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

Fall 2017

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.
Signature:

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

```
months = ["Jan","Feb","Mar","Apr","May",\
"Jun","Jul","Aug","Sep","Oct","Nov","Dec"]
half = months[6]
print(half.upper())
print(half[0])
print(months[-1].lower())
print(months[2:4])
start = 9
print(months[start-1])
term = 3
print(months[(start+term-1)%12])
```

Answer Key:

```
JUL
J
dec
['Mar', 'Apr']
Sep
Dec
```

(b) Consider the following shell command and resulting output:

```
ls t*
t.html              test.png           trash.html         turtle2.py
tc.htmk             testSubprocess.py  trashCans.csv      turtle3.py
tc.html             th.html            triangles.py

test:
herd.py           makeDirs*     projectFiles/
```

i. What is the output for:
`ls t*.png`

Answer Key:

```
test.png
```

ii. What is the output for:
`ls t* | grep ".p" | sort`

Answer Key:

```
herd.py
test.png
```

```
testSubprocess.py
triangles.py
turtle2.py
turtle3.py
```

2. (a) After executing the Python code:

```
import turtle
turtle.colormode(255)

apple = turtle.Turtle()
apple.color(0,0,0)

banana = turtle.Turtle()
banana.color(255,255,255)

cherry = turtle.Turtle()
cherry.color("#AA00AA")

date = turtle.Turtle()
date.color("#0000FF")
```

i. Which turtle is white?

Answer Key:

`banana`

ii. Which turtle is black?

Answer Key:

`apple`

iii. Which turtle is the brightest blue?

Answer Key:

`date`

iv. Which is purple?

Answer Key:

`cherry`

(b) Fill in the code below to make an image in which a pixel is blue if it has a non-positive entry in the array `elevations`. Otherwise, the pixel should be colored green.

```
# Takes elevation data of NYC and displays a map
import numpy as np
import matplotlib.pyplot as plt
elevations = np.loadtxt('elevationsNYC.txt')
#Base image size on shape (dimensions) of the elevations:
mapShape = elevations.shape + (3,)
floodMap = np.zeros(mapShape)

for row in range(mapShape[0]):
```

```
for col in range(mapShape[1]):
```

Answer Key:

```
if elevations[row,col] <= 0:
    #Below sea level
   floodMap[row,col,2] = 1.0     #Set the blue channel to 100%
else:
    #Above sea level
    floodMap[row,col,1] = 1.0   #Set the green channel to 100%

#Save the image:
plt.imsave('floodMap.png', floodMap)
```

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

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

Answer Key:

```
out = False
```

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

Answer Key:

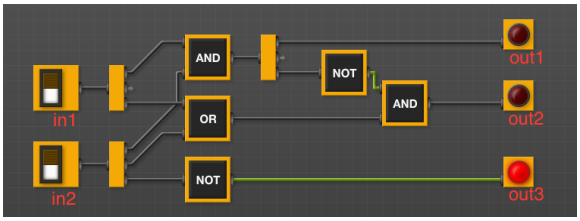
```
out = True
```

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

Answer Key:

```
out = False
```

iv.



Answer Key:

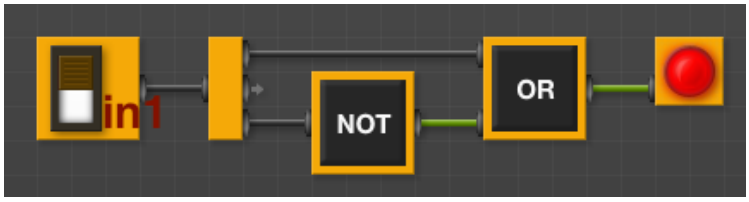
```
in1 = False
in2 = False
```

Answer Key:

```
out1 = False
out2 = False
```

(b) Design a circuit that takes a single input and always outputs True.

Answer Key:

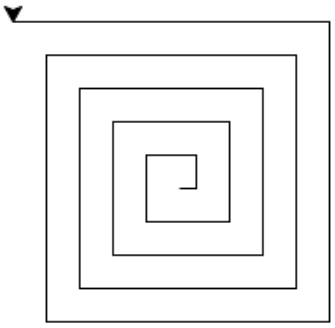


4. (a) Draw the output of the program:

```
#Mystery program...
import turtle

tH = turtle.Turtle()

for i in range(10,255,10):
    tH.color((i,i,i))
    tH.forward(i)
    th.left(90)
```



Answer Key:

(b) What is the output:

```
#Another mystery program...
def rest(s, num):
     b = 16
     while b > 0.5:
          if num >= b:
               s = s + "1"
          else:
               s = s + "0"
          num = num % b
          b = b / 2
     return(s)
def convert(n):
     returnS = ""
     if n < 0:
          returnS = rest("1", n+32)
     else:
          returnS = rest("0", n)
     return(returnS)
n = int(input("Enter a number: "))
s = convert(n)
print("Output is", s)
```

i. When the user enters: `2`?

Answer Key: `Output is 000010`

ii. When the user enters: `31`?

Answer Key: `Output is 011111`

iii. When the user enters: `-1`?

Answer Key: `Output is 111111`

5. Write a **complete Python program** that will read:

   - prompt the user for the name of a CSV file,
   - prompt the user for the name of a column in that CSV file, and
   - print out the average and standard deviation.

   Answer Key:

```
#Computes average and standard deviation of inputted column
import pandas as pd

fileName = input('Enter file name: ')
colName = input('Enter column name: ')
df = pd.read_csv(fileName)
ave = df[colName].mean()
std = df[colName.std()
print("Average is ", ave)
print("Standard deviation is ", std)
```

6. Using `folium` and `pandas`, write a **complete Python program** that asks the user for the name of a CSV file, name of the output file, and creates a map with markers for all the 311 complaints from the input file.

   Answer Key:

```
#Collisions program
import folium
import pandas as pd

inF = input('Enter CSV file name: ')
outF = input('Enter output file: ')
df = pd.read_csv(inF)

map311 = folium.Map(location=[40.768731, -73.964915], tiles="Cartodb Positron",zoom_start=

for index,row in df.iterrows():
    lat = row["LATITUDE"]
    lon = row["LONGITUDE"]
    name = row["TIME"]
    newMarker = folium.Marker([lat, lon], popup=name)
    newMarker.add_to(map311)

map311.save(outfile=outF)
```

7. Complete the following Python program, which creates a green turtle, draws a decagon (10-sided figure) to the window, and then prints a closing message. That is, write the functions `setUp()`, `drawDecagon()`, and `conclusion()`:

```
import turtle

def main():
    t = setUp()     #creates a green turtle
    drawDecagon(t)  #draws a decagon using the turtle
    conclusion()    #prints goodbye

if __name__ == "__main__":
    main()
```

Answer Key:

```
def setUp():
    trey = turtle.Turtle()
    trey.color("green")
    return(trey)

def drawDecagon(t):
    for i in range(10):
        t.forward(100)
        t.right(360/10)

def conclusion():
```

```
print("Goodbye!")
```

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

```
#Sample program that loops from 10 down to 0
ADDI $s0, $zero, 10 #set s0 to 10
ADDI $s1, $zero, 2  #use to decrement counter, $s0
AGAIN: SUB $s0, $s0, $s1
BEQ $s0, $zero, DONE
J AGAIN
DONE:  #To break out of the loop
```

Values of $s0:

Answer Key:

```
10
8
6
4
2
0
```

(b) Write a MIPS program where the register, `$s0` loops through the values: `1,2,3,4,5`

Answer Key:

```
#Program that loops from 1 upto 5
ADDI $s0, $zero, 1  #set s0 to 1
ADDI $s1, $zero, 1  #use to increment counter, s0
ADDI $s2, $zero, 5 #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)
```
//Mystery C++
#include <iostream>
using namespace std;
int main()
{
   cout << "Get your education" << endl;
   cout << "Don't forget from ";
   cout << "whence you came\n";
}
```

Answer Key:

```
Get your education
Don't forget from whence you came
```

(b)

```
//Mystery C++, #2
#include <iostream>
using namespace std;
int main()
{
  int count = 0;
  while (count < 8) {
    cout <<"The world turned upside down\n";
    count = count + 2;
  }
}
```

Answer Key:

```
The world turned upside down...
The world turned upside down...
The world turned upside down...
The world turned upside down...
```

(c)

```
//Mystery C++, #3
#include <iostream>
using namespace std;
int main()
{
  for (int i = 0; i < 5; i++) {
    for (int j = 5; j > i; j--)
      if (j % 2 == 0)
        cout << "+";
      else
        cout << "-"
    cout << endl;
  }
}
```

Answer Key:

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

10. (a) Write a **complete Python program** that prompts the user to enter 5 numbers and prints out the total of the numbers entered.

Answer Key:

```
#Asks for 5 numbers and prints total
total = 0
for i in range(5):
   n = float(input('Enter a number: '))
   total = total + n
print("Total is", total)
```

(b) Write a **complete C++ program** that repeatedly prompts the user for a number until one that is strictly larger than 0 is entered. Your program should print out the final number the user entered:

Answer Key:

```
//Checks input for positive number
#include <iostream>
using namespace std;
int main()
{
  cout << "Please enter age: ";
  int age = 0;
  cin >> age;
  while (age < 0) {
    cout << "You entered a negative number.\n";
    cout << "Please enter age: ";
    cin >> age;
  }
  cout << "You entered your age as: " << age;
  return 0;
}
```