BT3051: Data Structures and Algorithms (Jul-Nov 2019)

Test 0

31st July 2019

Note: Answers can be in Python code/C code/pseudocode, only the algorithms will be evaluated. Assume all indices start from 0.

Instructions: This is a *diagnostic* test. The sole purpose of this test is to assess the level of the class and the strengths and weaknesses, which will help in better structuring the course. Some questions are meant to be unreasonably tough. You are expected to attempt all questions.

1. (4 marks) Given a string of length not more than 100, output 2 strings of length x starting from position y and length w starting from position z, separated by a comma and a space.
e.g. Input: `WhyAreWeWritingATestOnTheSecondDayOfTheSemester x=7, y=8, w=6, z=25.`
Output: `Writing, Second.`

2. (4 marks) Given a positive integer N,
a) print squares of all the even numbers from 1 to N and cubes of all the odd numbers,
b) print the sums of squares and cubes.
e.g. N=5
Output:

```
1
4
27
16
125
20
153
```

3. What will be the output for the following piece of code?

```
elements=[0,1]
def Sequence(n):
    if n<0:
        print("Please enter a positive integer")
    elif n<=len(elements):
        return elements[n-1]
    else:
        temp = Sequence(n-1)+Sequence(n-2)
        elements.append(temp)
        print(temp)
        return temp

Sequence(7)
```

4. Consider a class Ecoli defined as follows:

```
class Ecoli:
    def __init__ (self, ATP, glucose):
        """Create a new Ecoli instance.
        ATP: the ATP maintenance requirement
        glucose: the glucose uptake rate"""

        self._ATP = ATP
        self._glucose = glucose

    def get_ATP(self):
        """Return value of ATP maintenance requirement"""

        return self._ATP

    def get_glucose(self):
        """Return the value of the glucose uptake rate"""
        return self._glucose
```

Write a function CheckConditions to perform the following: For a given instance of the class, if the value of the ATP maintenance requirement is equal to 8.39 and the value of the glucose uptake rate is 10, print "Optimal conditions for growth". Else, set the value of the ATP and glucose attributes to 8.39 & 10 respectively.

5. Give the output for the following code: *(range(i,j) runs from i to j-1)*

```
for i in range(1,4):
    for j in range(1,6):
       k=i*j
       print (k, end=' ')
    print()
```

6. **Stacks and Queues** are abstract data types that serve as a collection of elements.
In a stack, the order in which elements come off is LIFO (last in, first out)
In a queue, the order in which elements come off is FIFO (first in, first out)
Which of these 2 scenarios uses stacks and which uses queues?
a) The back button in a web browser.
b) The current format for course registration.

7. Write a program to perform the addition of two matrices with m rows and n columns.

8. Write an algorithm to find the maximum sum of 2 integers from a given array of integers.

9. Write a piece of code to reverse an array of numbers.

10. Given an mRNA of arbitrary length as input, print the first 10 codons present in the mRNA.