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

17 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.

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

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

    Output:

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

    Output:

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

    Output:

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

    Output:

   (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*
    ```

    Output:

    ii. What is the output for:

    ```
    $ ls -l | grep "Apr"
    ```

    Output:

    iii. What is the output for:

    ```
    $ ls -l | grep "Apr" | wc -l
    ```

    Output:

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

```
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")
```

    i. which is blue:

    ii. which is pink:

    iii. which is green:

    iv. which is gray:

(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
```

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

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

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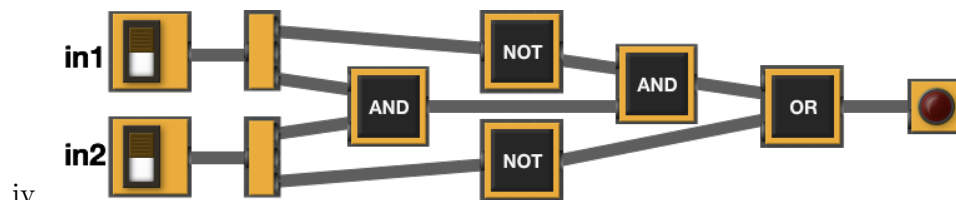   ```
    in1 = False
    in2 = True
    out = not in1 and (in2 or not in1)
    ```
    out = [                    ]

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

    iv.

    

    ```
    in1 = False
    in2 = False
    ```
    out = [                    ]

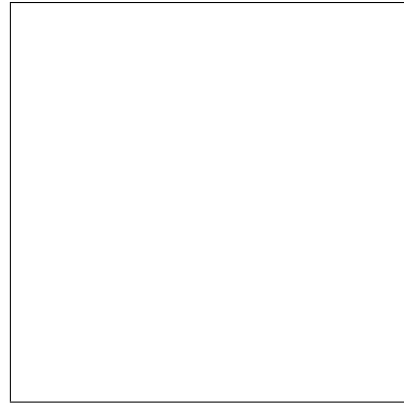    (b) Design a circuit that implements the logical expression:

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

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

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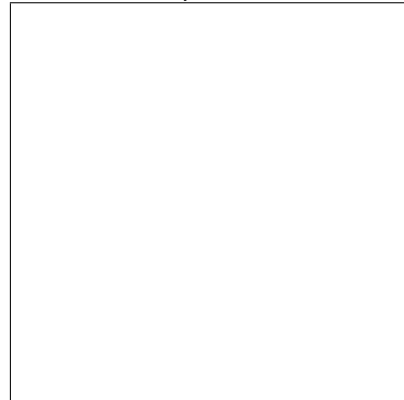
```
import turtle
tess = turtle.Turtle()
tess.shape("turtle")

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

   ii. `ramble(tess,6)`

(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()`:

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

   iii. What does `start()` return:

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`

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):

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):

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

```
import pandas as pd
def getData():
    """
    Asks the user for the name of the CSV and
    Returns a dataframe of the contents.
    """
```

```
def getLocale():
    """
    Asks the user for latitude and longitude of the user's current location and
    Returns those floating points numbers.
    """
```

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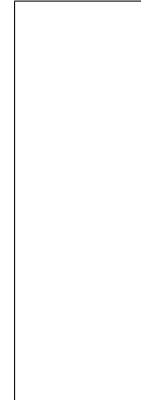
8. (a) What are the values of register, $s0 for the run of this MIPS program:

    ```
    #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:

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

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

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

Output:

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

Output:

(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;
  }
}
```

Output:

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.

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

$$r = 2r - .25rf$$
$$f = 0.95f + .1rf$$

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.