Row:	Seat:

Final Examination, Version 2
CSci 127: Introduction to Computer Science
Hunter College, City University of New York

Fall 2025

Exam Rules

- Show all your work. Your grade will be based on the work shown.
- You may have pens, pencils and one 8 1/2" x 11" reference sheet filled with notes. No other materials are allowed.
- No phones, computers, tablets, calculators, watches, smart glasses, smart pencils, earpods, or other electronic devices are allowed.
- All electronic devices must be turned off and stored in your bag. If you are not able to turn off the Bluetooth/Wifi on your device, put it in your bag at the front of the room.
- **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:
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1. (a) What will the following Python code print:

```
rom = {'i' : 1, 'v': 5, 'x' : 10}
s = "x+vii+xiv"
num = s.count('+')+1
print("There are", num, "items.")
rnums = s.split('+')
print("Last number is", rnums[-1])
print("First is", rom[rnums[0]])
sum = 0
for c in rnums[1]:
    sum = sum+rom[c]
    print(sum)
print("Middle is:", sum)
```

Output:

(b) The commands below are **run sequentially**, what is the output after each has run:

```
$ ls
nyc.csv  nyc.png  queens.png  si.png
$ pwd
/Users/csguest
```

setup.sh

```
echo "2V2V2V"
mkdir my_files
cd my_files
mkdir notes
mkdir work
```

i.
```
$ mv nyc.png man.png
$ ls
```

Output:

ii.
```
$ mkdir images
$ mv *.png images
$ ls
```

Output:

iii.
```
$ mkdir nyc
$ ls nyc* | wc -l
```

Output:

iv.
```
$ chmod +x setup.sh
$ ./setup.sh
$ cd my_files
$ ls
```

Output:

2. (a) Check all that apply:

   i. What color is `tess` after this command? `tess.color("#FFFFFF")`

   ☐ black ☐ red ☐ white ☐ gray ☐ green

   ii. Select all the **odd** binary numbers:

   ☐ 0001 ☐ 0100 ☐ 0111 ☐ 1011 ☐ 1110

   iii. Select the hexadecimal numbers **larger than the decimal number 20**:

   ☐ 9 ☐ F ☐ 20 ☐ A6 ☐ FF

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

   i.
```
nums = [ 'a', 'b', 'c', 'd', 'e', 'f']

for i in range( ☐ , ☐ , ☐ ):
    print(nums[i], end=" ")
```

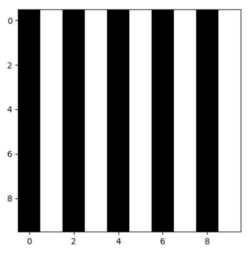
Output:
```
b d f
```

   ii.
```
import numpy as np
import matplotlib.pyplot as plt
img = np.ones( (10,10,3) )

img[ ☐ , ☐ , :] = 0

plt.imshow(img)
plt.show()
```

Output:



   (c) Consider the code:
```
1  import turtle
2  tess = turtle.Turtle()
3  for i in range(5):
4      hex_col = input('Enter color (as hex): ")
5      tess.color(hex_col)
6      tess forward(20)
7      tess.stamp()
```

   i. **Circle** the code above and mark line with **(i)** that caused this error:
```
    hex_col = input('Enter color (as hex): ")
                    ^
SyntaxError: unterminated string literal (detected at line 4)
```
   Write the code that would fix the error:

   ☐

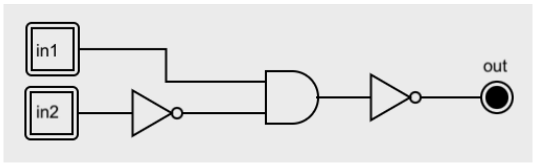
   ii. **Box** the code above and mark line with **(ii)** that caused this error:
```
    tess forward(20)
    ^^^^^^^^^^^^
SyntaxError: invalid syntax
```
   Write the code that would fix the error:

   ☐

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

   i.
```
in1 = False
in2 = True
out = in1 or in2
```
   out =

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

   iii. 

   out =

```
in1 = True
in2 = True
```

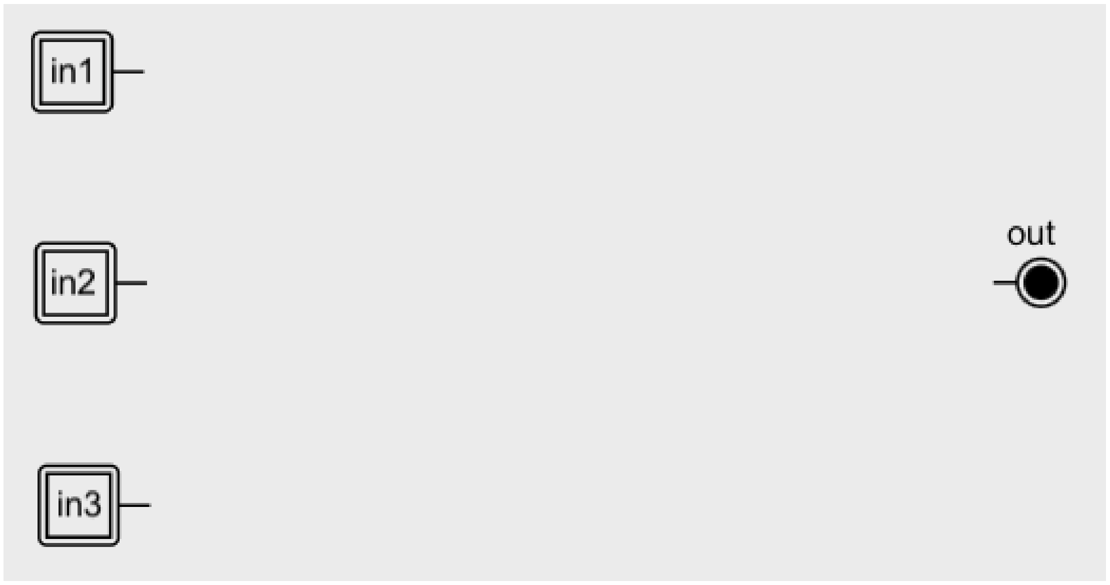
(b) Fill in the values to yield the output:

   i.
```
in1 =
in2 =
```
   out = `False`

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

(c) Design a circuit that implements the logical expression:

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



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

i. `ramble(tia,0)`

ii. `ramble(tia,5)`

```
import turtle
tia = turtle.Turtle()
tia.shape("circle")

def ramble(t,side):
    if side < 3:
        t.stamp()
    else:
        for i in range(side):
            t.forward(side*10)
            t.left(360/side)
        ramble(t,side-1)
```

(b) For the following code:

```
def helper(greet, name):
    if len(greet) < 5:
        greet = greet + greet
    msg = greet + " " + name
    return ( msg.lower() )
```

```
def v2():
    mess = "HeLLo"
    th = "Thomas"
    yun = helper(mess,th)
    return yun
```

i. What are the formal parameters for `helper()`:

ii. What are the actual parameters for `helper()` when called in `v2()`:

iii. What value does `v2()` return:

5. Design an algorithm that inputs two strings and returns true if, the two words use exactly the same letters (e.g. anagrams). For example, your algorithm should return false for `"monsoon", "moons"` since `"monsoon"` has 3 o's while `"moons"` has only 2. Your algorithm should return true for `"angered", "enraged"` since they have the same letters occurring the same number of times.

Libraries: (if any)	
Input:	
Output:	

Design Pattern:

☐ Accumulator ☐ Max/Min ☐ Finding Duplicates ☐ Searching

Principal Mechanisms (select all that apply):

☐ Loop	☐ Conditional (if/else)	☐ Recursion	☐ Indexing/slicing
☐ `input()`	☐ Dictionary	☐ List Comprehension	☐ Regular Expressions

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

(Assume libraries have already been imported.)

6. Fill in the Python code below that creates an interactive map using Plotly Express.

```
#Libraries used:



#Read in names, latitutes, and longitudes into separate variables:

name_str =

lat_str =

lon_str =

#Split up the inputted strings into lists:

names =

lats =

lons =

#Set up a dictionary of the lists (used to make df):



#Make a DataFrame of the dictionary:



#Use column names of df for keyword args:



#Ask for output file name:



#Write DataFrame to specified file:
```

7. Write a **complete Python program** that makes a DataFrame to store addresses and saves the DataFrame in a CSV file. Your program should ask the user for:

   - A list of last names,
   - A list of first names,
   - A list of emails, and
   - The name for the output (CSV) file.

   For example, a sample run of your program:

```
Enter last names: Hunter Raab Kirschner Cantor
Enter first names: Thomas Jennifer Anne Nancy
Enter emails: th1870@hunter jr2001@hunter ak2023@hunter nc2024@hunter
Enter file name:  addr.csv
```

   would create a DataFrame:

```
        Last     First         emails
0     Hunter    Thomas  th1870@hunter
1       Raab  Jennifer  jr2001@hunter
2  Kirschner      Anne  ak2023@hunter
3     Cantor     Nancy  nc2024@hunter
```

   and save the results to `addr.csv`.

8. (a) Consider the following MIPS program:

```
ADDI $s0, $zero, 2
ADDI $s1, $zero, 3
SUB $s2, $s1, $s0
ADD $s3, $s1, $s2
```

After the program runs, what is the value stored in:

$s0 register	$s1 register	$s2 register	$s3 register

(b) Consider the MIPS code:

```
ADDI $sp, $sp, -5
ADDI $t0, $zero, 49
ADDI $s2, $zero, 57
SETUP: SB $t0, 0($sp)
ADDI $sp, $sp, 1
ADDI $t0, $t0, 2
BEQ $t0, $s2, DONE
J SETUP
DONE: ADDI $t0, $zero, 0
SB $t0, 0($sp)
ADDI $sp, $sp, -4
ADDI $v0, $zero, 4
ADDI $a0, $sp, 0
syscall
```

i) How many character are printed?	
ii) What is the first character printed?	
iii) What is the whole message printed?	
iv) Detail the changes needed to the code to print the message in reverse:	

9. (a) What is the output:

```
#include <iostream>
using namespace std;
int main()
{
    cout << "One fish, ";
    cout << "two fish" << endl << "red ";
    cout << "fish, blue fish\n";
    cout << "Dr. Seuss";
    return 0;
}
```

Output:

(b) Fill in the missing code to yield the output:

```
#include <iostream>
using namespace std;
int main()
{
    int myst = -10, quest = 8;
    while ( (myst < 25) && (quest > 0) )
    {
        cout << myst << "\t" << quest << endl;



    }
    return 0;
}
```

Output:

```
-10    8
0      6
10     4
20     2
```

(c) What is the output:

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

Output:

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

C++ program:

Python program:

```
num = 1
while num %2 != 0:
    num = int(input('Enter even number:'))
print("You entered", num)
```

(b) Write a **complete C++ program** that asks for the number of repetitions, print `"Hello!"` that many times.

A sample run of your code:

```
Enter repetition time:  5
Hello!
Hello!
Hello!
Hello!
Hello!
```

SCRATCH PAPER

SCRATCH PAPER

CSCI 127 Reference Sheet, Fall 2025

Turtles: Let t be a turtle.

Function	Description
`t=Turtle.turtle()`	Creates turtle `t`.
`t.forward(x)`	Moves `t` forward `x` steps.
`t.backward(x)`	Moves `t` backward `x` steps.
`t.left(x)`/`t.right(x)`	Turns `t` left/right `x` degrees.
`t.penup()`/`t.pendown()`	Lifts `t`'s pen up/down.
`t.stamp()`	Stamps at `t`'s current location.
`t.goto(x,y)`	Moves `t` to `(x,y)`.

String Methods: Let s be a string.

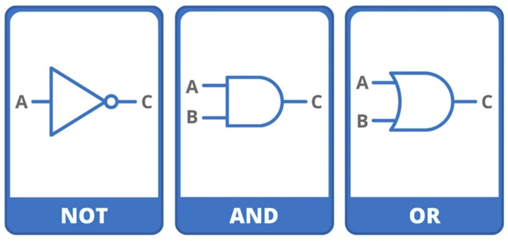
Function	Description
`len(s)`	Returns the length of `s`.
`s.lower()`	Returns `s` as lower case characters.
`s.upper()`	Returns `s` as upper case characters.
`s.count(t)`	Returns count of t in s.
`s.find(t)`	Returns index of t in s (-1 not found).
`s.split(d)`	Splits `s` into list of strings on `d`.
`s.join[lst]`	Joins `lst` into a string, by `s`.
`s[i:j]`	Substring (slice) of s: from i to j-1.
`ord(c)`	Returns Unicode/ASCII of `c`.
`chr(i)`	Returns character of `i`.

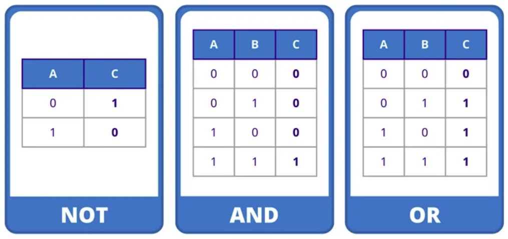
Containers: Lists, Ranges & Dictionaries.

Function	Description
`l = []`	Creates an empty list.
`l = [a,b,c]`	List with 3 elements.
`l.append(elt)`	Adds `elt` to end of list.
`l[i]`	Access element at index `i`.
`range(start,stop,step)`	Range object from `start` to `stop-1`, by `step`.
`zip(l1,l2)`	Combines `l1` & `l2` pairwise.
`[x*x for x in l1]`	List of `l1`'s elements squared. (using list comprehension).
`d = {}`	Creates an empty dictionary.
`d = {k1:v2,k2:v2}`	Dictionary of key/value pairs.
`d[k] = v`	Adds `k:v` to dictionary.
`d[k]`	Access value at key `k`.
`k in d`	Checks if key is in dictionary.
`d.keys() / d.values()`	Returns keys/values of `d`.

Functions:

Function	Description
def fname(x,y):	Defines function, `fname`, with
`command1`	(formal) input parameters, `x` and `y`.
`command2...`	Body of function indented.
`return(v)`	Returns value `v`.
`c = fname(a,b)`	Calls/invokes `fname` with (actual) parameters `a` & `b`, returns to `c`.





NOT

A	C
0	1
1	0

AND

A	B	C
0	0	0
0	1	0
1	0	0
1	1	1

OR

A	B	C
0	0	0
0	1	1
1	0	1
1	1	1

(from truthtablegen.com)

numpy: Let np be the numpy package.

Function	Description
`arr_z = np.zeros((10,20,3))`	Sets up array for 10x20 black image.
`arr_1 = np.ones((10,20,z))`	Sets up array for 10x20 white image.
`arr[start:stop:step]`	Slice from `start` to `stop-1` by `step`.
`arr = plt.imread('image.png')`	Read in an image.
`plt.imshow(arr)`	Show `arr` as image.
`plt.show()`	
`plt.imsave('image.png', arr)`	Save an array to file.

Pandas: Let pd the Pandas package, df be a DataFrame, & s a Series.

Function	Description
`pd.read_csv(fn)`	Returns a DataFrame with file `fn`.
`pd.DataFrame(d)`	Returns DataFrame from dictionary `d`.
`df.to_csv(fn)`	Writes `df` to `fn`.
`df[col]`	Returns `col` column as a Series.
`df[[col1,col2]]`	Returns DataFrame with `col1` & `col2`.
`df.columns`	List of column names of `df`.
`df.head(n)`/`df.tail(n)`	First/last `n` lines of `df`.
`df.plot(x=col)`	Returns a figure with `col` as x-axis.
`fig.savefig(fn)`	Writes `fig` to `fn`.
`s.min()`/`s.max()`/`s.mean()`	Returns min/max/average of `s`.
`s.value_counts()`	Counts # times each value occurs.
`df.groupby(col)`	Groups `df` by values in `col`.

Plotly Express: Let px be the Plotly Express package.

Function	Description
longitude	Degrees east/west from -180 to 180.
latitude	Degrees north/south from -90 to 90.
px.scatter_geo(df,...)	Returns outline map as fig. Keywords args: `lon,lat,size,hover_name,projection,title`.
px.scatter_map(df,...)	Returns tiled map as fig. Keywords args: `lon,lat,size,hover_name,title,zoom`.
fig.show()	Displays map on browser.
fig.write_html(fn)	Writes `fig` to `fn`.

MIPS: Let rs, rt, & rd be registers.

Function	Description
`ADD rd, rs, rt`	Adds values of rs and rt and stores in rd.
`ADDI rd, rs, imm`	Adds values of rs and imm and stores in rd.
`SUB rd, rs, rt`	Subtracts values of rs and rt and stores in rd.
`BEQ rs, rt, target`	If registers `rs == rt`, jump to `target`.
`JUMP target`	Jump to target.

UNIX:

Function	Description
`ls` / `ls -l` / `ls *.py`	Lists files / lists long / lists matching pattern.
`cp x y` / `mv x y`	Copies/renames file x to file y.
`pwd`	Prints path to current directory.
`mkdir x`	Creates directory called `x`.
`cd ../` / `cd /usr/bin`	Changes directory via relative/absolute path.
`echo "message"`	Displays message
`ls|wc -c` / `ls|grep pat`	Uses pipes to count # of files/match `pat`

C++:

Function	Description
`#include <iostream>`	Includes library with `cin/cout`.
`using namespace std;`	Use standard names w/o `std::`.
`int main() {...}`	Function definition.
`int x;`	Declares variable `x` to be an integer.
`float y;`	Declares variable `y` to be a float.
`cin >> x;`	Reads input into `x`.
`cout << x;`	Prints `x`.
`for (i=0; i<10; i++){...}`	Basic for-loop.
`while (logicalExpression){...}`	Basic while-loop.
`return(v);`	Returns value `v`.

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]

(From wikipedia commons)