University of Cape Town ~~ Department of Computer Science

Computer Science 1015F ~~ 2017

Class Test 3

***** Solutions *****

Enter the following details AND shade in the corresponding blocks to the right with your Student Number.

Faculty (please tick one):

Science	Engineering	Commerce	Humanities	Other:

Student Number :

____

Name (optional) :

____

Marks : 40

Time : 40 minutes

Instructions:

a) Answer all questions.

b) Write your answers in PEN in the spaces provided.

c) Show all calculations where applicable.

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

0 1 2 3 4 5 6 7 8 9

FOR OFFICIAL USE ONLY:

Question	1	2	3	4	5	6	7	8
Max	23	17						
Marks 0 1 2 3 4 5 6 7 8 9								
Marker								

Question 1 – Arrays and Recursion [23]

Examine the `Q1.py` module listed at the end of the test and answer the following questions.

(i) Write down the **exact output** produced when the `Q1.py`. module is executed. [7]

['b', 'a', 't'] #[1]
['b', 'aa', 'ttt'] #[2]
[[0, 0, 0], [0, 0, 0]][2]
[[0, 0, 0, 0, 0, 0]][2]

(ii) Write Python code for the function `mirror(arr1D)` in the `Q1.py` module that alters `arr1D` as follows. This function changes `arr1D` to be twice its original length, where the additional elements added are a reflection of the original list. For example, in the Python interpreter, it would behave as follows.

```
>>> X=[1,2,3]
>>> mirror(X)
>>> print(X)
[1, 2, 3, 3, 2, 1]
```

[5]

```
def mirror(arr1D):
  for i in range(len(arr1D)-1,-1,-1):  #2
      arr1D.append(arr1D[i])    #2

#no return! #1
```

(iii) The function `boss(arr1D)` in the `Q1.py` module function is recursive. What is the recursive stopping case for this function? [1]

len(arr1D)==1
OR "when the list/array has one element in it".

(iv) Explain clearly, briefly and in general what the `boss(arr1D)` function does. [1]

It outputs the maximum value in the list/arr given as input.

(v) Write down the exact output when the function `boss(arr1D)` in the `Q1.py` module is called as follows in the Python interpreter. [2]

```
import Q1.py
print(Q1.boss([40,10,56,15]))
```

56

(vi) Explain, with reasons, what will happen if the function `boss(arr1D)` in the `Q1.py` module is called as follows in the Python interpreter. [2]

```
import Q1.py
Q1.boss([])
```

Infinite recursion and/or RuntimeError [1] because the stopping case is never reached[1].

(vii) Now write a **recursive version** of the function `tot(numbersL)` that has the same output as the iterative version on all inputs. You can assume that only non-empty 1D lists of integers will be sent to the function. [5]

```
def totRec(numbersL):
    """Returns the sum of the elements in a list of numbers"""
```

```
def totRec(numbersL):
    """Returns the sum of the elements in a list of numbers"""
    if len(numbersL)==1:    #1
        return numbersL[0]   #1
    else: return numbersL[0]+totRec(numbersL[1:])  #3
```

Note: ***zero marks if recursive call missing!!***

Question 2 – Dictionaries and Files [17]

Examine the `Q2.py` module listed at the end of the test and answer the following questions.

(i) Explain what happens if this program is executed and a file called "`input.txt`" does not exist in the current directory. [2]

The program crashes with a IOError

(ii) Explain what happens if this program is executed and a file called "`output.txt`" does not exist in the current directory. [2]

The file is created in the current directory

(iii)The file "`input.txt`" contains the following lines of text.

```
hamburger 3
coke 1
hamburger 2
chips 5
coke 3
```

Write down the exact contents of the file "`output.txt`" after the program has executed. [4]

```
chips 5

coke 4

hamburger 5

#2 marks for correct words on correct lines, #2 marks for correct
values
```

(iv) Write a function `FlipFile(filename)` that reverses the contents of a file. For example, `FlipFile("input.txt")` would change the contents of "`input.txt`" to the the following lines of text.

```
coke 3
chips 5
hamburger 2
coke 1
hamburger 3
```

[9]

def FlipFile(filename):

```
    file1=open(filename,'r')  #1

    allData=file1.readlines() #1

    file1.close()   #1

    file1=open(filename,'w') #1

    for i in range(len(allData)-1,-1,-1): #2

        print(allData[i],file=file1,end='') #2 – if end='' not there, ignore

    file1.close() #1

# or equivalent correct answer with list slicing to reverse etc.
```

Code examples for the test – you may detach this sheet.

Question 1

```
#Module Q1.py
def tot(numbersL):
    """Returns the sum of the elements in a list of
numbers"""
    sum=0
    for n in numbersL: sum+=n
    return sum

def amplify(arr1, arr2):
    if len(arr1)!=len(arr2): return
    for i in range(len(arr1)):
        arr1[i]*=arr2[i]

def create(rows, cols):
    arr2D=[]
    for i in range(rows):
        arr2D.append([])
        for j in range(cols):
            arr2D[i].append(0)
    return arr2D

def boss(arr1D):
    if len(arr1D)==1:return arr1D[0]
    val=boss(arr1D[1:])
    if val>arr1D[0]: return val
    return arr1D[0]

def mirror(arr1D):
    #Code missing here


chars=['b','a','t']
X=[1,2,3]
print(chars)
amplify(chars,X)
print(chars)
print(create(2,3))
print(create(X[0],tot(X)))
```

Question 2

```
#Module Q2.py

file1=open("input.txt",'r')

weights={}
for line in file1:
    values=line.split()
    word,number=values[0],eval(values[1])
    if word!='':
        if word not in weights:
            weights[word]=number
        else:
            weights[word]=weights[word]+number
file1.close()

file2=open("output.txt",'w')

for w in weights:
    print(w,weights[w],file=file2)

file2.close()
```