

CSE 312 Midterm 3

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I. QUESTION (GREEDY) (15 POINTS)

There are n people who need to be assigned to execute n jobs, one person per job. The cost that would occur if the i th person is assigned to j th job is given in a matrix C_{ij} . The problem is to find an assignment with the minimum total cost. Your function will return an array of person indexes which are assigned to the jobs.

```
int[] assignment(int[][] C)
```

II. QUESTION (GREEDY) (20 POINTS)

Find the shortest tour through a given set of n cities that visits each city exactly once before returning to the city where it started. Assume that there is an edge between every pair of cities and the distances between cities i and j are given by the matrix D_{ij} , return the indexes of cities in the order they are visited.

```
int[] travelingSalesman(int[][] D)
```

III. QUESTION (GREEDY) (15 POINTS)

Given n knapsack items of known weights w_1, w_2, \dots, w_n and values v_1, v_2, \dots, v_n and a knapsack of capacity W , find the most valuable subset of the items that fit into the knapsack. Your function will return the indexes of the items that will be put into the knapsack.

```
ArrayList knapsack(KnapsackItem[] items, int W)
```

IV. QUESTION (DYNAMIC PROGRAMMING) (15 POINTS)

Calculate the Stirling number of the second kind using the following formula:

$$s(n, k) = s(n-1, k-1) + (n-1)s(n-1, k)$$

```
int stirlingOfSecondKind(int n, int k)
```

V. QUESTION (DYNAMIC PROGRAMMING) (20 POINTS)

Find the maximum total sale price that can be obtained by dividing N units into integer-length subunits if the sale price of a unit of length i is given by $price_i$.

```
int maximumPrice(int[] price, int N)
```

VI. QUESTION (DYNAMIC PROGRAMMING) (15 POINTS)

You are given a text containing only characters (a, b, c, d). Your task is to find the length of the shortest subsequence of this text that will contain all four characters. For example, if the text is caabab-ddbcddbaddbbaba, then the shortest subsequence is cddba and the length is 5.

```
int shortestSubsequence(String text)
```