**Instructions for solving this assignment.**

Dear Students.

In order to solve this assignment, you need to follow the following steps in the exact steps.

Any failures to adhere to these following rules will result In you getting an immediate **ZERO** in this entire assignment without any tolerance to breaking a single rule.

1. Each question should be solved in the same page alone.
2. For questions that have an analysis requirement you are required to do the steps and not just give the final analysis or you will get **ZERO** in the entire question.
3. For questions that requires analysis of the algorithm you write, feel free to either divide the page vertically or horizontally with a fine line.
4. This assignment will be solved in a handwritten manner, you **MUST** write your name and ID on the word using the computer, no printed solutions will be accepted, and any printed solutions will result in a total grade of **ZERO, unclear handwriting will receive an immediate ZERO**.
5. You will be required to submit this assignment on the e-learning before the deadline beneath **Lab Assignment** **2**.
   1. You MUST print the file, solve each question, scan it, add it to a word file it in the same order it was downloaded (do not include this page), the word file name must be in the following format, Fullname\_ID, and upload it.
6. You will be required to submit this assignment as a hard copy by hand anytime before the deadline either in the lab or at E248/E249 to the TA of the lab or request from any of the TA’s colleagues to leave it on their assigned desk (**make sure the papers are in a file attached together through and by using a stapler).**
7. Follow the lab instructions for solving any of the problems or you will receive an immediate **ZERO.**
8. Plagiarism will result in receiving **ZERO** and possible **deprivation** from the course.
   1. This includes copying from your colleagues, copying from ChatGPT, Claude or any external resource that can be an artificial intelligence system or a website.

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**Question 1 (Transform and Conquer)**

You are given an array that is not sorted, Consider the problem of finding the distance between the 2 furthest elements in that array, Keep in considering, **SPACE IS A CONCERN**.

Perform BigO analysis (**With Steps**)

**Question 2 (Space for Time Tradeoff)**

Create a function called insert\_into\_closed\_hash that takes an array of values called V and inserts them in an array called H, returns the H, the hash function is as follows ( (x\*7) % n ).

**Question 3 (Dynamic Programming)**

Coin Change Problem:

You are given an unlimited supply of coins of k different types and a total amount of money n.

The objective is to find out the total number of different ways to make the change for that amount using the given coin types

You will be given 2 parameters to this function, coins (containing that type of coins you have sorted in ascending order, rem (remaining change)

**Example 1:**

Types of coins: {1, 5, 10, 25, 50},

amount of money: 11

Answer**: There are 4 ways (you will return the number 4)**

1, 10

1, 5, 5

1, 1, 1, 1, 1, 1, 5

1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1

**Example 1:**

Types of coins: {1, 5, 10, 25, 50, 100, 200},

amount of money: 5

Answer**: There are 4 ways (you will return the number 4)**

5

2, 2, 1

2, 1, 1, 1

1, 1, 1, 1, 1

**You must design this algorithm using Memoization (Top Down)**

What is the big O of this algorithm? (**without any steps**)

**Answer Page for Dynamic Programming Question**