unable to work on two projects at the same time on a particular day.</i></p> <p>(b) Both the algorithmic paradigms: Divide-and-Conquer and Dynamic Programming solve a problem by breaking it into smaller problem instances, and by solving them. What is the <b>fundamental difference</b> between these two paradigms? [2]</p>	<b>Net Profit (In Million Dollars)</b>	200	150	100	50	300	<b>Duration (In Days)</b>	3	2	1	2	5	
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	<p><b>(b)</b> What is <b>activity selection</b> problem? Is it true that the activity selection problem has one unique optimal solution? Justify your answer.</p>	<b>[1]</b>
	<p><b>(c)</b> You are given the arrival and the departure times of eight trains for a railway platform, and each one is in the format: [arrival time, departure time). Only one train can use the platform at a time. Suppose that you have got the following train-use requests for the next day.</p> <p style="text-align: center;">{ [8, 12), [6, 9), [11, 14), [2, 7), [1, 7), [12, 20), [7, 12) , [13, 19) }</p> <p>Find the <b>maximum number of trains</b> that can use the platform without any collision by using <i>earliest departure time</i>.</p>	<b>[2]</b>