UNIVERSITY OF KWAZULU-NATAL

COMP102: Compute Programming

Test 2

Thursday, 15 September 2022

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Time Allocated:	90 minutes
Total Marks:	50

Question 1: 1D Array Set or Bag [15 marks]

In mathematics, a **set** is defined as a collection of elements that contains no duplicates. In contrast, a **bag** is a collection of elements which can contain a duplicate.

Write a program that will determine whether an integer 1D array is a **set** or **bag**. The program should check whether any of the elements are repeated in the array. Your program should work for an array of any length.

Given the array `[1, 0, 5, 2, 4, 4]`, your program should output:

```
The array is a bag.
```

Given the array `[1, 0, 5, 2, 4, 10, 8, 12, 6]`, your program should output:

```
The array is a set.
```

Question 2: Major or Minor Diagonal [20 marks]

	0	1	2	3
0	4	1	5	5
1	1	8	7	6
2	5	4	10	11
3	5	2	6	10

Figure 1: 4-by-4 2D array showing major diagonal with red background and minor diagonal with green background paint.

Consider Figure 1 above. The **major diagonal** of a matrix is defined as diagonal going from the top left-hand corner to the bottom right-hand corner of the square matrix (cells with **red** background). The **minor diagonal** is defined as the diagonal

going from the top-right hand corner to the bottom left-hand corner (cells with **green** background).

Write a method that receives an integer 2D array and determines whether the **sum of the values** in the major diagonal is greater than the sum of the values in the minor diagonal. This method will return no values, but simply display an appropriate message on the console.

For example, for the 2D array shown in Figure 1, the sum of the major diagonal is 32. The sum of the minor diagonal is 21. Therefore, the output would read:

```
Sum of major diagonal > sum of minor diagonal.
```

NB: Do not be tempted to hard-code the indices on the minor diagonal. Your method needs to be able to work for a square matrix of any size.

Question 3: Doubloons [15 marks]

A string is said to be a doubloon if every letter that appears in the string appears exactly twice. For example, the following strings are all doubloons:

```
abba, anna, arraigning, beriberi, bilabial, boob, caucasus,
coco, dada, deed, emmett, hannah, horseshoer, intestines,
isis, mama, mimi, murmur, noon, otto, papa, peep, reappear,
redder, sees, shanghaiings, toto
```

Write a method that accepts a string and determines whether it is a doubloon or not. The method should return a value of **true** if it is, and **false** otherwise. In the main method, prompt the user to enter a string and use your method to determine whether it is a doubloon. For example, for the string `abba`, `reappear` and `Sibonelo`, your program should output:

```
abba is a doubloon
reappear is a doubloon
sibonelo is not a doubloon
```

NB: You need to transform the string a user enters into lowercase.

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