

| | |
|------|-------|
| Row: | SEAT: |
| | |

FINAL EXAM, VERSION 5
 CSci 127: Introduction to Computer Science
 Hunter College, City University of New York
 13 December 2019

Exam Rules

- Show all your work. Your grade will be based on the work shown.
- The exam is closed book and closed notes with the exception of an 8 1/2" x 11" piece of paper filled with notes, programs, etc.
- When taking the exam, you may have with you pens and pencils, and your note sheet.
- You may not use a computer, calculator, tablet, phone, earbuds, or other electronic device.
- **Do not open this exam 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: | | | | | | | | | |
| Email: | | | | | | | | | |
| Signature: | | | | | | | | | |

ASCII TABLE

| Decimal | Hex | Char | Decimal | Hex | Char | Decimal | Hex | Char | Decimal | Hex | Char |
|---------|-----|------------------------|---------|-----|---------|---------|-----|------|---------|-----|-------|
| 0 | 0 | [NULL] | 32 | 20 | [SPACE] | 64 | 40 | @ | 96 | 60 | , |
| 1 | 1 | [START OF HEADING] | 33 | 21 | ! | 65 | 41 | A | 97 | 61 | a |
| 2 | 2 | [START OF TEXT] | 34 | 22 | " | 66 | 42 | B | 98 | 62 | b |
| 3 | 3 | [END OF TEXT] | 35 | 23 | # | 67 | 43 | C | 99 | 63 | c |
| 4 | 4 | [END OF TRANSMISSION] | 36 | 24 | \$ | 68 | 44 | D | 100 | 64 | d |
| 5 | 5 | [ENQUIRY] | 37 | 25 | % | 69 | 45 | E | 101 | 65 | e |
| 6 | 6 | [ACKNOWLEDGE] | 38 | 26 | & | 70 | 46 | F | 102 | 66 | f |
| 7 | 7 | [BELL] | 39 | 27 | ' | 71 | 47 | G | 103 | 67 | g |
| 8 | 8 | [BACKSPACE] | 40 | 28 | (| 72 | 48 | H | 104 | 68 | h |
| 9 | 9 | [HORIZONTAL TAB] | 41 | 29 |) | 73 | 49 | I | 105 | 69 | i |
| 10 | A | [LINE FEED] | 42 | 2A | * | 74 | 4A | J | 106 | 6A | j |
| 11 | B | [VERTICAL TAB] | 43 | 2B | + | 75 | 4B | K | 107 | 6B | k |
| 12 | C | [FORM FEED] | 44 | 2C | , | 76 | 4C | L | 108 | 6C | l |
| 13 | D | [CARRIAGE RETURN] | 45 | 2D | - | 77 | 4D | M | 109 | 6D | m |
| 14 | E | [SHIFT OUT] | 46 | 2E | . | 78 | 4E | N | 110 | 6E | n |
| 15 | F | [SHIFT IN] | 47 | 2F | / | 79 | 4F | O | 111 | 6F | o |
| 16 | 10 | [DATA LINK ESCAPE] | 48 | 30 | 0 | 80 | 50 | P | 112 | 70 | p |
| 17 | 11 | [DEVICE CONTROL 1] | 49 | 31 | 1 | 81 | 51 | Q | 113 | 71 | q |
| 18 | 12 | [DEVICE CONTROL 2] | 50 | 32 | 2 | 82 | 52 | R | 114 | 72 | r |
| 19 | 13 | [DEVICE CONTROL 3] | 51 | 33 | 3 | 83 | 53 | S | 115 | 73 | s |
| 20 | 14 | [DEVICE CONTROL 4] | 52 | 34 | 4 | 84 | 54 | T | 116 | 74 | t |
| 21 | 15 | [NEGATIVE ACKNOWLEDGE] | 53 | 35 | 5 | 85 | 55 | U | 117 | 75 | u |
| 22 | 16 | [SYNCHRONOUS IDLE] | 54 | 36 | 6 | 86 | 56 | V | 118 | 76 | v |
| 23 | 17 | [ENG OF TRANS. BLOCK] | 55 | 37 | 7 | 87 | 57 | W | 119 | 77 | w |
| 24 | 18 | [CANCEL] | 56 | 38 | 8 | 88 | 58 | X | 120 | 78 | x |
| 25 | 19 | [END OF MEDIUM] | 57 | 39 | 9 | 89 | 59 | Y | 121 | 79 | y |
| 26 | 1A | [SUBSTITUTE] | 58 | 3A | : | 90 | 5A | Z | 122 | 7A | z |
| 27 | 1B | [ESCAPE] | 59 | 3B | ; | 91 | 5B | [| 123 | 7B | { |
| 28 | 1C | [FILE SEPARATOR] | 60 | 3C | < | 92 | 5C | \ | 124 | 7C | |
| 29 | 1D | [GROUP SEPARATOR] | 61 | 3D | = | 93 | 5D |] | 125 | 7D | } |
| 30 | 1E | [RECORD SEPARATOR] | 62 | 3E | > | 94 | 5E | ^ | 126 | 7E | ~ |
| 31 | 1F | [UNIT SEPARATOR] | 63 | 3F | ? | 95 | 5F | _ | 127 | 7F | [DEL] |

(Image from wikipedia commons)

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

```
pioneers = "Lovelace,Ada-Fleming,Williamina-Hopper,Grace"
```

```
i. num = pioneers.count(',')
   num = num + pioneers.count('-')
   print(pioneers[len(pioneers)-num:])
```

Output:

```
names = pioneers.split('-')
```

```
ii. l = names[0].split(',')
    print(l[1].upper())
```

Output:

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

Output:

- (b) Consider the following shell commands:

```
$ pwd
/Users/login/csci127
$ ls
elev.csv  p50.py  p60.py  snow.csv
```

- i. What is the output for:

```
$ mkdir hwk
$ mv *py hwk
$ ls
```

Output:

- ii. What is the output for:

```
$ cd hwk
$ ls | grep ^p
```

Output:

- iii. What is the output for:

```
$ cd ../
$ pwd
```

Output:

2. (a) Consider the code:

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

- i. After the command: `thomasH.color("#000000")`, what color is `thomasH`?
☐ black ☐ red ☐ white ☐ gray ☐ purple
- ii. After the command: `thomasH.color("#AB0000")`, what color is `thomasH`?
☐ black ☐ red ☐ white ☐ gray ☐ purple
- iii. Fill in the code below to change `thomasH` to be the brightest blue:

```
thomasH.color("#  ")
```

- iv. Fill in the code below to change `thomasH` to be the color white:

```
thomasH.color("#  ")
```

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

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

Output:

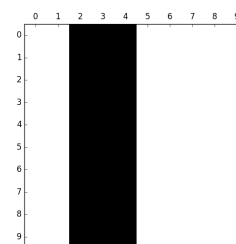
0 1 2 3 4 5 6 7

ii. `for j in range(, ,):`
 `print(i, end=" ")`

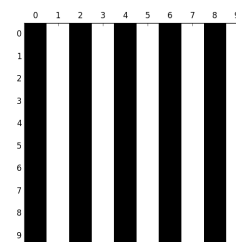
Output:

-5 -3 -1 1

Output:



Output:



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

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

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

in1 = True

i. in2 = False

out = in1 or (not in2)

☐ True

☐ False

in1 = True

ii. in2 = False

out = (in1 or not in2) and in2

☐ True

☐ False

in1 = False

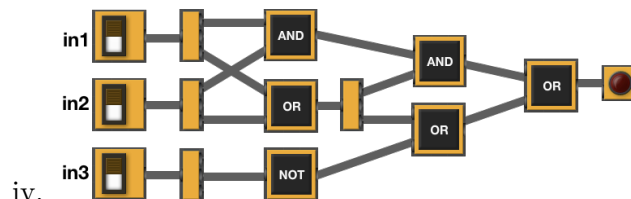
in2 = True

iii. in3 = in1 or not in2

out = not in2 or in3

☐ True

☐ False



in1 = True

in2 = False

in3 = False

☐ True

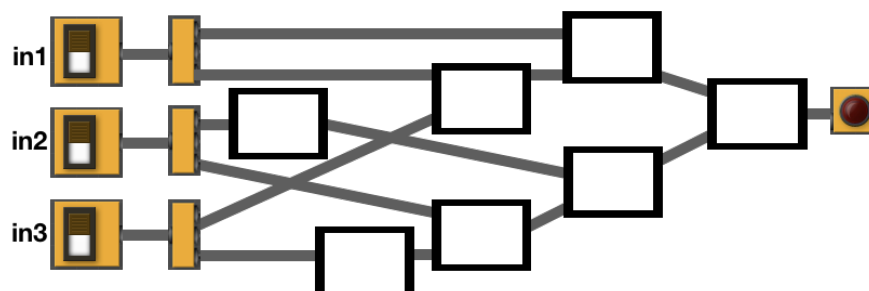
☐ False

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

not in2 or not (in1 or in2)

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

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

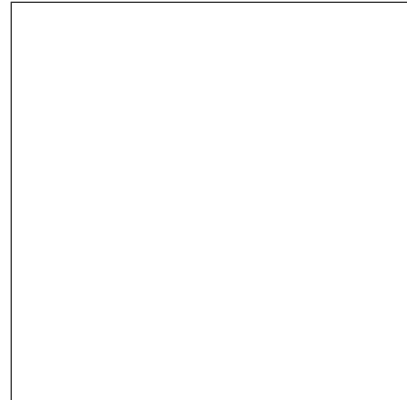


4. (a) Draw the output for the function calls:

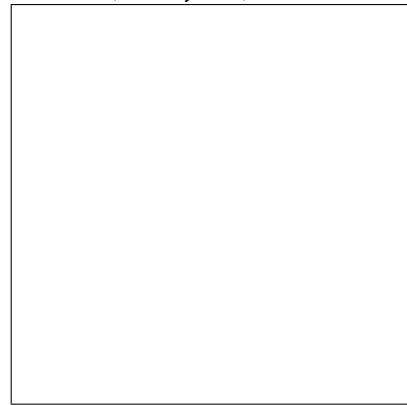
```
import turtle
tara = turtle.Turtle()
tara.shape('turtle')

def ramble(tex, side):
    if side <= 0:
        tex.stamp()
    elif side <= 10:
        for i in range(3):
            tex.left(120)
            tex.forward(20)
    else:
        tex.right(90)
        tex.forward(side)
        ramble(tex, side//2)
```

i. `ramble(tara,5)`



ii. `ramble(tara,160)`



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

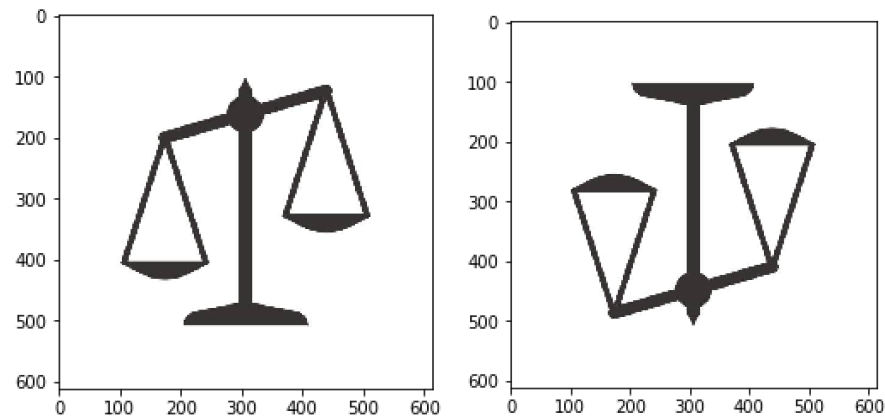
- (c) If you call `ramble(tara, 5)`, which branches of the function are tested:

- ☐ 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(tara, 160)`, which branches of the function are tested:

- ☐ 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).

5. Design an algorithm that rotates an image by 180 degrees (upside down image). For simplicity, you may assume a square image (i.e. same height and length)



Libraries:

Input:

Output:

Process (as a list of steps):

6. Given the FiveThirtyEight dataset containing data on nearly 3 million tweets sent from Twitter handles connected to the Internet Research Agency, a Russian “troll factory”, a snapshot given in the image below:

| author | content | region | language | publish_date | harvested_date | following | followers | updates |
|--------|---|---------|----------|------------------|------------------|-----------|-----------|---------|
| 10_GOP | "We have a sitting Democrat US Senator on trial | Unknown | English | 10/1/2017 19:58 | 10/1/2017 19:59 | 1052 | 9636 | 253 |
| 10_GOP | Marshawn Lynch arrives to game in anti-Trump s | Unknown | English | 10/1/2017 22:43 | 10/1/2017 22:43 | 1054 | 9637 | 254 |
| 10_GOP | JUST IN: President Trump dedicates Presidents | Unknown | English | 10/1/2017 23:52 | 10/1/2017 23:52 | 1062 | 9642 | 256 |
| 10_GOP | Dan Bongino: "Nobody trolls liberals better than | Unknown | English | 10/1/2017 2:47 | 10/1/2017 2:47 | 1050 | 9644 | 247 |
| 10_GOP | '@SenatorMenendez @CarmenYulinCruz Doesn' | Unknown | English | 10/1/2017 2:52 | 10/1/2017 2:53 | 1050 | 9644 | 249 |
| 10_GOP | As much as I hate promoting CNN article, here t | Unknown | English | 10/1/2017 3:47 | 10/1/2017 3:47 | 1050 | 9646 | 250 |
| 10_GOP | After the 'genocide' remark from San Juan Mayc | Unknown | English | 10/1/2017 3:51 | 10/1/2017 3:51 | 1050 | 9646 | 251 |
| 10_GOP | Sarah Sanders destroys NBC reporter: "Trump n | Unknown | English | 10/10/2017 20:57 | 10/10/2017 20:57 | 1066 | 10319 | 301 |
| 10_GOP | Hi @MichelleObama, remember when you praise | Unknown | English | 10/10/2017 22:06 | 10/10/2017 22:06 | 1066 | 10320 | 302 |
| 10_GOP | Wow! Even CNN is slamming the Obamas for sil | Unknown | English | 10/10/2017 22:17 | 10/10/2017 22:17 | 1066 | 10322 | 303 |
| 10_GOP | First lady Melania Trump visits infant opioid treat | Unknown | English | 10/10/2017 23:42 | 10/10/2017 23:42 | 1068 | 10328 | 304 |
| 10_GOP | "It took Hillary abt 5 minutes to blame NRA for n | Unknown | English | 10/11/2017 20:26 | 10/11/2017 20:27 | 1070 | 10358 | 308 |

Fill in the Python program below:

#P6,V1: extracts trolls with highest number of followers

#Import the libraries for data frames and plotting data:

#Prompt user for input file name:

csvFile =

#Read input data into data frame:

trolls =

#Group tweets by author and organize by the number of followers

trollFollowers = trolls.groupby([" "])[" "].max()

#Print the top 3 authors/trolls with largest number of followers

print(trollFollowers[:])

#Generate a bar plot of the top 3 authors/trolls with largest number of followers

trollFollowers.

plt.show()

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 primarily red. A pixel is primarily red if the red value is over 90% and the green and blue values are less than 10%.

#Import the packages for images and arrays:

#Ask user for image name and read into img:

#Get height and width:

#Initialize counter:

#Loop through all the pixels & update count if primarily red:

#Compute and print fraction:

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

Output:

- (b) Modify the program to print out 26 consecutive letters in decreasing order ('Z' down to 'A'). Shade in the box for each line that needs to be changed and rewrite the instruction below.

| | | |
|--------------------------|----------------------------|--|
| <input type="checkbox"/> | ADDI \$sp, \$sp, -11 | # Set up stack |
| <input type="checkbox"/> | ADDI \$s3, \$zero, 1 | # Store 1 in a registrar |
| <input type="checkbox"/> | ADDI \$t0, \$zero, 74 | # Start \$t0 at 74 (J) |
| <input type="checkbox"/> | ADDI \$s2, \$zero, 64 | # Use to test when you reach 64 |
| <input type="checkbox"/> | SETUP: SB \$t0, 0(\$sp) | # Next letter in \$t0 |
| <input type="checkbox"/> | ADDI \$sp, \$sp, 1 | # Increment the stack |
| <input type="checkbox"/> | SUB \$t0, \$t0, \$s3 | # Decrease the letter by 1 |
| <input type="checkbox"/> | BEQ \$t0, \$s2, DONE | # Jump to done if \$t0 == \$s2 |
| <input type="checkbox"/> | J SETUP | # If not, jump back to SETUP for loop |
| <input type="checkbox"/> | DONE: ADDI \$t0, \$zero, 0 | # Null (0) to terminate string |
| <input type="checkbox"/> | SB \$t0, 0(\$sp) | # Add null to stack |
| <input type="checkbox"/> | ADDI \$sp, \$sp, -11 | # Set up stack to print |
| <input type="checkbox"/> | ADDI \$v0, \$zero, 4 | # 4 is for print string |
| <input type="checkbox"/> | ADDI \$a0, \$sp, 0 | # Set \$a0 to stack pointer for printing |
| <input type="checkbox"/> | syscall | # Print to the log |

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

(a)

```
//Quote by Grace Hopper
#include <iostream>
using namespace std;
int main()
{
    cout << "One accurate measurement ";
    cout << "is \nworth a thousand ";
    cout << "expert ";
    cout << "opinions. " << endl << "G.H.";
    return 0;
}
```

Output:

(b)

```
#include <iostream>
using namespace std;
int main()
{
    double num = 0;
    double tot = 0;
    while (tot < 10) {
        cout << "Please enter amount\n";
        cin >> num;
        tot += num;
    }
    cout << tot << endl;
    return 0;
}
```

Given the input: 5, 3, 4

Output:

(c)

```
#include <iostream>
using namespace std;
int main(){
    int i, j;
    for (i = 1; i < 5; i++){
        for (j = 0; j < i; j++){
            if(j % 2 == 0)
                cout << "X";
            else
                cout << "0";
        }
        cout << endl;
    }
    return 0;
}
```

Output:

10. (a) Translate the following python program into a **complete C++ program**:

```
#Python Loops, V1
for i in range(25,101,25):
    print(i+1, i+2)
```

```
//include library and namespace
```

```
//function signature
```

```
{
    //loop line
```

```
    //loop body
```

```
    //return
```

```
}
```

- (b) The number of Instagram monthly active users grew from ~130 million in 2013 to ~1000 million (1 billion) in 2019. The average annual growth rate can then be estimated as

$$\text{avgGrowth} = \frac{\% \text{growth}}{\text{number-of-years}} = \frac{100 \cdot \frac{1000-130}{130}}{2019 - 2013} = 134\%$$

We can thus estimate the average annual growth: **avgGrowth = 134%**.

Write a **complete C++ program** that asks the user for a year greater than 2013 (assume user complies) and prints the estimated number (in millions) of monthly active Instagram users in that year.

```
//include library and namespace
```

```
//function signature
```

```
{  
    //initialize variables
```

```
//obtain input
```

```
//calculate users
```

```
//output users
```

```
//return
```

```
}
```