

FINAL EXAM, VERSION 4  
CSci 127: Introduction to Computer Science  
Hunter College, City University of New York

28 May 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, 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.									
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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:

```
s = "The%North**The%Mountain**The%Islands**The%Rock**The%Stormlands"
i. kingdoms = s.split('**')
   print(s.count('**'))
   print(s[-20:-16])
```

**Output:**

```
kingdoms = s.split('**')
m = kingdoms[1]
ii. words = m.split('%')
   print(words[1].upper())
```

**Output:**

```
for kingdom in kingdoms:
iii.     word = kingdom.split('%')
        print(word[1])
```

**Output:**

- (b) Consider the following shell commands:

```
$ ls
homework  p40.py  p41.py  p55.cpp  trees.csv
```

- i. What is the output for:

```
$ cp p55.cpp prog55.cpp
$ ls
```

**Output:**

- ii. What is the output for:

```
$ mv p*. * homework
$ ls | grep *. *
```

**Output:**

- iii. What is the output for:

```
$ pwd
/Users/yourlogin
$ echo "hello, you are in $PWD."
```

**Output:**

2. (a) For each row below containing a decimal and hexadecimal number, circle the **largest value** in the row (or “Equal” if both entries have the same value):

	Decimal:	Hexadecimal:	Equal
a)	<input type="checkbox"/> 254	<input type="checkbox"/> FF	<input type="checkbox"/> <i>Equal</i>
b)	<input type="checkbox"/> 10	<input type="checkbox"/> A	<input type="checkbox"/> <i>Equal</i>
c)	<input type="checkbox"/> 38	<input type="checkbox"/> 25	<input type="checkbox"/> <i>Equal</i>
d)	<input type="checkbox"/> 22	<input type="checkbox"/> 16	<input type="checkbox"/> <i>Equal</i>
e)	<input type="checkbox"/> 20	<input type="checkbox"/> 20	<input type="checkbox"/> <i>Equal</i>

- (b) Given the function below

```
def decimalToOctString(decNum):  
    octString = ""  
    while decNum > 0:  
        if decNum % 8 == 0:  
            lead = '0'  
        else:  
            lead = str(decNum % 8)  
        octString = lead + octString  
        decNum = decNum // 8  
    print(octString)
```

- i. What is the output of `decimalToOctString(8)`

**Output:**

- ii. What is the output of `decimalToOctString(15)`

**Output:**

What is the output of `decimalToOctString(64)`

**Output:**

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

`in1 = False`

i. `in2 = True`

`out = not in1 or not in2`

out =

`in1 = False`

ii. `in2 = True`

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

out =

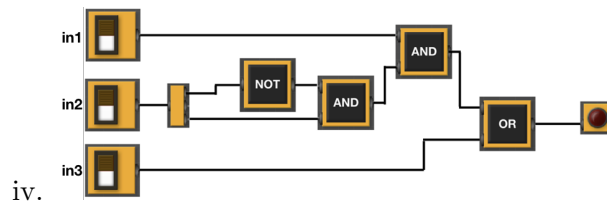
`in1 = not True`

`in2 = not False and False`

iii. `in3 = not in1 and not in2`

`out = not in2 or not in3`

out =



`in1 = True`

`in2 = True`

`in3 = False`

out =

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

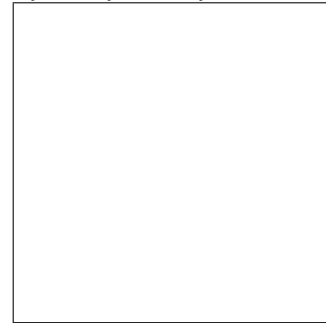
$(\text{not}(\text{not}(\text{in1 and in2}) \text{ or } (\text{not in2}))) \text{ and } ((\text{not in3 or in3}) \text{ or } (\text{not}(\text{in2 and in3})))$

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

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

def mystery(tommy, n):
    tommy.left(180)
    for i in range(n):
        tommy.right(90)
        tommy.forward(50)
        tommy.left(90)
        tommy.forward(50)
```

- i. `mystery(tammy, 5)`



- ii. what are the formal parameters of `mystery1`?

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- (b) Given the function definition:

```
def enigma(n):
    for i in range(n,0,-1):
        help(i)
        print()
```

```
def help(x):
    for j in range(x):
        print((x+j) % 2, end=' ')
```

- i. What is the output for `enigma(6)`?


5. Design an algorithm that prints out the number of 311 calls reporting “Illegal Parking” after a user-specified date from the NYC 311 calls OpenData. Specify the libraries, inputs and outputs for your algorithm and give the design in pseudocode.

Unique Key	Created Date	Closed Date	Agency	Agency Name	Complaint Type
42102569	04/01/2019 12:00:14 AM	04/01/2019 07:43:05 AM	NYPD	New York City Police Department	Noise - Residential
42101059	04/01/2019 12:00:21 AM	04/01/2019 06:12:11 AM	NYPD	New York City Police Department	Illegal Parking
42099515	04/01/2019 12:01:01 AM	04/01/2019 02:27:27 AM	NYPD	New York City Police Department	Blocked Driveway
42103744	04/01/2019 12:01:31 AM	04/01/2019 01:51:02 AM	NYPD	New York City Police Department	Noise - Residential
42102533	04/01/2019 12:01:50 AM	04/01/2019 12:24:02 AM	NYPD	New York City Police Department	Illegal Parking
42102278	04/01/2019 12:03:02 AM	04/01/2019 01:51:01 AM	NYPD	New York City Police Department	Noise - Residential
42098650	04/01/2019 12:03:11 AM	04/01/2019 05:33:50 PM	NYPD	New York City Police Department	Noise - Residential
42107429	04/01/2019 12:03:41 AM	04/03/2019 10:46:33 AM	HPD	Department of Housing Preservation	HEAT/HOT WATER
42110677	04/01/2019 12:04:37 AM	04/01/2019 12:04:37 AM	DOB	Department of Buildings	Building/Use
42103502	04/01/2019 12:04:38 AM	04/01/2019 07:05:09 AM	NYPD	New York City Police Department	Noise - Residential

**Libraries:**

**Input:**

**Output:**

**Process:**

6. Fill in the Python program that will:

- prompt the user for the name of the input file
- prompt the user for the name of the output file
- read the image from the input file into a data frame
- compute the height and width of the image
- extract the **right quarter** of the image and save it to the output file



#P6,V4: saves the right quarter of an image

#Import the libraries for storing and displaying images:

#Prompt user for input file name:

#Prompt user for output file name:

#Read image into a numpy array:

#Compute the height of the image

#Compute the width of the image

# Select right quarter and store in rightQuarterImg

#Save the right quarter image



7. Complete the following program, based on the payroll dataset in the image below and the comments in the functions:

Fiscal Year	Agency Name	Agency Start Date	Work Location Borough	Title Description	Base Salary	Pay Basis	Regular Hours	OT Hours
2018	BOARD OF ELECTION	07/28/2014	MANHATTAN	TEMPORARY CLERK	13.79	per Hour	234.18	75.75
2018	BOARD OF ELECTION	02/28/2016	QUEENS	TEMPORARY CLERK	15	per Hour	1664.55	87
2018	BOARD OF ELECTION	03/13/2016	BRONX	FINANCIAL CLERK	19.79	per Hour	1638.88	66.25
2018	BOARD OF ELECTION	10/02/2017	BRONX	TEMPORARY CLERK	15	per Hour	1195.75	57.5
2018	BOARD OF ELECTION	10/31/2016	BRONX	TEMPORARY CLERK	15	per Hour	1339.38	60.75
2018	BOARD OF ELECTION	06/11/2012	BRONX	TEMPORARY CLERK	15	per Hour	1258.75	58.25

```
import pandas as pd
def readDataFrame():
    """ Prompts the user for the name of the input file.
    Reads the dataframe.
    Returns the dataframe."""

    def alterDataFrame(df):
        """ Prompts the user for the name of the new column.
        Computes the new column as total hours worked (regular hours + OT hours).
        Returns the dataframe with the new column and the new column's name."""

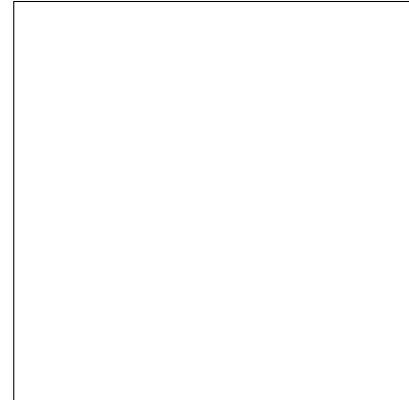
        def printColumnAverage(df, column):
            """ Prints the average of the column."""

        def main():
            df = readDataFrame()
            df2, newColName = alterDataFrame(df)
            printColumnAverage(df2, newColName)
```

8. (a) What are the values of register \$s0 for the run of this MIPS program:

```
#Sample program that loops up to 50
ADDI $s0, $zero, 10 #set s0 to 10
ADDI $s1, $zero, 5 #use to increment counter, $s0
ADDI $s2, $zero, 50 #use to compare for branching
AGAIN: ADD $s0, $s0, $s1
BEQ $s0, $s2, DONE
J AGAIN
DONE: #To break out of the loop
```

Values of register \$s0:



- (b) Indicate what modifications are needed to the MIPS program (repeated below) so that it decrements by 10 all the way down to 0 (shade in the box for each line that needs to be changed and rewrite the instruction in the space below).

☐ ADDI \$s0, \$zero, 10 #set s0 to 10

☐ ADDI \$s1, \$zero, 5 #use to increment counter, \$s0

☐ ADDI \$s2, \$zero, 50 #use to compare for branching

☐ AGAIN: ADD \$s0, \$s0, \$s1

☐ BEQ \$s0, \$s2, DONE

☐ J AGAIN

☐ DONE: #To break out of the loop

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

(a)

```
//Quote by George R.R. Martin, A Game of Thrones
#include <iostream>
using namespace std;
int main(){
    cout << "We are only human and";
    cout << "\nthe gods have fashioned ";
    cout << "us for love." << endl;
    cout << "That is our great glory\n";
    cout << "and our great tragedy.";
    return 0;
}
```

**Output:**

(b)

```
//More GOT
#include <iostream>
using namespace std;
int main(){
    int count = 0;
    while (count < 3) {
        cout <<"Laughter is... \n";
        count++;
    }
    cout << "\npoison to fear.";
    cout << endl;
    return 0;
}
```

**Output:**

(c)

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

**Output:**

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

```
#Python Loops, V4:
for i in range(50,0,-10):
    print('*', i, '*')
```

- (b) Assume that sea level rises 0.75% each year. Write a **complete C++ program** that asks the user for the starting elevation and computes the number of years it will take until the coast is under water.