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.

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

   Output:

   ```python
   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])
   ```

   (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:

   Output:

   ```
   $ ls t*.png
   ```

      ii. What is the output for:

   Output:

   ```
   $ ls t* | grep ".p" | sort
   ```

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?

ii. Which turtle is black?

iii. Which turtle is the brightest blue?

iv. Which is purple?

(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]):




        #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
```
out =

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

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

    iv.
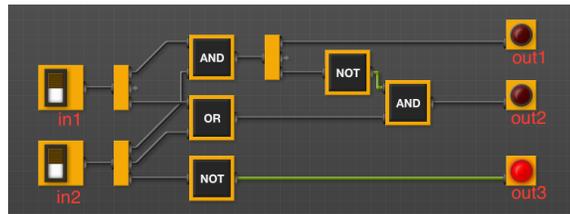

```
in1 = False
in2 = False
```

out1 =

out2 =

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

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)
```

Output:
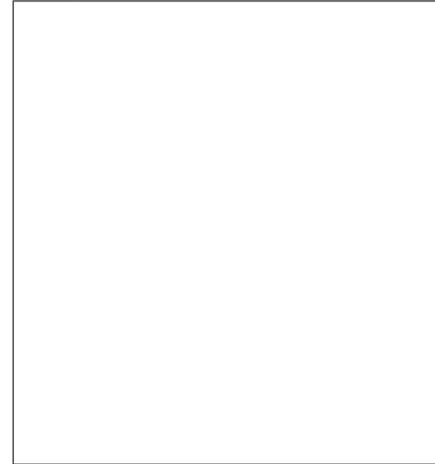
(b) What is the output:

```
#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?

Output:

ii. When the user enters: 31?

Output:

iii. When the user enters: -1?

Output:

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.

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.

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()
```

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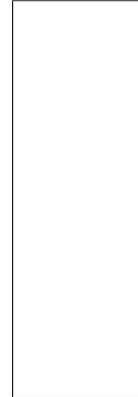
(b)   Write a MIPS program where the register, `$s0` loops through the values: `1,2,3,4,5`

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

(a)
```cpp
//Mystery C++
#include <iostream>
using namespace std;
int main()
{
    cout << "Get your education" << endl;
    cout << "Don't forget from ";
    cout << "whence you came\n";
}
```

Output:

(b)
```cpp
//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;
  }
}
```

Output:

(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 (j % 2 == 0)
        cout << "+";
      else
        cout << "-";
    cout << endl;
  }
}
```

Output:

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

(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: