

Row:	SEAT:

MOCK FINAL EXAM  
 CSci 127: Introduction to Computer Science  
 Hunter College, City University of New York

May 16, 2023

### 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.**

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I understand that all cases of academic dishonesty will be reported to the Dean of Students and will result in sanctions.									
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# 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) Fill in the code below to produce the Output on the right:

```
seasons = "Spring,Summer,Autumn,Winter"
```

```
i. autumn_winter = seasons.split(",")[2:]
   for s in autumn_winter:
       print( s.lower() )
```

**Output:**

```
autumn
winter
```

```
ii. spring_autumn = seasons.split(",")[:2]
    for s in spring_autumn:
        print( s.upper() )
```

**Output:**

```
SPRING
AUTUMN
```

- (b) Consider the following shell commands:

```
$ pwd
/usr/student
$ ls
hello.csv grades.csv test.py hello.py
```

- i. What is the output for:

```
$ mkdir data
$ mv *csv data
$ cd data
$ ls
```

**Output:**

```
hello.csv grades.csv
```

- ii. What is the output for:

```
$ cd ../
$ ls -l | grep hello | wc -l
```

**Output:**

```
1
```

- iii. What is the output for:

```
$ ls | grep test
```

**Output:**

```
test.py
```

2. (a) Select the color corresponding to the rgb values below:

i. `rgb = (65, 65, 65)`

black       red       white       gray       blue

ii. `rgb = "#0000AB"`

black       red       white       gray       blue

iii. `rgb = (255, 255, 255)`

black       red       white       gray       blue

iv. What is the binary number equivalent of decimal number 54?

Decimal 54 = Binary

**Answer: 110110**

v. What is the Decimal number equivalent to Hexadecimal 2F?

Hexadecimal 2F = Decimal

**Answer: 47**

(b) Given the list `fruits` below, fill in the code to produce the Output on the right:

```
fruits = ["orange", "banana", "apple", "cherry", "strawberry"]
```

```
i.
for i in range( 2 ):
    for j in range( 5 ):
        print(fruits[j] 0, end=" ")
```

**Output:**

```
o b a c s
o b a c s
```

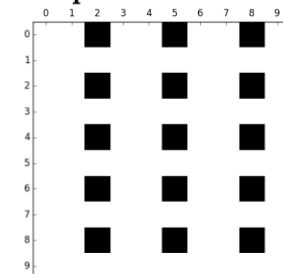
```
ii. for j in range( 0, 5, 2 ):
    print(fruits[j] -1, end=" ")
```

**Output:**

```
e e y
```

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

**Output:**

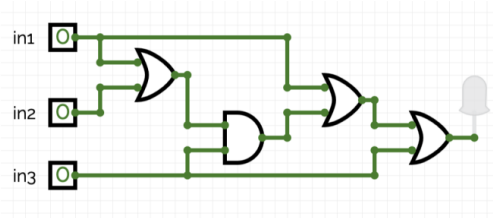


3. (a) What is the value (True/False):

in1 = False  
 i. in2 = True  True  False  
 out = not in1 and in2

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

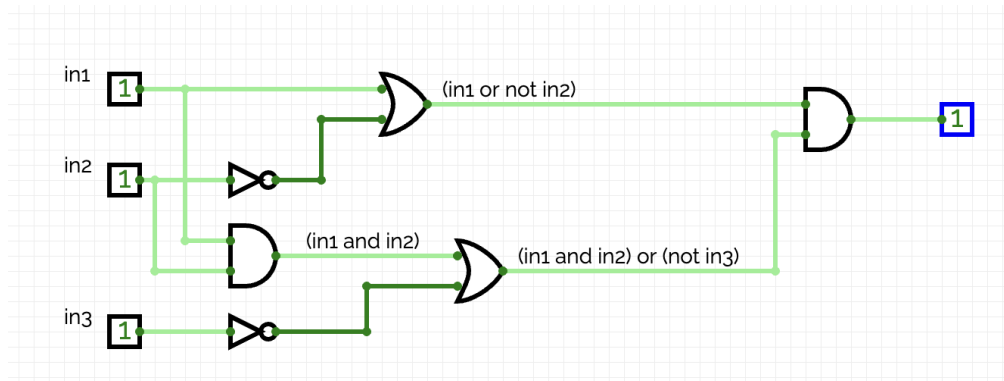
in1 = True  
 in2 = False  
 iii. in3 = not in1 or not in2  
 out = not in1 and in3  True  False



iv.  
 in1 = False  
 in2 = False  
 in3 = False  
 True  False

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

$(in1 \text{ or } \text{not } in2) \text{ and } ((in1 \text{ and } in2) \text{ or } \text{not } in3)$



4. Consider the following functions:

```
def hello(chris, amy):  
    amanda = 0  
    for num in chris:  
        if frog(num, amy):  
            amanda += 2  
  
    return amanda
```

```
def frog(a, b):  
    return a > b  
  
def main():  
    mylist = [1, 6, 5, -3, 7]  
    print(hello(mylist, 2))
```

(a) What are the formal parameters for `frog()`?

a, b

(b) What are the actual parameters for `hello()`?

mylist, 2

(c) How many calls are made to `frog()` after calling `main()`?

5

(d) What is the output after calling `main()`?

i. **Output:**

6

5. Design an algorithm that asks the user for the name of a text file containing a grid of numbers and loads it into a 2D array of integers (think like an image without the color channel), then outputs the index (row, col) of the LARGEST number in the array.

**Libraries:**

**numpy**

**Input:**

**the input file**

**Output:**

**the index of the largest number**

**Design Pattern:**

Search

Find Min

Find Max

Find All

**Principal Mechanisms (select all that apply):**

Single Loop

Nested Loop

Conditional (if/else) statement

Indexing / Slicing

`split()`

`groupby()`

**Process (as a concise and precise LIST OF STEPS / pseudocode):**

(Assume libraries have already been imported.)

**Answer:**

- (a) Ask the user for input file name
- (b) Load the data into a numpy array, call it `grid`
- (c) Set variables `maxRow` and `maxCol` to 0
- (d) Use a nested loop to consider every number in the grid, looping through rows in the outer loop and columns in the inner loop
- (e) If the current number (`grid[currentRow, currentColumn]`) is greater than the number at `grid[maxRow, maxCol]`, set `maxRow` to the current row and set `maxCol` to the current column
- (f) Return `maxRow` and `maxCol`

6. Consider the `medalcount.csv` dataset that reports the medal count for skating at the 2014 Winter Olympics. A snapshot is given in the image below:

Country	Gold	Silver	Bronze
Canada	0	3	0
Italy	0	0	1
Germany	0	0	1
Japan	1	0	0
Kazakhstan	0	0	1
Russia	3	1	1
South Korea	0	1	0
United States	1	0	1

Fill in the Python program below:

```
#Import the libraries for data frames.
```

```
import pandas as pd
```

```
#Read input data into data frame:
```

```
df = pd.read_csv("medalcount.csv")
```

```
#Create a new column that has a total medal count for each country
```

```
df["Total"] = df["Gold"] + df["Silver"] + df["Bronze"]
```



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:**

---

```
#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):

#Increase the count if the current pixel's red, green, and blue values are equal:
        if img[row,col,0] == img[row,col,1] == img[row,col,2]:
            count = count + 1

#Compute and print fraction:
totalPixelCount = height*width
fractionGray = count/totalPixelCount
print("Fraction gray is", fractionGray)
```

---

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

**Output:**

**ABCDE**

- (b) Modify the program to print out the string "abc". Shade in the box for each line that needs to be changed and rewrite the instruction next to it.

`ADDI $sp, $sp, -6`    **Answer: `ADDI $sp, $sp, -4`**

`ADDI $s3, $zero, 1`

`ADDI $t0, $zero, 65`    **Answer: `ADDI $t0, $zero, 97 #(a)`**

`ADDI $s2, $zero, 5`    **Answer: `ADDI $s2, $zero, 3`**

`SETUP: SB $t0, 0($sp)`

`ADDI $sp, $sp, 1`

`SUB $s2, $s2, $s3`

`ADDI $t0, $t0, 1`

`BEQ $s2, $zero, DONE`

`J SETUP`

`DONE: ADDI $t0, $zero, 0`

`SB $t0, 0($sp) # Add null to stack`

`ADDI $sp, $sp, -5`    **Answer: `ADDI $sp, $sp, -3`**

`ADDI $v0, $zero, 4 # 4 is for print string`

`ADDI $a0, $sp, 0 # Set $a0 to stack pointer`

`syscall # Print to the log`

9. Fill in the C++ programs below to produce the Output on the right.

---

```

#include <iostream>
using namespace std;
int main(){
    for( int i = 100; i < 500; i+=100 ){
        cout << i*2 << endl;
    }
    return 0;
}

```

(a)

---

**Output:**

200  
400  
600  
800

---

```

#include <iostream>
using namespace std;
int main(){
    int count = 200;
    int num = 100;
    while( count >= 50 && num >= 90 ){
        cout << count << " " << num << endl;
        count -= 50;
        num -= 5;
    }
    return 0;
}

```

(b)

---

**Output:**

200 100  
150 95  
100 90

---

```

#include <iostream>
using namespace std;
int main(){
    for( int i = 0; i < 5; i++ ){
        cout << "Hello" << endl;
    }
    return 0;
}

```

(c)

---

**Output:**

Hello  
Hello  
Hello  
Hello  
Hello

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

```
for i in range(97,113,3):
    for j in range(i,60,-4):
        print(i," ",j)
```

**Answer:**

---

```
#include <iostream>
using namespace std;

int main() {
    for (int i = 97; i < 113; i += 3) {
        for (int j = i; j > 60; j -= 4) {
            cout << i << " " << j << endl;
        }
    }
    return 0;
}
```

---