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

15 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.
```
s = "Ada:)Lovelace:)Grace:)Hopper"
a = s[0:3]
print(a.upper())
```
Output:

   ii.
```
names = s.split(":)")
print(names[-1])
```
Output:

   iii.
```
b,c,d = names[1],names[2],names[3]
print(b,d)
```
Output:

   iv.
```
print(b[-1]+"n"+d[-2]+"ine")
print('Put_line: ("', a.lower(),'")')
```
Output:

   (b) Consider the following shell commands:

```
$ ls -l *z*
-rw-r--r--@ 1 stjohn  staff      5308 Mar 21 14:38 quizzes.html
-rw-r--r--  1 stjohn  staff     54013 Mar 20 18:57 zoneDist.csv
-rw-r--r--@ 1 stjohn  staff      1519 Mar 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 -l *z* | grep ".html"
```
Output:

   ii. What is the output for:

```
$ ls -l *z* | grep ".html" | wc -l
```
Output:

2. (a) Fill in the missing code below:

```
#Demonstrates colors, using turtles
import turtle
tess = turtle.Turtle()
#Set color of tess to blue:
```

```
#Set color of tess to maximum red, maximum blue, and no green:
```

```
#Set color of tess using hexcodes: red, green, and blue all equal to "A0":
```

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

```
Ask user for input, and store in the string, binString.
Set decNum = 0.
For each c in binString,
    Set n to be int(c)
    Double decNum and add n to it (decNum = 2 * decNum + n)
Print decNum
```

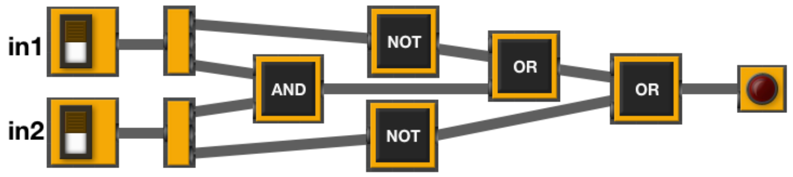
3. (a) What is the value (True/False):

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

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

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

iv.



```
in1 = True
in2 = False
```
out =

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

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

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

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

def ramble(t,length):
    if length < 10:
        t.stamp()
    else:
        t.forward(length)
        t.left(90)
        ramble(t,length-10)
```

i. `ramble(tess,0)`

ii. `ramble(tess,50)`

(b) What is returned when the function is invoked on the inputs below:

```
def gee(a,b):
     while a != b:
          if a > b:
               a = a - b
          else:
               b = b - a
     return a
```

i. `gee(1,1)` **Return:**

ii. `gee(2,3)` **Return:**

iii. `gee(2,4)` **Return:**

iv. `gee(16,24)` **Return:**

5. Write a **complete Python program** that uses `folium` to make a map of New York City. Your map should be centered at $(40.75, -74.125)$ and include a marker for the main campus of Hunter College. The HTML file your program creates should be called: `nycMap.html`.

6. Using `matplotlib.pyplot` and `numpy`, write a **complete Python program** that reads in an array (grid) of elevations, `elevations.txt`. Your program should create an image where for each element of the array, the corresponding pixel is colored in the final image is:

   - colored blue if the elevation is 0 or less,
   - black if the elevation is positive and divisible by 10, and
   - gray otherwise.

   Your resulting image should be stored in a file, `topoMap.png`.

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.
   - `totalTrees()`: returns the number of trees (length) in the DataFrame, and
   - `biggestDiameter()`: returns the largest diameter (`tree_dbh`) in the DataFrame.

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

```
def totalTrees(df):
     """
     Takes a DataFrame as input.
     Returns the length of the DataFrame.
     """
```

```
def biggestDiameter(df):
     """
     Takes a DataFrame as input.
     Returns the maximum value in the column, tree_dbh..
     """
```

8. (a) What is the output for a run of this MIPS program:

```
# Store 'Help!!' at the top of the stack
ADDI $sp, $sp, -7
ADDI $t0, $zero, 72 # H
SB $t0, 0($sp)
ADDI $t0, $zero, 101 # e
SB $t0, 1($sp)
ADDI $t0, $zero, 108 # l
SB $t0, 2($sp)
ADDI $t0, $zero, 112 # p
SB $t0, 3($sp)
ADDI $t0, $zero, 33 # !
SB $t0, 4($sp)
ADDI $t0, $zero, 33 # !
SB $t0, 5($sp)
ADDI $t0, $zero, 0 # (null)
SB $t0, 6($sp)
ADDI $v0, $zero, 4 # 4 is for print string
ADDI $a0, $sp, 0
syscall  # print to the log
```

Output:

(b) Write a MIPS program that prints: `Hi!  Hi!`

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

(a)

```
//Lewis Carroll, Alice in Wonderland
#include <iostream>
using namespace std;
int main()
{
  cout << "Take care of the sense, "<< endl;
  cout << "and the sounds will \n take care";
  cout << "of themselves." << endl
  cout <<  endl;
}
```

Output:

(b)

```
//Lewis Carroll, more Alice...
#include <iostream>
using namespace std;
int main()
{
  int count = 2;
  while (count > 0) {
    cout <<"Twinkle, ";
    count--;
  }
  cout << "little bat!"
}
```

Output:

(c)

```
//Stars and more stars
#include <iostream>
using namespace std;
int main()
{
  int i, j;
  for (i = 1; i <= 5; i++)
  {
    for (j = 1; j <= i; j++)
      cout << "*";
    cout << endl;
  }
}
```

Output:

10. (a) Write a **complete Python program** that prompts the user for a string and then prints the string in reverse. For example, if the user entered, `Python`, your program would print: `nohtyP`.

(b) Write a **complete C++ program** that prints the spread of disease, following the Susceptible, Infected, Recovered (SIR) model:

$$\begin{aligned} S &= .95S \\ I &= I + .05S - .04I \\ R &= R + .04I \end{aligned}$$

where S is the size of the susceptible population, I is the number of currently infected in the population, and R is the number who have recovered. Each day, 4% of those ill recover and 5% of the susceptible population becomes infected. Assume that the starting susceptible population at year 0 is 1000 with 100 infected and 100 recovered. Your program should print for the first 10 days: the day, the number of susceptible population, the number currently infected, and the number who have recovered.