Islamic University of Technology (IUT)

Organization of Islamic Cooperation (OIC)

Department of Electrical and Electronic Engineering (EEE)

EEE 4416: Simulation Lab

Lab – 10 Assignment

You might find a few problems difficult in this last week. Solve any 8 problems for the assignment.

1. Write a function **'jump_search (arr, val)'** to check whether an element (val) exists in an array (arr) or not using the 'jump search' algorithm. Return its index as well.
2. Write a function **'manual_sort(arr)'** to implement any of the sorting algorithms other than bubble sort.
3. Write a function **'job_seq'** to solve the job sequencing problem discussed in the lab manual of week 10 using the greedy algorithm.

Exercise – 04*

Problem statement: Balanced parentheses

Write a function called **'balance'** to find if the given parentheses expression is balanced. For example,

```
>> balance('(()()())')
   1

>> balance('(()()())(')
   0

>> balance('((()))()())')
   0

>> balance('((((()))(((())))')
   1

>> balance('(()()()(((()))()()(((((())))))')
   1

>> balance('(()()(((((((((((((()))))')
   0
```

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Exercise - 05

Find the number of leaps you need to take to find the '**first occurrence**' of an element in an array using **the jump search** algorithm. For example,

a=[2,5,6,9,12,15,15,16,17,19,31]

To find 16 with a jump step of 3, you follow: 2 -> 9 -> 15 -> 19 -> 17 -> 16

So, the total number of jumps = 5

n.b. to go forward, you take an n-step jump; to go backwards, you jump only one step back.

- In this problem, you will have repetition of numbers. You need to find the index of the first occurrence.
- The array is always sorted. But you need to look out and go backward even after finding the element to ensure it is the first occurrence.
- If the jump step is larger than the array size, u directly go to the last element of the array.

Test case – 01:

- a=[1,5,9,14,17,18,23,33,36,38];
- x=38;
- n=2;
- y_correct = 5

Test case – 02:

- a=[5, 10, 10, 10, 25, 30, 35, 35, 55, 65, 100, 600, 4000, 10000, 10000, 30000, 30000, 48000]
- x=30
- n=2
- y_correct = 4

Test case – 03:

- a=[2,5,6,9,12,14,15,16,17,19,31]
- x=2
- n=5
- y_correct = 0

Test case – 04:

- a=[5, 10, 10, 10, 25, 30, 35, 35, 55, 65, 100, 600, 4000, 10000, 10000, 30000, 30000, 48000]
- x=10000
- n=4
- y_correct = 7

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Exercise – 06

Write a function to dump the extra zeros located to the south-east of the matrix. For example:

```
a1 = [1 2 0;
      0 3 0;
      0 0 0];
```

I want to get a new matrix, that is:

```
b1 = [1 2;
      0 3];
```

Another example:

```
a2 = [1 2 0 4 0;
      2 3 0 5 0;
      3 4 0 6 0;
      1 0 0 0 0];


b2 = [1 2 0 4;
      2 3 0 5;
      3 4 0 6;
      1 0 0 0];
```

Test Case:

- Input: [1 1 0 0 0
  1 0 0 0 0
  0 0 0 3 0
  0 0 0 0 0
  0 0 0 0 0]
- Output: [1 1 0 0
  1 0 0 0
  0 0 0 3]

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Exercise – 07**

A rod of length n can be cut into different sizes. Different prices are associated with different lengths of cuts.

- length, len= [1, 2, 3, 4, 5, 6, 7, 8]
- price, p = [1, 5, 8, 9,10,17,17,20]

Here, if you cut a piece of length 5, the price for that piece is 10. For a length of 8, the price is 20.

Say, you have to obtain a rod of length x. **By cutting the rod in which way will give you the maximum price?**

For instance, say x=4.

You can cut the rod into pieces like (1,3)/(3,1), (2,2), (1,1,1,1), (1,1,2)/(1,2,1)/... or (4).

The maximum revenue that you can get here is when you cut the rod into (2,2) pieces to get length x => 5+5=10.

For (1,3)=>9; (1,1,1,1)=> 4; (1,1,2)=>7, (4)=>9.

In this problem, you have to return the maximum revenue you can obtain by cutting the rod of size x.

Test case – 01:

- p=[1,5,8,9,10,17,17,20]
- x=8
- y_correct = 22

Test case – 02:

- p=[1,5,8,9,10,17,17,20]
- x=7
- y_correct = 18

Test case – 03:

- p=[10,5,3,18]
- x=2
- y_correct = 20

Test case – 04:

- p=[10,5,36,18,36]
- x=5
- y_correct = 56

* You will need Dynamic Programming to solve this problem.

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Exercise – 08

Solve the following problem in the given link:

https://www.mathworks.com/matlabcentral/cody/problems/45425-the-tortoise-and-the-hare-01

Exercise – 9*

Solve the following problem in the given link:

https://www.mathworks.com/matlabcentral/cody/problems/45416-don-t-be-greedy

Exercise – 10*

Write a function **'euler_11'** solving problem 11 of Project Euler (https://projecteuler.net/problem=11)

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