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

10 December 2019

Answer Key:

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

    i.
    ```
    pioneers="Asimov%Isaac#Shelley%Mary#Gibson%William"
    num = pioneers.count('%')
    num = num + pioneers.count('#') + 2
    print(pioneers[len(pioneers)-num:].lower())
    ```

    Answer Key:
    ```
    william
    ```

    ii.
    ```
    names = pioneers.split('#')
    m = names[1]
    print(m[-4]+'. '+m[:7])
    ```

    Answer Key:
    ```
    M. Shelley
    ```

    iii.
    ```
    for n in names:
        print(n.split('%')[0][0])
    ```

    Answer Key:
    ```
    A
    S
    G
    ```

    (b) Consider the following shell commands:

```
$ pwd
/Users/login/temp
$ ls
csBridge.png Elevations.csv  p25.py  p27.py
```

  i. What is the output for:
```
$ mkdir hwk
$ mv *.p* hwk
$ ls
```

   Answer Key:

   `Elevations.csv`

 ii. What is the output for:
```
$ cd hwk
$ ls | grep ^p | wc -l
```

   Answer Key:

   `2`

iii. What is the output for:
```
$ pwd
$ cd ../
$ pwd
```

   Answer Key:

   `/Users/login/csci127/hwk`
   `/Users/login/csci127`

2. (a) Consider the code:

   Answer Key:

```
import turtle
thomasH = turtle.Turtle()
```

  i. After the command: `thomasH.color("#1B1B1B")`, what color is `thomasH`?
    ☐ black   ☐ red   ☐ white   **X** gray   ☐ teal

 ii. After the command: `thomasH.color("#00AAAA")`, what color is `thomasH`?
    ☐ black   ☐ red   ☐ white   ☐ gray   **X** teal

iii. Fill in the code below to change `thomasH` to be the color white:
    `thomasH.color("#` **F** | **F** | **F** | **F** | **F** | **F** `")`

iv. Fill in the code below to change `thomasH` to be the brightest purple:
`thomasH.color("#` **F** | **F** | **0** | **0** | **F** | **F** `")`

(b) Fill in the code to produce the output on the right:

i.
Answer Key:
```
for i in range( 10 ):
    print(i, end=" ")
```

Output:
```
0 1 2 3 4 5 6 7 8 9
```

ii.
Answer Key:
```
for j in range( -2, 8, 2 ):
    print(i, end=" ")
```
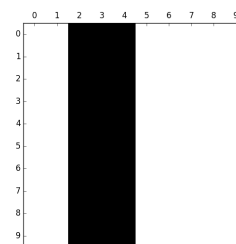
Output:
```
-2 0 2 4 6
```

Output:

iii.
Answer Key:
```
import numpy as np
import matplotlib.pyplot as plt
im = np.ones( (10,10,3) )
im[:, 2 :5,:]  = 0
plt.imshow(im)
plt.show()
```


iv.
Answer Key:
```
import numpy as np
import matplotlib.pyplot as plt
im = np.ones( (10,10,3) )
im[0:: 2 , 2:: 3 , :]  = 0
plt.imshow(im)
plt.show()
```
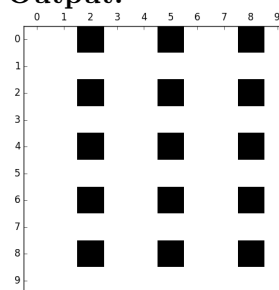
Output:

3. (a) What is the value (True/False):
```
in1 = False
in2 = True
out = in1 or in2
```
i.

Answer Key:
```
out = True
```

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

Answer Key:

```
out = True
```

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

Answer Key:

```
out = False
```

iv.


```
in1 = True
in2 = False
in3 = False
```
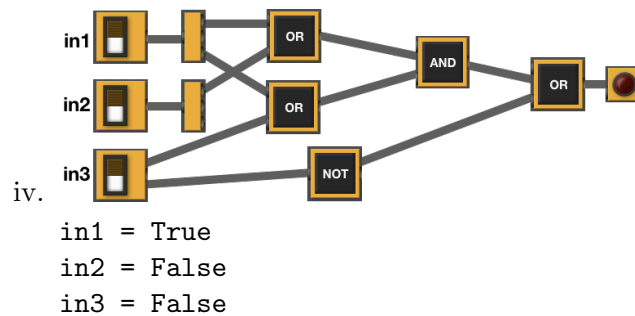
Answer Key:

```
out = True
```

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

```
((in1 or in2) and (not in2))
```
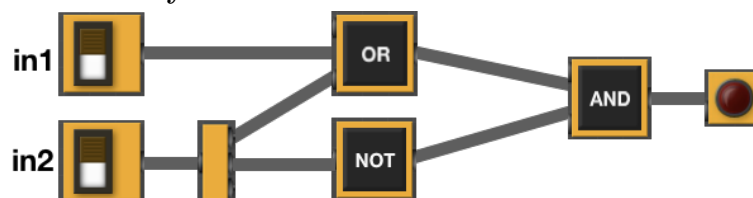
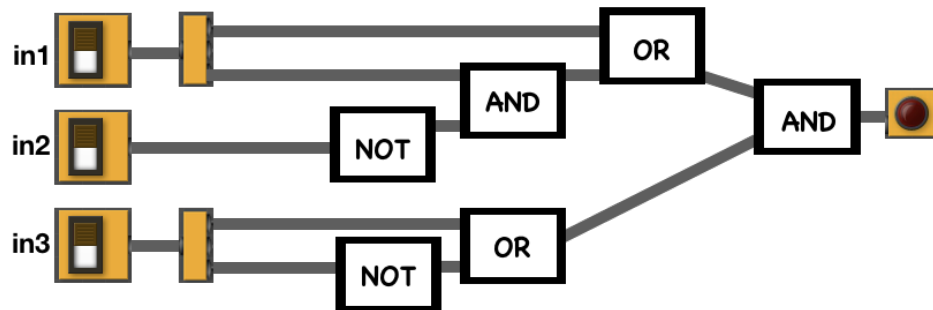**Answer Key:**

(c) Fill in the circuit that implements the logical expression:

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

Answer Key:

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

            i. `ramble(tess,8)`

            Answer Key:

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

def ramble(t, len):
    if len <= 10:
        t.stamp()
    elif len%2 == 0:
        t.left(90)
        t.forward(len)
        ramble(t, len//2)
    else:
        t.right(90)
        t.forward(len)
        ramble(t, len//2)
```

            ii. `ramble(tess,180)`

            Answer Key:

(b) What are the formal parameters for `ramble()`:

        Answer Key: t, len

(c) If you call `ramble(tess,8)`, which branches of the function are tested:

Answer Key:

X the `if`-clause only,

☐ the `elif`-clause only,

☐ the `else`-clause only,

☐ `if`-clause and the `elif`-clause, or

☐ all the clauses are visited from this invocation (call).

(d) If you call `ramble(tess, 180)`, which branches of the function are tested:

Answer Key:

☐ the `if`-clause only,

☐ the `elif`-clause only,

☐ the `else`-clause only,

☐ `if`-clause and the `elif`-clause, or

X all the clauses are visited from this invocation (call).

5.

Consider the driving times from Hunter College to LaGuardia Airport using the different routes which factors in delays due to traffic (x cars) already en route:

- $T_{RFK}(x) = 14 + \frac{x}{10,000}$, the time, in minutes, for the Triborough/RFK bridge route.

- $T_{KQB}(x) = 18 + \frac{x}{5,000}$, the time, in minutes, for the Koch Queensboro bridge route.

- $T_{Tun}(x) = 16 + \frac{x}{1,000}$, the time, in minutes, for the Queens Midtown Tunnel route.
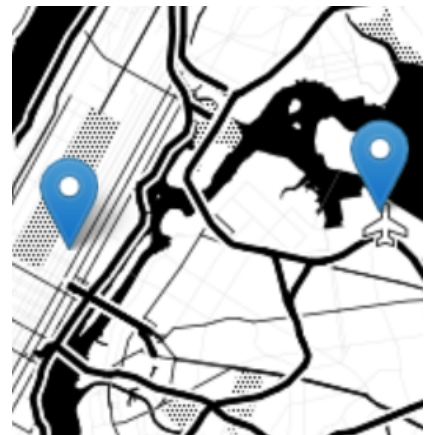
Design an algorithm that, given the current status of traffic at any given moment, suggests the best route.

- **Input:**

  Answer Key: The number of cars currently on each route

- **Output:**

  Answer Key: The suggested route

- **Process (as a list of steps):**

Answer Key: There are several different ways to approach this. A selfish routing approach will always suggest the current fastest route. A distributed approach would consider how many other cars are currently being routed in the same direction :

(a) Ask for the number of cars currently on each route

(b) Compute the driving times along each of the three routes given the number of cars currently on each.

(c) Distribute the currently requesting cars along the three routes taking into account the computed driving times

(d) Output the suggested route

6. Given the YouTube dataset of top-trending videos in 2017, a snapshot given in the image below:

video_id	trending_date	title	channel_title	publish_time	views	likes	dislikes
2kyS6SvSYSE	17.14.11	WE WANT T	CaseyNeistat	2017-11-13T17:13:0	748374	57527	2966
1ZAPwfrtAFY	17.14.11	The Trump F	LastWeekTonight	2017-11-13T07:30:0	2418783	97185	6146
5qpjK5DgCt4	17.14.11	Racist Supe	Rudy Mancuso	2017-11-12T19:05:2	3191434	146033	5339
puqaWrEC7tY	17.14.11	Nickelback l	Good Mythical M	2017-11-13T11:00:0	343168	10172	666
d380meD0W0M	17.14.11	I Dare You: (	nigahiga	2017-11-12T18:01:4	2095731	132235	1989
gHZ1Qz0KiKM	17.14.11	2 Weeks witl	iJustine	2017-11-13T19:07:2	119180	9763	511
39idVpFF7NQ	17.14.11	Roy Moore &	Saturday Night L	2017-11-12T05:37:1	2103417	15993	2445
nc99ccSXST0	17.14.11	5 Ice Cream	CrazyRussianHac	2017-11-12T21:50:3	817732	23663	778
jr9QtXwC9vc	17.14.11	The Greates	20th Century Fox	2017-11-13T14:00:2	826059	3543	119
TUmyygCMMGA	17.14.11	Why the rise	Vox	2017-11-13T13:45:1	256426	12654	1363

Fill in the Python program below:

Answer Key:

```
#P6, Mock: extracts data about indifferent views and about videos
#with highest number of likes

#Import the libraries for data frames and plotting data:
import pandas as pd
import matplotlib.pyplot as plt

#Prompt user for input file name:
csvFile = input('Enter CSV file name: ')

#Read input data into data frame:
youtube = pd.read_csv(csvFile)

#Calculate a new column for the number of indifferent views
# (i.e. those views that did not like nor dislike)
youtube['indifferent'] =youtube['views'] - (youtube['likes'] + youtube['dislikes'])

#Print the maximum number of indifferent views on a video
print(youtube['indifferent'].max())
```

```
#Group videos by channel to find out the maximum number of likes on each channel
channelLikes = youtube.groupby(['channel_title'])["likes"].max()

#Print the top 5 channels with largest number of likes
print(channelLikes[:5])
```

7. Write a **complete Python program** that prompts the user for the name of an .png (image) file and prints the fraction of pixels that are grayscale, or a shade of gray. Recall that a pixel is a shade of gray if the red, green, and blue values are all equal.

Answer Key:

```
#Import the packages for images and arrays:
import matplotlib.pyplot as plt
import numpy as np

#Ask user for image name and read into img:
inImg = input('Enter input image: ')
img = plt.imread(inImg)

#Get height and width:
height = img.shape[0]
width = img.shape[1]

#Initialize counter:
count = 0

#Loop through all the pixels:
for row in range(height):
    for col in range(width):
        #Check if the red, green, and blue values are equal for each pixel and update cour
        if img[row,col,0] == img[row,col,1] == img[row,col,2]:
            count = count + 1

#Compute and print fraction:
frac = count/(height*width)
print('Fraction gray is', frac)
```

8. (a) What does the following MIPS program print:

Answer Key:

```
KMOQS
```

(b) Modify the program to print out 10 consecutive letters starting with 'K'. Shade in the box for each line that needs to be changed and rewrite the instruction in the space below.

Answer Key:

```
#Loop through characters
ADDI $sp, $sp, -11          # Set up stack
ADDI $t0, $zero, 75         # Start $t0 at 75 (K)
ADDI $s2, $zero, 85         # Use to test when you reach 85 (T)
SETUP: SB $t0, 0($sp)       # Next letter in $t0
ADDI $sp, $sp, 1            # Increment the stack
ADDI $t0, $t0, 1            # Increase the letter by 1
BEQ $t0, $s2, DONE          # Jump to done if $t0 == 85
J SETUP                     # If not, jump back to SETUP for loop
DONE: ADDI $t0, $zero, 0    # Null (0) to terminate string
SB $t0, 0($sp)              # Add null to stack
ADDI $sp, $sp, -11          # Set up stack to print
ADDI $v0, $zero, 4          # 4 is for print string
ADDI $a0, $sp, 0            # Set $a0 to stack pointer for printing
syscall                     # Print to the log
```

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

(a)
```
//Quote by Mary Shelley
#include <iostream>
using namespace std;
int main()
{
    cout<<"Invention,\nit must be ";
    cout<<"humbly admitted,\ndoes not ";
    cout<<"consist in ";
    cout<<"creating"<<endl<<"out of ";
    cout<<"void,\nbut out of chaos. ";
    cout<<"M.S.";
    return 0;
}
```

Answer Key:

```
Invention,
it must be humbly admitted,
does not consist in creating
out of void,
but out of chaos. M.S.
```

(b)
```cpp
#include <iostream>
using namespace std;
int main()
{
    double tot = 0;
    cout <<"Please enter amount\n";
    cin >> tot;
    while (tot > 100) {
        tot = tot - (tot * 0.5);
        cout << tot << endl;
    }
    return 0;
}
```

Answer Key:

```
Please enter amount
200
100
```

(c)
```cpp
#include <iostream>
using namespace std;
int main(){
    int i, j;
    for (i = 1; i < 6; i++){
        for (j = 1; j < 6; j++){
            if(j % 2 == 1)
                cout << i;
            else
                cout << j;
        }
        cout << endl;
    }
    return 0;
}
```

Answer Key:

```
12141
22242
32343
42444
52545
```

10. Write a **complete C++ program** that repeatedly asks the user for their score on a programming assignment until the entered score is a negative number. The program then **prints the average programming assignment score**. The negative number simply indicates that the user has finished entering scores and it is not included in the average.

Answer Key:

```cpp
#include <iostream>
using namespace std;
int main()
{
    double score = 0, total_score = 0, toal_assignments = 0;

    while(score >= 0)
    {
        cout << "Please enter your score on a programming assignment: ";
        cin  >> score;
        if(score >= 0)
        {
            total_score += score;
            toal_assignments++;
        }
    }

    cout << "Your average  programming assignment score is " << total_score / toal_assignm
    return 0;
}
```