

FINAL EXAM, VERSION 3  
CSci 127: Introduction to Computer Science  
Hunter College, City University of New York

22 May 2018

**Answer Key:**

1. (a) What will the following Python code print:

i. 

```
a = "one+two+three+four+five+six"
print(a.count("+"))
```

**Answer Key:**

5

ii. 

```
b = a.split("+")
print(b[0])
```

**Answer Key:**

one

iii. 

```
num = b[-1].upper()
print(num)
```

**Answer Key:**

SIX

iv. 

```
for c in num:
    print(c.lower())
```

**Answer Key:**

s  
i  
x

(b) Consider the following shell commands:

```
$ ls  
nyc.txt  p50.py  p51.py  p52.py
```

- i. What is the output for:  
\$ ls \*.py

**Answer Key:**

p50.py p51.py p52.py

- ii. What is the output for:  
\$ ls \*.py | wc -l

**Answer Key:**

3

- iii. What is the output for:  
\$ mkdir programs  
\$ mv \*.py programs  
\$ ls | wc -l

**Answer Key:**

2

2. (a) After executing the Python code, write the name of the turtle:

i. which is purple:

**Answer Key:**

savannah

ii. which is pink:

```
import turtle
turtle.colormode(255)
```

**Answer Key:**

```
brian = turtle.Turtle()
brian.color(255,0,0)
savannah = turtle.Turtle()
savannah.color(1.0,0.0,1.0)
calvin = turtle.Turtle()
calvin.color("#DDDDDD")
olga = turtle.Turtle()
olga.color("#BB0000")
```

olga

iii. which is red:

**Answer Key:**

brian

iv. which is gray:

**Answer Key:**

calvin

(b) Write the Python code for the following algorithm:

```
function decodeMessage(numberList)
    Create an empty message
    For each number in the list of numberList
        code = 65 + ((number + 1) modulo 26)
        Convert the code to the corresponding Unicode character
        Concatenate the character to the beginning of the message
    Return the message
```

**Answer Key:**

#Shift message right by 1 and make upper case:

```
def decodeMessage(numberList):
    mess = ""
    for number in numbers:
        code = 65 + ((numberList + 1)%26)
        ch = chr(code)
```

```

    mess = mess + ch
    return(mess)

```

3. (a) What is the value (True/False):

```
in1 = True
```

i. `in2 = True`

```
out = in1 and in2
```

**Answer Key:**

```
out = True
```

```
in1 = True
```

ii. `in2 = True`

```
out = not in1 or (in2 and not in1)
```

**Answer Key:**

```
out = False
```

```
in1 = False
```

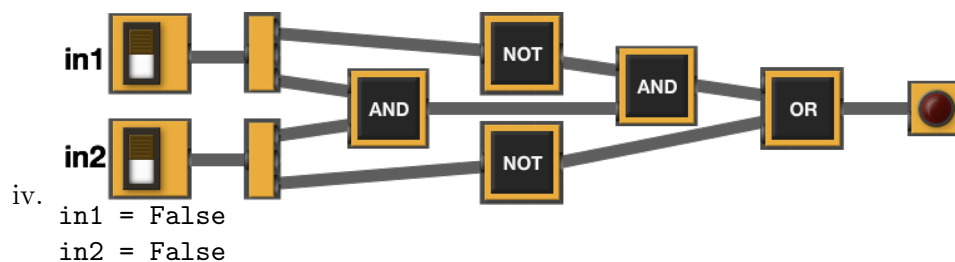
```
in2 = True or not in1
```

iii. `in3 = in1 and in2`

```
out = in1 and not in3
```

**Answer Key:**

```
out = False
```

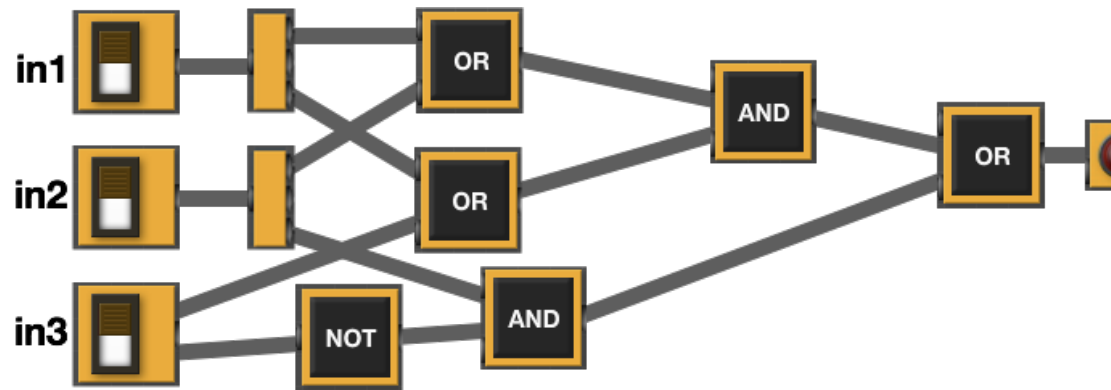


**Answer Key:**

```
out = True
```

(b) Design a circuit that implements the logical expression:

```
((in1 or in2) and (in1 or in3)) and (in2 or not in3)
```



Answer Key:

4. (a) Draw the output for the function calls:

i. `ramble(tess,0)`

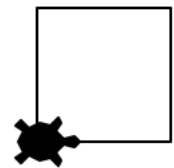
```
import turtle
tess = turtle.Turtle()
tess.shape("turtle")

def ramble(t,side):
    if side == 0:
        t.stamp()
    else:
        for i in range(side):
            t.forward(50)
            t.left(360/side)
```



Answer Key:

ii. `ramble(tess,4)`



Answer Key:

- (b) For the following code:

```
def v3(panda, lily):
    if panda + lily > 10:
        return lily
    else:
        return -1

def start():
    xiaojie = 5
    karoline = 11
    nicky = v3(xiaojie,karoline)
    return nicky
```

- i. What are the formal parameters for `v3()`:

Answer Key: panda, lily

ii. What are the formal parameters for `start()`:

**Answer Key:** None

iii. What does `start()` return:

**Answer Key:** 11

5. Write a **complete Python program** that asks the user for numbers (separated by spaces) and prints how many end in 0.

For example:

- If the user entered: 101 15 50 640
- Your program should print: 2

**Answer Key:**

```
#Counting numbers ending in 0
```

```
numbers = input('Enter numbers: ')
num = numbers.count('0 ')
if numbers[-1] == '0':
    num = num+1
print("Number of numbers ending in 0 is", num)
```

6. Write a **complete Python program** that asks the user for the name of a .png (image) file and displays the lower right quarter of the image.

For example if the image is `hunterLogo.png` (left), the displayed image would be (right):



**Answer Key:**

```
#Name:  CSci 127 Teaching Staff
#Date:  Fall 2017
#This program loads an image, displays it, and then creates and displays
#      a new image that is only the lower right corner.

#Import the packages for images and arrays:
import matplotlib.pyplot as plt
```

```
import numpy as np

inF = input('Enter file name: ')
img = plt.imread(inF)    #Read in image from inF

height = img.shape[0]    #Get height
width = img.shape[1]     #Get width
print(height,width)

img2 = img[height/2:, width/2:]    #Crop to lower right corner

plt.imshow(img2)          #Load our new image into pyplot
plt.show()                #Show the image (waits until closed to continue)
```

7. Fill in the following functions that creates a graph of the fraction of population over time:

- `getData()`: asks the user for the name of the CSV and returns a DataFrame of the contents,
- `makeFraction()`: creates a column of the fraction of the two columns, and
- `makeGraph()`: makes a plot of the x versus y columns specified.

**Answer Key:**

```
import pandas as pd
import matplotlib.pyplot as plt

def getData():
    """
    Asks the user for the name of the CSV. Returns a DataFrame of the contents.
    """
    fName = input('Enter current latitude: ')
    df = pd.read_csv(fName)
    return(df)

def makeFraction(df,top,total,frac):
    """
    Makes a new column, frac, of df that is df[top]/df[total]
    Returns the DataFrame, df
    """
    df[frac] = df[top]/df[total]
    return df

def makeGraph(df,xCol,yCol):
    """
    Makes a pyplot plot of x versus y column in DataFrame df
    """
    df.plot(x = xCol, y = yCol)
```

8. (a) What are the values of register, \$s0 for the run of this MIPS program:

```
#Sample program that loops from 20 down to 5
ADDI $s0, $zero, 20 #set s0 to 20
ADDI $s1, $zero, 5  #use to decrement counter, $s0
ADDI $s2, $zero, 5  #use to compare for branching
AGAIN: SUB $s0, $s0, $s1
BEQ $s0, $s2, DONE
J AGAIN
DONE:  #To break out of the loop
```

**Values of \$s0:**

**Answer Key:**

20  
15  
10  
5

- (b) Write a MIPS program where the register, \$s0 loops through the values: 3,6,9,12

**Answer Key:**

```
#Program that loops from 3 up to 12, by threes
ADDI $s0, $zero, 3  #set s0 to 2
ADDI $s1, $zero, 3  #use to increment counter, s0
ADDI $s2, $zero, 12 #set s2 to use for comparison
AGAIN: ADD $s0, $s0, $s1
BEQ $s0, $s2, DONE
J AGAIN
DONE:  #To break out of the loop
```

9. What is the output of the following C++ programs?

```
//Walt Whitman
#include <iostream>
using namespace std;
int main()
(a) {
    cout << "I exist as\nI am,";
    cout << "\nthat is enough" << endl;
    cout << "--W. Whitman";
}
```

**Answer Key:**

I exist as  
I am,



```

that is enough.
--W. Whitman
//Greetings!
#include <iostream>
using namespace std;
int main()
{
    cout << "Begin" << endl;
    int x = 2;
(b) while (x > 0) {
        cout << "Again\n";
        x--;
    }
    cout << "End"
}

```

**Answer Key:**

```

Begin
Again
Again
End
//Pluses and minuses
#include <iostream>
using namespace std;
int main()
{
    int i, j;
    for (i = -2; i < 2; i++)
(c) {
        for (j = 0; j < 3; j++)
            if (i < 0)
                cout << "+";
            else
                cout << "-";
        cout << endl;
    }
}

```

**Answer Key:**

```

---
---
+++
+++

```

10. (a) Write a **complete Python program** that asks the user for their graduation year. If they enter a number before 1920, the program continues to ask for their graduation year. The

program then prints the year that was entered.

**Answer Key:**

#Input checking:

```
year = int(input('Enter your graduation year: '))
while year < 1920:
    year = int(input('Enter your graduation year: '))
print("You entered:", year)
```

- (b) Write a **complete C++ program** that prints the change in population of the the United States:

$$p = p + Bp - Dp$$

where  $p$  is the population,  $B$  is the birth rate of 12.4 births for every 1000 people ( $\frac{12.4}{1000}$ ) each year, and  $D$  is the death rate of 8.4 for every 1000 people ( $\frac{8.4}{1000}$ ). In 2017, the population of United States was 325.7 million. Your program should print expected population over the 10 years from 2017 to 2026. Each line should have: the year and the population (in millions).

**Answer Key:**

```
//NY State Population Growth
#include <iostream>
using namespace std;
int main()
{
    float p = 325.7;
    int year;
    cout << "Year\tPopulation (in Millions)\n";
    for (year = 2017; year < 2027; year++) {
        cout << year << "\t" << p << "\n";
        p = p + p*(12.4/1000) - p*(8.4/1000);
    }
    return 0;
}
```