

Row:	SEAT:

FINAL EXAM, VERSION 1
CSci 127: Introduction to Computer Science
Hunter College, City University of New York
 20 December 2021

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) Given the quote in the code below, fill in the code to produce the Output on the right:

```
quote = ' "Every moment is a fresh beginning." -T.S Eliot-'
```

i. `print(quote[])`

Output:

T.S Eliot

ii. `print(quote[2:7].)`

Output:

EVERY

iii. `print("This quote has", end=" ")`
`print(quote.count()-2, "words.")`

Output:

This quote has 6 words.

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

```
numbers = "1, 2, 3, 4, 5"
```

i. `num_list = numbers.`

```
for n in num_list :
```

ii. `print()`

Output:

2

3

4

5

6

- (c) Consider the following shell commands:

```
$ ls
```

```
bronx.html  logo.png  queens.html  snow.png
```

- i. What is the output for:

```
$ mkdir maps images
```

```
$ mv *html maps
```

```
$ ls
```

Output:

- ii. What is the output for:

```
$mv *.png images
```

```
$ cd maps
```

```
$ ls | grep ee
```

Output:

- iii. What is the output for:

```
$ cd ../
```

```
$ ls
```

Output:

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

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

black red white gray purple

ii. `rgb = "#AB0000"`

black red white gray purple

iii. `rgb = (1.0, 0.0, 1.0)`

black red white gray purple

iv. Select the SMALLEST Hexadecimal number:

0F 99 A0 FF C3

v. What is the Binary number equivalent to decimal 40?

110100 011101 101000 000111 101010

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

```
words = [ "fast", "clear", "light", "hot", "cold"]
```

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

Output:

fast clear light

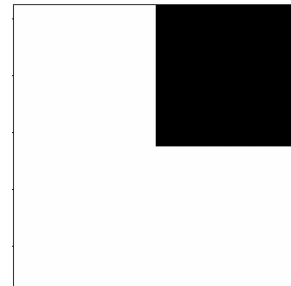
ii. `for j in range(, ,):`
 `print(words[j], end=" ")`

Output:

clear cold

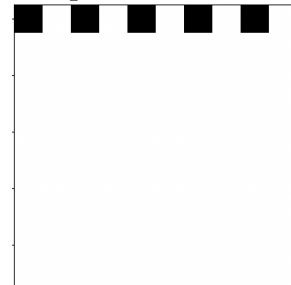
iii. `import numpy as np`
 `import matplotlib.pyplot as plt`
`im = np.ones((10,10,3))`
`im[, , :] = 0`
`plt.imshow(im)`
`plt.show()`

Output:



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

Output:



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

in1 = False

i. in2 = True

True

False

out = not in1 and in2

in1 = False

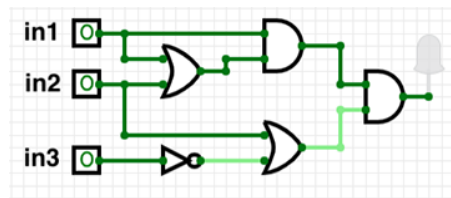
ii. in2 = True

in3 = in1 or not in2

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

True

False



iii.

in1 = True

in2 = True

in3 = False

True

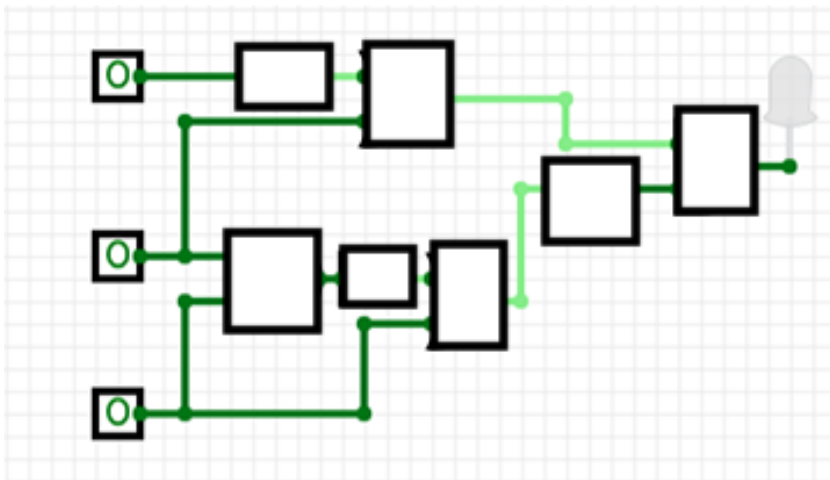
False

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

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

(c) Fill in the circuit with the gate-symbol or gate-name that implements the logical expression:

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



4. Consider the following functions:

```
def count_larger(l, n):  
    count = 0  
    for i in range(len(l)):  
        if compare(l[i], n):  
            count += 1  
    return count
```

```
def compare(num, comp):  
    return num > comp
```

```
def main():  
    numbers = [21, 34, 69, 62, 82, 46, 15]  
    print(count_larger(numbers, 50))
```

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

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

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

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

Output:

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:

Input:

Output:

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()` `input()`

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

(Assume libraries have already been imported.)

6. Consider the `open_restaurants.csv` dataset for **restaurant reopening applications** under Phase Two of the New York Forward Plan to place outdoor seating in front of their business on the sidewalk and/or roadway. **Each row in the dataset corresponds to an application.** A snapshot of the data is given in the image below:

Seating Interest	Restaurant Name	Borough	Sidewalk Area	Roadway Area	Approved for Sidewalk Seating	Approved for Roadway Seating
sidewalk	HUNGRY GHOST	Manhattan	200	640	yes	no
both	Prince Laban&Chinese rest	Queens	144	144	yes	yes
sidewalk	Philly Pretzel Factory	Brooklyn	6500	920	yes	no
both	BICKLES TO GO	Bronx	100	160	yes	yes
roadway	STARBUCKS	Manhattan	160	160	no	yes
roadway	OVENLY	Brooklyn	40	168	no	yes
sidewalk	LE PAIN QUOTIDIEN	Manhattan	105	280	yes	no
both	Le Pain Quotidien GCW	Manhattan	90	240	yes	yes
both	Asian Kabab and Curry	Brooklyn	60	60	yes	yes

Fill in the Python program below:

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

```
#Prompt user for input file name:
```

```
csvFile = 
```

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

```
df = 
```

```
#Print the number of applications for each Seating Interest
# (i.e. number of applications for sidewalk, number for roadway, etc.)
```

```
print()
```

```
#Group the data by Borough to extract applications in Queens
#use groupby and get_group
```

```
queens = 
```

```
#Print the largest sidewalk area in Queens
```

```
print()
```


7. Consider the Python program below to display the multiplication table for an input number. **Fill-in the functions** based on the comments and the overall program. Pay attention to the sample output in the comments in-order to implement the function correctly. Note that the sample output for `print_mult_table` is not complete to save space, **your function must display the full multiplication table**.

```
# Displays multiplication table n
# Example output multiplication table of 3:
# 3 X 1 = 3
# 3 X 2 = 6
# . . .
# 3 X 9 = 27
# 3 X 10 = 30
```

```
def print_mult_table(n):
```

```
# Validate the input to be between 1 and 10
# If the input is not in the expected range,
# keep asking for the number.
# Example output:
# Please enter a number between 1 and 10.
# Display the multiplication table of?
```

```
def validate_input(num):
```

```
# Display multiplication table of an input number in range 1 - 10
```

```
def main():
```

```
    num = int(input("Display multiplication table of? "))
    num = validate_input(num)
```

```
    #print the multiplication table of num
    print_mult_table(num)
```

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

Output:

- (b) Modify the program to print out Hall!
Shade in the box for each line or line-pair that needs to be changed and rewrite the instruction below. If the line needs to be deleted, write *Delete*.

- ADDI \$sp, \$sp, -7

- ADDI \$t0, \$zero, 72 # store 72 in \$t0
SB \$t0, 0(\$sp)

- ADDI \$t0, \$zero, 101 # store 101 in \$t0
SB \$t0, 1(\$sp)

- ADDI \$t0, \$zero, 108 # store 108 in \$t0
SB \$t0, 2(\$sp)

- ADDI \$t0, \$zero, 108 # store 108 in \$t0
SB \$t0, 3(\$sp)

- ADDI \$t0, \$zero, 111 # store 111 in \$t0
SB \$t0, 4(\$sp)

- ADDI \$t0, \$zero, 33 # store 33 in \$t0
SB \$t0, 5(\$sp)

- ADDI \$t0, \$zero, 0 # (null)
SB \$t0, 6(\$sp)

- ADDI \$v0, \$zero, 4 # 4 is for print string

- ADDI \$a0, \$sp, 0 # Set \$a0 to stack pointer

- syscall # Print to the log

(c) Modify the MIPS program below to count from 30 to 0, down by 5. Shade in the box for each line that needs to be changed and rewrite the instruction below.

`ADDI $s0, $zero, 30 #set s0 to 30`

`ADDI $s1, $zero, 3 #set s1 to 3`

`ADDI $s2, $zero, 15 #use to compare for branching`

`AGAIN: SUB $s0, $s0, $s1`

`BEQ $s0, $s2, DONE`

`J AGAIN`

`DONE: #To break out of the loop`

(d) After the modification, how many times is the line labeled `AGAIN:` executed?

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

```

#include <iostream>
using namespace std;
int main()
{
    for(int i = 0; i <=30; ) {
        cout << i*2 << endl;
    }
    return 0;
}

```

(a)

Output:

0
20
40
60

```

#include <iostream>
using namespace std;
int main()
{
    int count = 5;
    int num = 2;
    while(count  && num ) {
        cout << count << " " << num << endl;
        count -=1;
        if(count % 2 == 0)
            num -=1;
    }
    return 0;
}

```

(b)

Output:

5 2
4 1
3 1
2 0
1 0

```

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

```

(c)

Output:

Still counting!
Still counting!
Still counting!
Still counting!
Still counting!
Still counting!
Still counting!
Still counting!
Still counting!

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

```
for i in range(0,10,2):
    for j in range(i,0,-1):
        print(i, j)
```

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

```
//main function signature
```

```
{
```

```
    //outer loop line
```

```
        //inner loop line
```

```
            //loop body
```

```
                //return
```

```
}
```

(b) Write a **complete C++ program** that asks the user for their age and outputs the age category on a new line as follows:

- "Child" if the user is 18 or younger
- "Adult" if the user is older than 18 but less than 65
- "Senior" otherwise

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

```
//main function signature
```

```
{
```

```
  //declare variables
```

```
  //obtain input
```

```
  //output age category
```

```
  //return
```

```
}
```