Final Exam, Version 3
CSci 127: Introduction to Computer Science
Hunter College, City University of New York

20 December 2017

Answer Key:

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

```python
flist = "speech,worship,want,fear,fdr"
freedoms = flist.split(",")
pres = freedoms[-1]
print(pres.upper())
num = flist.count(",")
print(num, "Freedoms")
for i in range(0,4):
    if i < 2:
        print("\tof", end=" ")
    else:
        print("\tfrom", end=" ")
    print(freedoms[i])
```

Answer Key:

```
FDR
4 Freedoms
of speech
of worship
from want
from fear
```

(b) Consider the following shell commands:

```
$ ls
hw1.py     hw2.py     hw3.py     turtle.py
```

i. What is the output for:

```
$ mv t*.py mock.py
$ mkdir programs
$ ls
```

Answer Key:

```
hw1.py    hw2.py    hw3.py    mock.py    programs/
```

ii. What is the output for:
```
$ cp hw1.py t.py
$ mv hw*.py programs
$ ls
```

Answer Key:

```
mock.py    programs/ t.py
```

2. (a) Fill in the missing values in the table:

Decimal	Binary	Hexadecimal
3	**Answer Key:** 11	3
Answer Key: 6	110	6
Answer Key: 11	1011	B
33	100001	**Answer Key:** 21
254	11111110	**Answer Key:** FE

(b) Fill in the code below to make an image in which a pixel is red if it has an entry of 0 in the array `elevations`. Otherwise, the pixel should be colored blue.

```
# Takes elevation data of NYC and displays coastlines
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:
            #Coastline:
            floodMap[row,col,0] = 1.0     #Set the red channel to 100%
        else:
            #Everyone else
            floodMap[row,col,2] = 1.0   #Set the blue channel to 100%

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

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

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

Answer Key:

out = False

    ii.
```
in1 = False
in2 = False
out = in1 or (in2 or not in1)
```
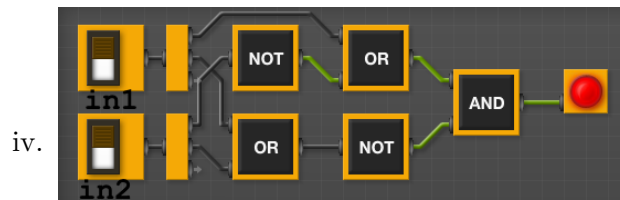
Answer Key:

out = False

    iii.
```
in1 = True
in2 = True
in3 = (in1 or in2)
out = in1 and not in3
```
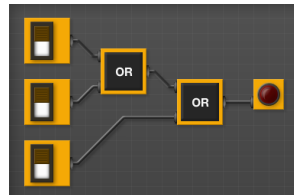
Answer Key:

out = False

iv.


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

Answer Key:

```
out = False
```

(b) Design a circuit that takes three inputs and returns true when one or more of the inputs are true. Otherwise if returns false.

Answer Key:

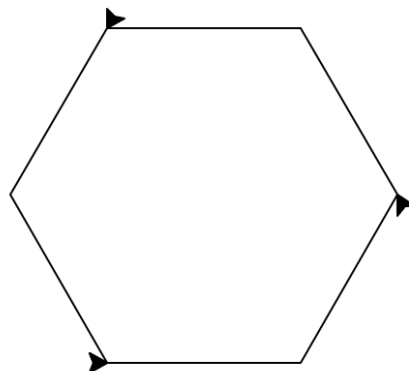4. (a) Draw the output of the program:
```
#turtle mystery
import turtle

tess = turtle.Turtle()
for i in range(6):
        if i%2 == 0:
                tess.stamp()
        tess.forward(100)
        tess.left(60)
```


Answer Key:

(b) What is the output:

```
#Another mystery program...
#mystery
def shift(num):
    num = num + 1
    if num > ord('z'):
        num = ord('a')
    return chr(num)

def enigma(letters):
    mess = ""
    for l in letters:
        n = ord(l)
        c = shift(n)
        mess = mess + c
    return mess


word = input("Enter a word: ")
s = enigma(word)
print("Output is:", s)
```

i. When the user enters: **'h'**?

Answer Key: Output is: i

ii. When the user enters: **'ktu'**?

Answer Key: Output is: luv

iii. When the user enters: **'oxsgnm'**?

Answer Key: Output is: python

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 minimum value and average of the column.

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)
m = df[colName].min()
M = df[colName].mean()
print("Minimum is ", m)
print("Maximium is ", M)
```

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):

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. Complete the following Python program, which creates a turtle, prompts the user for a string, and then controls the turtles actions:

   - 'F': moves the turtle forward
   - 'L': turns the turtle 90 degrees to the left
   - 'R': turns the turtle 90 degrees to the right

   That is, write the functions `setUp()`, `getInput()`, and `doAction()`:

```
import turtle
def main():
    t = setUp()     #creates a green turtle
    s = getInput()  #get string from user
```

```
        for action in s:
            doAction(t,action)  #Do 'F', 'L', or 'R'

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

Answer Key:

```
import turtle

def setUp():
    tess = turtle.Turtle()
    tess.shape("turtle")
    return(tess)

def getInput():
    commands = input("Please enter a command string: ")
    return(commands)

def doAction(tess, ch):
    #perform action indicated by the character
    if ch == 'F':              #move forward
        tess.forward(50)
    elif ch == 'L':          #turn left
        tess.left(90)
    elif ch == 'R':            #turn right
        tess.right(90)
    else:                      #for any other character, print an error message
        print("Error: do not know the command:", c)

def main():
    t = setUp()      #creates a green turtle
    s = getInput()   #get string from user
    for action in s:
        doAction(t,action)  #Do 'F', 'L', or 'R'

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

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

```
#Set up counters:
ADDI $s0, $zero, 3
ADDI $s1, $zero, 1
AGAIN: ADDI $sp, $sp, -3
ADDI $t0, $zero, 72 # H
SB $t0, 0($sp)
```

```
ADDI $t0, $zero, 105 # i
SB $t0, 1($sp)
ADDI $t0, $zero, 0  # (null)
SB $t0, 2($sp)
ADDI $v0, $zero,50 #50 is for printing message
ADDI $a0, $sp, 0
syscall
SUB $s0, $s0, $s1
BEQ $s0, $zero, AGAIN
```

Answer Key: Values of $s0:

```
3
2
1
0
```

Answer Key: Output:

```
Hi
Hi
Hi
```

(b) Write a MIPS program that prints the letter 'H' 10 times:

Answer Key:

```
#Set up counters:
ADDI $s0, $zero, 10
ADDI $s1, $zero, 1
AGAIN: ADDI $sp, $sp, -2
ADDI $t0, $zero, 72 # H
SB $t0, 0($sp)
ADDI $t0, $zero, 0 # (null)
SB $t0, 1($sp)
ADDI $v0, $zero,50 #50 is for printing message
ADDI $a0, $sp, 0
syscall
SUB $s0, $s0, $s1
BEQ $s0, $zero, AGAIN
```

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

(a)
```cpp
//Neil deGrasse Tyson
#include <iostream>
using namespace std;
int main()
{
    cout << "There is no greater";
    cout << "education\n than one";
    cout << "that is self-driven\n";
}
```

Answer Key:

```
There is no greater education
 than one that is self-driven.
```

(b)
```cpp
//Mystery C++, #2
#include <iostream>
using namespace std;
int main()
{
    int count = 3;
    while (count <= 25) {
        cout << count;
        count = count * 2;
    }
}
```

Answer Key:

361224

(c)
```cpp
//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 (i % 2 == 0)
                cout << "+";
            else
                cout << "-";
        }
        cout << endl;
    }
}
```

Answer Key:

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

10. (a) Write a **complete Python program** that prompts the user to enter a string. If the user enters an empty string, your program should continue prompting the user for a new string until they enter a non-empty string. Your program should then print out the string entered.

Answer Key:

```python
#Asks for string, with input checking:
s = ""
while s == "":
    s = input('Enter a non-empty string: ')

print("You entered", s)
```

(b) Write a **complete C++ program** that asks the user for a number and prints "Negative" if the number entered is less than 0, "Zero" if it equals 0, and "Positive" otherwise.

Answer Key:

```cpp
//Checks input for positive number
#include <iostream>
using namespace std;
int main()
{
  cout << "Please enter number: ";
  int num = 0;
  cin >> num;
  if (num < 0)
    cout << "Negative\n";
  else if (num < 0)
    cout << "Zero\n";
  else
    cout << "Positive";
  return 0;
}
```