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

21 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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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:

i.
```
s = "51st@Street&59th@Street&68th@Street&77th@Street"
print(s.count('&'))
print(s[-6:])
```

Output:

ii.
```
stops = s.split('&')
hc = stops[2]
words =  hc.split('@')
print(words[0])
```

Output:

iii.
```
for station in stops:
    print(station[:2])
```

Output:

(b) Consider the following shell commands:

```
$ ls
logo.png map.png payroll.csv  prog4.py  prog5.py  prog6.cpp
```

i. What is the output for:

```
$ ls *.png
```

Output:

ii. What is the output for:

```
$ mkdir homework
$ ls
```

Output:

iii. What is the output for:

```
$ ls -l | grep "prog" | wc -l
```

Output:

2. (a) For each row below containing a decimal and hexadecimal number, shade the box corresponding to the **largest value** in the row (or "Equal" if both entries have the same value):

	Decimal:	Hexadecimal:	Equal
a)	☐ 10	☐ 10	☐ *Equal*
b)	☐ 14	☐ E	☐ *Equal*
c)	☐ 35	☐ 20	☐ *Equal*
d)	☐ 21	☐ 15	☐ *Equal*
e)	☐ 250	☐ FF	☐ *Equal*

(b) Given the function below

```
def binaryStringToDecimal(binString):
    decNum = 0
    for c in binString:
        n = int(c)
        decNum = (decNum * 2) + n
    print(decNum)
```

i. What is the output of binaryStringToDecimal('10')

Output:

ii. What is the output of binaryStringToDecimal('1111')

Output:

What is the output of binaryStringToDecimal('11010')

Output:

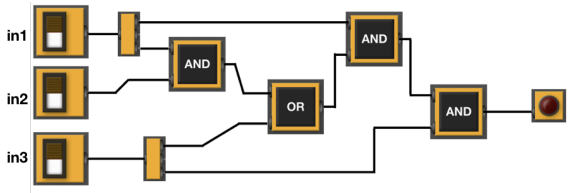
3. (a) What is the value (True/False):

i.
```
in1 = True
in2 = False
out = in1 and not(in2)
```
out = ____

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

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

iv.




```
in1 = True
in2 = False
in3 = True
```
out = ____

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

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

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

```
import turtle

def mystery1(tess, x, y):
    for i in range(2):
        tess.forward(x)
        tess.left(90)
        tess.forward(y)
        tess.left(90)

def mystery2(tina, s):
    mystery1(tina, s, s)


taj = turtle.Turtle()
```

i. `mystery1(taj, 100, 20)`

ii. `mystery2(taj, 100)`

(b) Given the function definitions:

```
def enigma(n):
   for i in range(n+1):
      help(i)
   print()
```

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

i. What is the output for `enigma(5)`?

5. Design an algorithm that prints out the number of "HONDA" cars that were issued tickets after a user-specified date from the NYC parking tickets OpenData. Specify the libraries, inputs and outputs for your algorithm and give the design in pseudocode.

Summons Number	Plate ID	Registration State	Plate Type	Issue Date	Violation Code	Vehicle Body Type	Vehicle Make	Issuing Agency
1452304336	HDD4487	NY	PAS	03/01/2019	50	SUBN	HONDA	P
1452304312	HLB4369	NY	PAS	03/01/2019	50	SDN	NISSA	P
1454397573	GYC8645	NY	PAS	03/03/2019	46	SUBN	FORD	P
1454528242	797AD2	MA	PAS	03/11/2019	21	SUBN	JEEP	S
1440960963	HHY4596	NY	PAS	03/11/2019	21	SDN	TOYOT	S
1453641105	HXF9462	99	PAS	03/14/2019	21	SUBN	TOYOT	S
1449273531	HPJ5059	NY	PAS	03/14/2019	14	SDN	HONDA	P
1434121811	T772573C	NY	PAS	03/31/2019	19	SDN	TOYOT	P
1453583476	XDDY62	NJ	PAS	04/03/2019	14	DELV	FUS	P
1453282713	GVN2523	NY	PAS	04/03/2019	21	SUBN	TOYOT	S
1448651736	HPK2366	NY	PAS	04/04/2019	48	SDN	MITSU	P

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 **top quarter** of the image and save it to the output file


```
#P6,V2: saves the top 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 top quarter and store in topQuarterImg
```

```
#Save the top 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 the gross pay for the regular hours worked
     (base salary * regular 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 down from 100
ADDI $s0, $zero, 100 #set s0 to 100
ADDI $s1, $zero, 20 #use to decrement counter, $s0
ADDI $s2, $zero, 20 #use to compare for branching
AGAIN: SUB $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, 100 #set s0 to 100`

☐ `ADDI $s1, $zero, 20 #use to decrement counter, $s0`

☐ `ADDI $s2, $zero, 20 #use to compare for branching`

☐ `AGAIN: SUB $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 << "A mind needs books ";
  cout << "as \na sword needs ";
  cout << "a whetstone," << endl;
  cout << "if it is to keep its edge.";
  return 0;
}
```

Output:

(b)

```
//More GOT
#include <iostream>
using namespace std;
int main()
{
  int count = 3;
  while (count > 0) {
    cout <<"Winter is coming ";
    count--;
  }
  cout << "!\nNothing burns ";
  cout << "like the cold." << endl;
  return 0;
}
```

Output:

(c)

```
//tic tac toe
#include <iostream>
using namespace std;
int main()
{
    int i, j;
    for (i = 0; i < 3; i++)
    {
        for (j = 0; j < 3; j++)
            if ( j % 2 == 0)
                cout << "X";
            else
                cout << "O";
        cout << endl;
    }
  return 0;
}
```

Output:

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

```
#Python Loops, V2:
for i in range(100,0,-10):
    print(i)
```

(b) Write a **complete C++ program** to compute the ticket price to enter the Metropolitan Museum of Art. Your program must ask the user for their age and print "Child: $0" if the age entered is 12 or less, "Adult: $25" if the age entered is less than 65, and "Senior: $17" otherwise.