Final Exam, Version 1
CSci 127: Introduction to Computer Science
Hunter College, City University of New York

17 May 2018

Answer Key:

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

    i.
    ```
    a = "Jan&Feb&Mar&Apr&May&Jun"
    print(a.count("&"))
    ```

    Answer Key:
    ```
    5
    ```

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

    Answer Key:
    ```
    Jan
    ```

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

    Answer Key:
    ```
    JUN
    ```

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

    Answer Key:

```
        j
        u
        n
```

(b) Consider the following shell commands:

```
$ ls -l
-rw-r--r--@ 1 stjohn  staff      5308 Mar 21 14:38 quizzes.html
-rw-r--r--  1 stjohn  staff     54013 Apr 20 18:57 zoneDist.csv
-rw-r--r--@ 1 stjohn  staff      1519 Apr 22 15:14 zoneMap.py
-rw-r--r--  1 stjohn  staff  16455174 Mar 20 19:02 zoning2.html
-rw-r--r--  1 stjohn  staff  17343896 Mar 20 18:58 zoningIDS.json
```

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

   Answer Key:

   `quizzes.html`

  ii. What is the output for:
```
$ ls -l | grep "Apr"
```

   Answer Key:
```
-rw-r--r--  1 stjohn  staff     54013 Apr 20 18:57 zoneDist.csv
-rw-r--r--@ 1 stjohn  staff      1519 Apr 22 15:14 zoneMap.py
```

 iii. What is the output for:
```
$ ls -l | grep "Apr" | wc -l
```

   Answer Key:
   2

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

i. which is blue:

Answer Key:

```
silvena
```

ii. which is pink:

```
import turtle
turtle.colormode(255)

lily = turtle.Turtle()
lily.color(0,255,0)
silvena = turtle.Turtle()
silvena.color(0,0,1.0)
alvin = turtle.Turtle()
alvin.color("#BBBBBB")
jesse = turtle.Turtle()
jesse.color("#AA0000")
```

Answer Key:

```
jesse
```

iii. which is green:

Answer Key:

```
lily
```

iv. which is gray:

Answer Key:

```
alvin
```

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

```
Ask user for input, and store in the string, octString.
Set decNum = 0.
For each c in octString,
    Set n to be int(c)
    Multiple decNum by 8 and add n to it
Print decNum
```

Answer Key:

```
#octal to decimal
octString = input('Enter num: ')
decNum =0
for c in octString:
    n = int(c)
    decNum = decNum * 8 + n
print(decNum)
```

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

      i.
```
in1 = True
in2 = False
out = in1 and in2
```

      Answer Key:

```
out = False
```

      ii.
```
in1 = False
in2 = True
out = not in1 and (in2 or not in1)
```

      Answer Key:

```
out = True
```

      iii.
```
in1 = True
in2 = False or not in1
in3 = in1 and in2
out = in1 or not in3
```

      Answer Key:

```
out = True
```
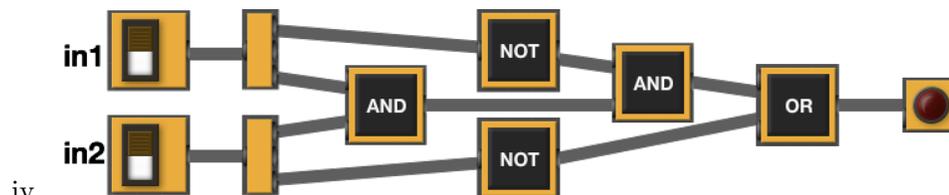
      iv.


```
in1 = False
in2 = False
```

      Answer Key:

```
out = True
```

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

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

```
circuitS18V1b.png
```
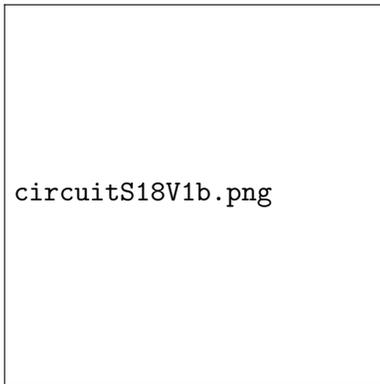
Answer Key:

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

i. `ramble(tess,0)`
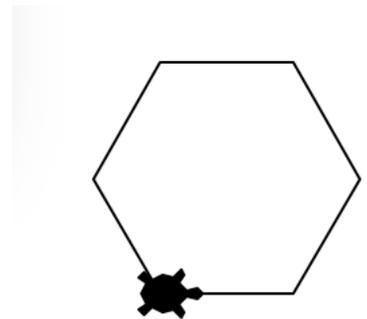
```
import turtle
tess = turtle.Turtle()
tess.shape("turtle")

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,6)`

Answer Key:

(b) For the following code:

```
def v1(vincent, munem):          def start():
    if vincent + munem > 0:           panda = 20
        return vincent                minh = -30
    else:                             qiuqun = v1(panda,minh)
        return -1                     return qiuqun
```

i. What are the formal parameters for `v1()`:

> **Answer Key:** vincent, munem

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

> **Answer Key:** None

    iii. What does `start()` return:

> **Answer Key:** 20

5. Write a **complete Python program** that asks the user for words (separated by spaces) and prints the number that end in `t`.

   For example:

   - If the user entered: `that tempest tea pot`
   - Your program should print: `3`

   Answer Key:

   ```
   #Counting words ending in t

   words = input('Enter words: ')
   num = words.count('t ')
   if words[-1] == 't':
       num = num+1
   print("Number of words ending in t is", num)
   ```

6. Write a **complete Python program** that asks the user for the name of a .png (image) file and displays the upper 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 upper 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 upper 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 are part of a program that maps GIS data from NYC OpenData CSV files:

   - `getData()`: asks the user for the name of the CSV and returns a DataFrame of the contents.
   - `getLocale()`: asks the user for latitude and longitude of the user's current location and returns those floating points numbers, and
   - `computeDist()`: computes the squared distance between two points (x1,y1) and (x2,y2):

$$(x1 - x2)^2 + (y1 - y2)^2$$

Answer Key:

```
import pandas as pd
def getData():
    """
    Asks the user for the name of the CSV and
    Returns a dataframe of the contents.
    """
    inF = input('Enter CSV file name: ')
    df = pd.read_csv(inF,nrows=1000)
    return(df)

def getLocale():
    """
    Asks the user for latitude and longitude of the user's current location and
    Returns those floating points numbers.
    """
    lat = float(input('Enter current latitude: '))
    lon = float(input('Enter current longitude: '))
    return(lat, lon)

def computeDist(x1,y1,x2,y2):
```

```
"""
Computes the squared distance between two points (x1,y1) and (x2,y2) and
Returns (x1-x2)^2 + (y1-y2)^2
"""
d = (x1 - x2)**2 + (y1 - y2)**2
return(d)
```

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

```
#Sample program that loops from 20 down to 0
ADDI $s0, $zero, 20 #set s0 to 20
ADDI $s1, $zero, 5  #use to decrement counter, $s0
ADDI $s2, $zero, 0  #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
0
```

(b) Write a MIPS program where the register, $s0 loops through the values: 4,8,12

Answer Key:

```
#Program that loops from 4 up to 12, by fours
ADDI $s0, $zero, 4  #set s0 to 4
ADDI $s1, $zero, 4  #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?

(a)
```
//Walt Whitman
#include <iostream>
using namespace std;
int main()
{
  cout << "Be curious,\nnot";
  cout << "judgmental." << endl;
  cout << "--W. Whitman" << endl;
}
```

Answer Key:

```
Be curious,
not judgmental.
--W. Whitman
```

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

Answer Key:

```
Hi
Bye
```

(c)
```cpp
//Pluses and minuses
#include <iostream>
using namespace std;
int main()
{
  int i, j;
  for (i = 0; i < 5; i++)
  {
    for (j = 0; j < 5; j++)
      if ((i+j) % 2 == 0)
        cout << "+";
      else
        cout << "-";
    cout << endl;
  }
}
```

Answer Key:

```
+-+-+
-+-+-
+-+-+
-+-+-
+-+-+
```

10. (a) Write a **complete Python program** that prompts the user for a string until a non-empty string is entered. The program then prints the non-empty string that was entered.

Answer Key:

```python
#Input checking:

s = input('Enter a string: ')
while s == "":
    s = input('Enter a non-empty string: ')
print("You entered:',s)
```

(b) Write a **complete C++ program** that prints the change in population of predator and prey following the Lotka-Volterra model:

$$
\begin{aligned}
r &= 2r - .25rf \\
f &= 0.95f + .1rf
\end{aligned}
$$

where r is the number of prey (such as rabbits) each year and f is the number of predators (such as foxes) each year. The rabbit population doubles each year, but $\frac{rf}{4}$ are eaten by foxes. The fox population decreases by 5% due to old age but increases in proportion to the food supply, $\frac{rf}{10}$. Assume that the starting population of prey (rabbits) is 1000 and starting population of predators (foxes) is 100. Your program should print for the first 10 years: the year, the number of prey and the number of predators.

Answer Key:

```cpp
//Predator/Prey Model
#include <iostream>
using namespace std;
int main()
{
  float r = 1000, f = 100;
  int year;
  cout << "Year\tPrey\tPredators\n";
  for (year = 0; year < 10; year++) {
    cout << year << "\t" << r << "\t" << f << "\n";
    r = 2*r - .25*r*f;
    f = 0.95*f + .1*r*f
  }
  return 0;
}
```