# Assignment-4 Part B

**(Total Points: 60)**

## Instructions:

- Download the attached python file assignment_4.py (make sure to **NOT** change the name of this file).
- Follow the instructions and **replace** all TODO comments in the scaffolding code.
- Do **NOT** change the function signature provided in the scaffolding code, but you can add as many as functions as you want to help you complete the task.
- Test your code as much as you can to make certain it is correct.
- Run flake8 in addition to testing your code; I expect professional and clear code with minimal flake8 warnings (<5) and having McCabe complexity (<10) from all of you.
- Create a write up with formatted code and screenshots of your output, running the McCabe complexity command and error free console. The code must be formatted as text and not as an image.
- Save the write-up as a PDF and submit it along with your python code (file name assignment_4.py) as separate attachments before the due date on canvas.
- Failure to follow these instructions can disrupt the grading process, and so it may result in substantial deductions to the overall score of the assignment of up to 25 points for each instruction.

**Note: Running flake 8**

flake8 path/to/your/file (for warnings and errors)
flake8 --max-complexity 10 path/to/your/file (for complexity)

## Problem 1 (Max points 20):

A numeric sequence of $a_i$ is ordered if $a_1 < a_2 < ... < a_N$. Let the subsequence of the given numeric sequence ($a_1, a_2, ..., a_N$) be any sequence ($a_{i1}, a_{i2}, ..., a_{iK}$), where $1 <= i_1 < i_2 < ... < i_K <= N$. For example, sequence (1, 7, 3, 5, 9, 4, 8) has ordered subsequences, e. g., (1, 7), (3, 4, 8) and many others. All longest ordered subsequences are of length 4, e. g., (1, 3, 5, 8).

Your program, when given the numeric sequence, must find the length of its longest ordered subsequence. The input list contains the elements of sequence - N integers in the range from 0 to 10000 each. 1 <= N <= 1000. Your output must contain a single integer that which is the length of the longest ordered subsequence of the given sequence.

## Sample Input

```
[1, 7, 3, 5, 9, 4, 8]
```

## Sample Output

```
4
```

## Problem 2 (Max points 20):

Due to recent rains (I know it’s very rare here), water has pooled in various places in the campus, which is represented by a rectangle of N x M (1 <= N <= 100; 1 <= M <= 100) squares. Each square contains either water ('#') or dry land ('-'). A pond is a connected set of one or more squares with water in them, where a square is considered adjacent to all eight of its neighbors. The problem is to figure out how many ponds have formed in the campus, given a diagram of the campus. The campus is represented by a grid represented by a list of N lines of characters separated by “,”. Each line contains M characters per line representing one row of the grid (campus). Each character is either '#' or '-'. The characters do not have spaces between them. Write a program to compute and return the number of ponds in the campus.

## Sample Input

```
["#--------##-",
 "-###-----###",
 "----##---##-",
 "---------##-",
 "---------#--",
 "--#------#--",
 "-#-#-----##-",
 "#-#-#-----#-",
 "-#-#------#-",
 "--#-------#-"]
```

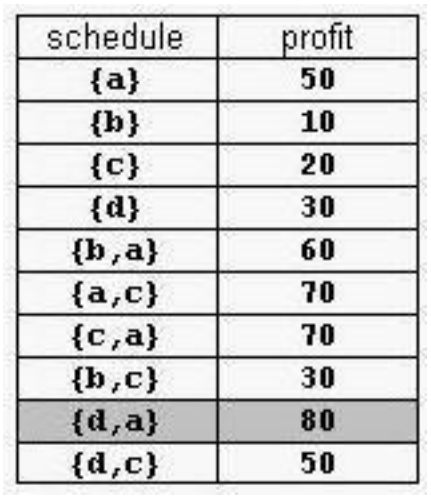
## Sample Output

```
3
```

(There are three ponds: one in the upper left, one in the lower left, and one along the right side)

## Problem 3 (Max points 20):

A supermarket has a set ‘Prod’ of products on sale. It earns a profit px for each product x∈Prod sold by a deadline dx that is measured as an integral number of time units starting from the moment the sale begins. Each product takes precisely one unit of time for being sold. A selling schedule is an ordered subset of products Sell ≤ Prod such that the selling of each product x∈ Sell, according to the ordering of Sell, completes before the deadline dx or just when dx expires. The profit of the selling schedule is Profit(Sell)=$\Sigma_{x \in Sell}$px. An optimal selling schedule is a schedule with a maximum profit.
For example, consider the products Prod={a,b,c,d} with (pa,da)=(50,2), (pb,db)=(10,1), (pc,dc)=(20,2), and (pd,dd)=(30,1). The possible selling schedules are listed in table 1. For instance, the schedule Sell={d,a} shows that the selling of product d starts at time 0 and ends at time 1, while the selling of product a starts at time 1 and ends at time 2. Each of these products is sold by its deadline. Sell is the optimal schedule and its profit is 80.



| schedule | profit |
|---|---|
| {a} | 50 |
| {b} | 10 |
| {c} | 20 |
| {d} | 30 |
| {b,a} | 60 |
| {a,c} | 70 |
| {c,a} | 70 |
| {b,c} | 30 |
| {d,a} | 80 |
| {d,c} | 50 |

Write a program that reads sets of products from the input and computes the profit of an optimal selling schedule for each set of products. Your input must be a list of n pairs (pi, di) of integers, that designate the profit and the selling deadline of the i-th product. Note: 0 < n < 100, 1 <= pi <= 1000 and 1 <= di <= 1000. For output, the program returns the profit of an optimal selling schedule for the set.

## Sample Input 1

```
[(50, 2), (10, 1), (20, 2), (30, 1)]
```

## Sample Output

```
80
```

## Sample Input 2

```
[(20, 1), (2, 1), (10, 3), (100, 2), (8, 2), (5,
20), (50, 10)]
```

## Sample Output 2

```
185
```

## Note

The sample input contains two product sets. The first set encodes the products from table 1. The second set is for 7 products. The profit of an optimal schedule for these products is 185.