

FINAL EXAM, VERSION 2
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 = "Mon*Tue*Wed*Thu*Fri"
print(a.count("*"))
```

Answer Key:

4

ii.

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

Answer Key:

Mon

iii.

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

Answer Key:

FRI

iv.

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

Answer Key:

f
r
i

(b) Consider the following shell commands:

```
$ ls
nyc.csv  p40.py  p41.py  trees.csv
```

i. What is the output for:
`$ ls *.csv`

Answer Key:

`nyc.csv trees.csv`

ii. What is the output for:
`$ ls *.csv | wc -l`

Answer Key:

2

iii. What is the output for:
`$ mkdir data`
`$ mv *.csv data`
`$ ls | wc -l`

Answer Key:

3

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

i. which is purple:

Answer Key:

jimmy

ii. which is pink:

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

Answer Key:

```
basak = turtle.Turtle()
basak.color(0,0,255)
jimmy = turtle.Turtle()
jimmy.color(1.0,0.0,1.0)
katherine = turtle.Turtle()
katherine.color("#CCCCCC")
jiaxing = turtle.Turtle()
jiaxing.color("#990000")
```

jiaxing

iii. which is blue:

Answer Key:

basak

iv. which is gray:

Answer Key:

katherine

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

```
function decodeMessage(numberList, k)
    Create an empty message
    For each number in the list, numberList
        code = 97 + ((number + k) 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 by k and make lower case message:

```
def decodeMessage(numberList, k):
    mess = ""
    for number in numberList:
        code = 97 + ((number + k)%26)
        ch = chr(code)
```

```

    mess = mess + ch
    return(mess)

```

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

```
in1 = False
```

i. `in2 = True`

```
out = in1 or in2
```

Answer Key:

```
out = True
```

```
in1 = True
```

ii. `in2 = True`

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

Answer Key:

```
out = True
```

```
in1 = False
```

```
in2 = True and not in1
```

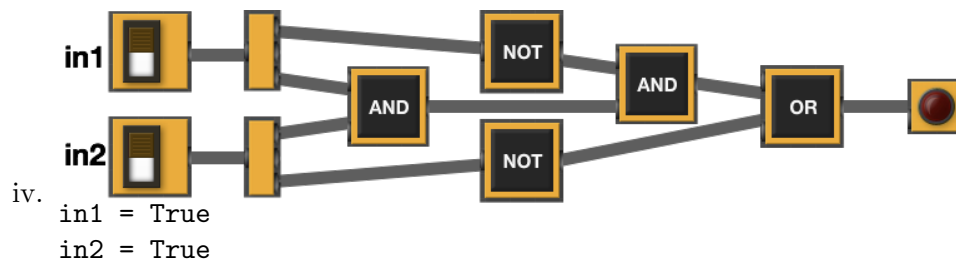
iii.

```
in3 = in1 or in2
```

```
out = in1 or not in3
```

Answer Key:

```
out = True
```



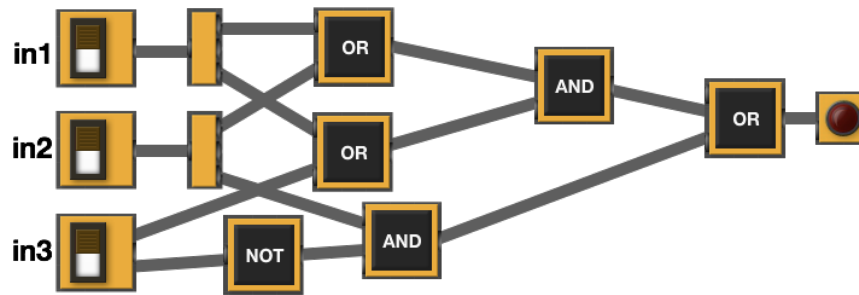
Answer Key:

```
out = False
```

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

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

Answer Key:



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

i. `ramble(tess,0)`

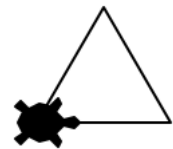
```
import turtle
tess = turtle.Turtle()
tess.shape("turtle")

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,3)`



Answer Key:

- (b) For the following code:

```
def v2(jaime, lily):
    if jaime + lily > 10:
        return lily
    else:
        return -1
```

```
def start():
    gwenaël = 8
    karen = 10
    katherineH = v2(gwenaël,karen)
    return katherineH
```

- i. What are the formal parameters for `v2()`:

Answer Key: `jaime, lily`

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

Answer Key: None

iii. What does `start()` return:

Answer Key: 10

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

For example:

- If the user entered: 101 15 50 645
- Your program should print: 2

Answer Key:

```
#Counting numbers ending in 5
```

```
numbers = input('Enter numbers: ')
num = numbers.count('5 ')
if numbers[-1] == '5':
    num = num+1
print("Number of numbers ending in 5 is", num)
```

6. Write a **complete Python program** that asks the user for the name of a .png (image) file and displays the upper left 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 upper left 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 upper left 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 scatter 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.scatter(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 25 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:

```
25
20
15
10
5
```

(b) Write a MIPS program where the register, \$s0 loops through the values: 4,6,8,10

Answer Key:

```
#Program that loops from 4 up to 10, by twos
ADDI $s0, $zero, 4  #set s0 to 2
ADDI $s1, $zero, 2  #use to increment counter, s0
ADDI $s2, $zero, 10 #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 << "Simplicity";
      cout << "is the glory\nof ";
      cout << "expression." << endl;
      cout << "--W. Whitman" << endl;
}
```

Answer Key:

Simplicity is the glory


```

of expression.
--W. Whitman
//Greetings!
#include <iostream>
using namespace std;
int main()
{
    cout << "Hi" << endl;
    int x = 2;
(b) while (x > 0) {
        cout << "Again\n";
        x--;
    }
    cout << "Bye"
}

```

Answer Key:

```

Hi
Again
Again
Bye
//Pluses and minuses
#include <iostream>
using namespace std;
int main()
{
    int i, j;
    for (i = 0; i < 4; i++)
(c) {
        for (j = -2; j < 3; j++)
            if (j < 0)
                cout << "+";
            else
                cout << "-";
        cout << endl;
    }
}

```

Answer Key:

```

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

```

10. (a) Write a **complete Python program** that asks the user for the year they were born. If

they enter a number before 1900, the program continues to ask for the year they were born. The program then prints the year that was entered.

Answer Key:

#Input checking:

```
year = int(input('Enter year you were born: '))
while year < 1900:
    year = int(input('Enter year born: '))
print("You entered:", year)
```

- (b) Write a **complete C++ program** that prints the change in population of the state of New York:

$$p = p + Bp - Dp$$

where p is the population, B is the birth rate of 12 births for every 1000 people ($\frac{12}{1000}$) each year, and D is the death rate of 7.8 for every 1000 people ($\frac{7.8}{1000}$). In 2017, the population of New York State was 19.85 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 = 19.85;
    int year;
    cout << "Year\tPopulation (in Millions)\n";
    for (year = 2017; year < 2027; year++) {
        cout << year << "\t" << p << "\n";
        p = p + p*(12/1000) - p*(7.8/1000);
    }
    return 0;
}
```