Final Exam, Version 2
CSci 127: Introduction to Computer Science
Hunter College, City University of New York

22 May 2018

Exam Rules

- Show all your work. Your grade will be based on the work shown.
- The exam is closed book and closed notes.
- When taking the exam, you may have with you pens, pencils, and an 8 1/2" x 11" piece of paper filled with notes, programs, etc.
- You may not use a computer, calculator, tablet, smart watch, or other electronic device.
- Do not open this exams until instructed to do so.

Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The College is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures.

I understand that all cases of academic dishonesty will be reported to the Dean of Students and will result in sanctions.
Name:
EmpID:
Signature:

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

i.
```
a = "Mon*Tue*Wed*Thu*Fri"
print(a.count("*"))
```

Output:

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

Output:

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

Output:

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

Output:

(b) Consider the following shell commands:

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

i. What is the output for:

```
$ ls *.csv
```

Output:

ii. What is the output for:

```
$ ls *.csv | wc -l
```

Output:

iii. What is the output for:

```
$ mkdir data
$ mv *.csv data
$ ls | wc -l
```

Output:

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

```
import turtle
turtle.colormode(255)

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")
```

i. which is purple: _____

ii. which is pink: _____

iii. which is blue: _____

iv. which is gray: _____

(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
```

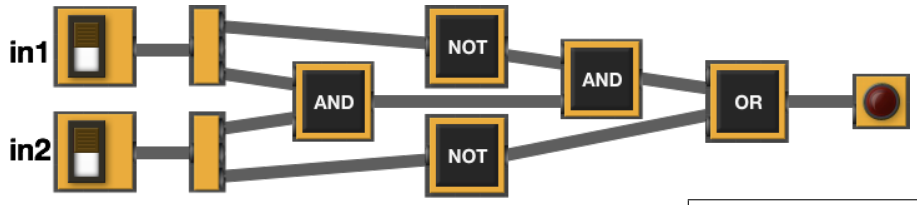
3. (a) What is the value (True/False):

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

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

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

iv.




```
in1 = True
in2 = True
```
out = ____

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

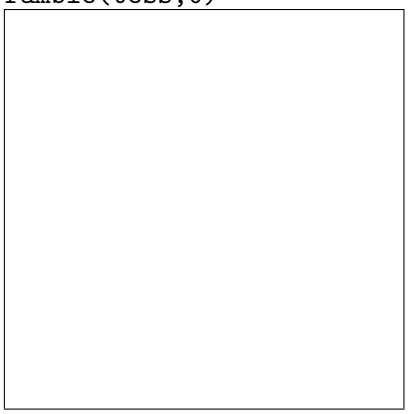
```
((in1 or in2) and (in1 or in3)) or (in2 or not in3)
```

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

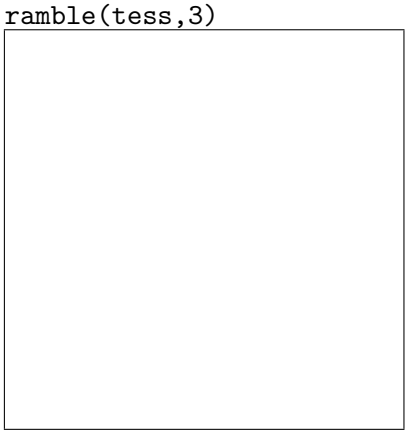
```
import turtle
tess = turtle.Turtle()
tess.shape("turtle")

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)`



ii. `ramble(tess,3)`



(b) For the following code:

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

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

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

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

iii. What does `start()` return:

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`

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):

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.

```
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.
    """
```

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

```
def makeGraph(df,xCol,yCol):
    """
    Makes a pyplot scatter plot of x versus y columns of DataFrame df
    """
```

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:

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

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

(a)

```
//Walt Whitman
#include <iostream>
using namespace std;
int main()
{
  cout << "Simplicity";
  cout << "is the glory\nof ";
  cout << "expression." << endl;
  cout << "--W. Whitman" << endl;
}
```

Output:

(b)

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

Output:

(c)

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

Output:

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.

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

$$p \quad = \quad p + Bp - Dp$$

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).