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

11 July 2018

Answer Key:

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

i.
```
a = "Jul^Aug^Sep^Oct^Nov^Dec"
print(a.count("^"))
```

Answer Key:
```
5
```

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

Answer Key:
```
Jul
```

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

Answer Key:
```
DEC
```

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

Answer Key:

```
d
e
c
```

(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 *IDS*`

Answer Key:

```
zoningIDS.json
```

ii. What is the output for:
`$ ls *zo* | grep "ing"`

Answer Key:

```
zoning2.html  zoningIDS.json
```

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

Answer Key:

```
2
```

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

```
import turtle
turtle.colormode(255)

karoline = turtle.Turtle()
karoline.color(0,255,0)
yasmeen = turtle.Turtle()
yasmeen.color(1.0,0,0)
jakub = turtle.Turtle()
jakub.color("#AAAAAA")
nicky = turtle.Turtle()
nicky.color("#880000")
```

i. which is red:

Answer Key:

```
yasmeen
```

ii. which is pink:

Answer Key:

```
nicky
```

iii. which is green:

Answer Key:

```
karoline
```

iv. which is gray:

Answer Key:

```
jakub
```

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

```
Ask user for a number, and store in decNum.
Set binString = "".
While decNum > 0:
    If decNum is even:
        Set lead to be "0"
    else
        Set lead to be "1"
    Let binString be lead + binString
    Set decNum to be half of decNum.
Print binString
```

Answer Key:

```
#decimal to binary
decNum = int(input('Enter num: '))
binString = ""
```

```
while decNum > 0:
    if decNum %2 == 0:
        lead = "0"
    else:
        lead = "1"
    binString = lead + binString
    decNum = decNum // 2
print(decNum)
```

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

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

Answer Key:

```
out = True
```

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

Answer Key:

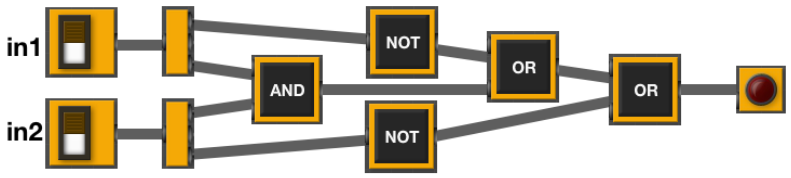
```
out = True
```

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

Answer Key:

```
out = True
```

iv.



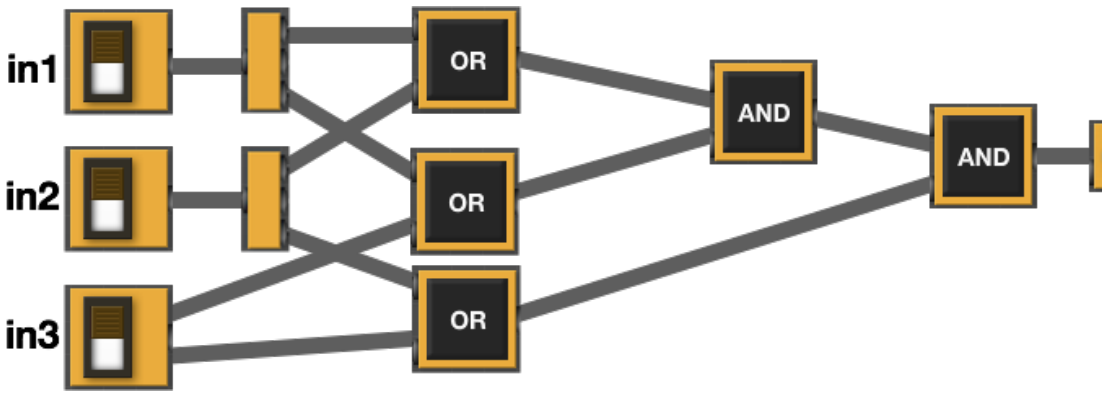

```
in1 = False
in2 = False
```

Answer Key:

```
out = True
```

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

```
((in1 or in2) and (in1 or in3)) and (in2 or in3)
```



Answer Key:

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

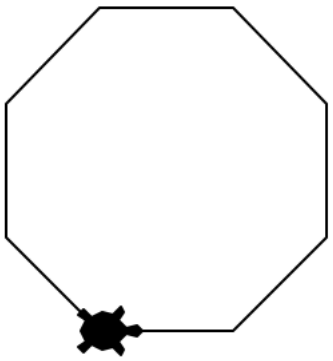
```
import turtle
tess = turtle.Turtle()
tess.shape("turtle")

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

i. `ramble(tess,0)`

Answer Key:

ii. `ramble(tess,8)`



Answer Key:

(b) For the following code:

```
def v4(antonio, carol):
    if antonio + carol < 10:
        return antonio
```

```
def start():
    jack = 5
    dandan = 20
```

```
    else:                                   ekaterina = v4(jack,dandan)
        return -1                           return ekaterina
```

i. What are the formal parameters for `v4()`:

Answer Key: antonio, carol

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

Answer Key: None

iii. What value does `start()` return:

Answer Key: -1

5. Write a **complete Python program** that asks the user for nouns (separated by spaces) and prints the number that are plural.

   To simplify the program, assume that all plural nouns end in "s".

   For example:

   - If the user entered: `shoe socks sweater suits`
   - Your program should print: `2`

   Answer Key:

```
#Counting plurals

nouns = input('Enter nouns: ')
num = nouns.count('s ')
if nouns[-1] == 's':
    num = num+1
print("Number of nouns is", num)
```

6. Write a **complete Python program** that asks the user for the name of a .png (image) file and displays the lower 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 lower 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 lower 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 are part of a program that analyzes NYC Urban Forest of street trees (from NYC OpenData):

   - `getData()`: asks the user for the name of the CSV file and returns a DataFrame of the contents.
   - `biggestDiameter()`: returns the largest diameter (`tree_dbh`) in the DataFrame, and
   - `makeGraph()`: makes a plot of the x versus y columns specified.

   Answer Key:

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

```
def biggestDiameter(df):
    """
    Takes a DataFrame as input and
    Returns the maximum value in
    the column, tree_dbh.
    """
    M = df['tree_dbh'].max()
    return(M)
```

```
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 10 down to 2
ADDI $s0, $zero, 10 #set s0 to 10
ADDI $s1, $zero, 2  #use to decrement counter, $s0
ADDI $s2, $zero, 2  #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:

```
10
8
6
4
2
```

(b) Write a MIPS program where the register, `$s0` loops through the values: `2,6,10,14`

Answer Key:

```
#Program that loops from 2 up to 14, by fours
ADDI $s0, $zero, 2  #set s0 to 2
```

```
ADDI $s1, $zero, 4  #use to increment counter, s0
ADDI $s2, $zero, 14 #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 << "The future is\nno more";
  cout << " uncetain than" << endl;
  cout << "the present."<< endl;
  cout << "--W. Whitman";
}
```

Answer Key:

```
The future is
no uncertain than
the present.
--W. Whitman
```

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

Answer Key:

```
Begin
End
```

(c)
```
//Pluses and minuses
#include <iostream>
using namespace std;
int main()
{
  int i, j;
  for (i = 1; i <= 5; i++)
  {
    for (j = 1; 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 password. If the user entered a string with fewer than 8 characters, the program repeatedly asks until a string with 8 or more characters is entered. The program then prints the string that was entered.

Answer Key:

```
#Input checking:

s = input('Enter a string: ')
while len(s) < 8:
    s = input('Enter a password with at least 8 characters: ')
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:

$$\begin{aligned} r &= 1.5r - .2rf \\ f &= 0.95f + .1rf \end{aligned}$$

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 increases by 50% each year, but $\frac{rf}{5}$ 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 500 and starting population of predators (foxes) is 10. Your program should print for the first 10 years: the year, the number of prey and the number of predators.

Answer Key:

```
//Predator/Prey model
#include <iostream>
using namespace std;
int main()
{
  float r = 500, f = 10;
  int year;
  cout << "Year\tPrey\tPredators\n";
  for (year = 0; year < 10; year++) {
    cout << "\t" << year << "\t" << r << "\t" << f << "\n";
    r = 1.5*r - .2*r*f;
    f = 0.95*f + .1*r*f
  }
  return 0;
}
```