Row:	Seat:

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

23 May 2022

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.**

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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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:

```
workdays = "Monday?Tuesday?Wednesday?Thursday?"
summer_months = "*June*July*August*"
long_weekend = "Friday_Saturday_Sunday"
seasons = "+Spring+Summer+Fall+Winter"
```

i.
```
print( [          ], [          ])
```
Output:
```
June Thursday
```

ii.
```
months = summer_months[     ].split(     )
print("Summer has" , len(     ), "months.")
```
Output:
```
Summer has 3 months.
```

iii.
```
for m in     
    print(          )
```
Output:
```
june
july
august
```

(b) Consider the following shell commands:

```
$ ls
hello.py  pictures    pp_hello.cpp    temp
```

i. What is the output for:
```
$ mv hello.py   p1.py
$ ls
```
Output:

ii. What is the output for:
```
$ mkdir python
$ mv *.py  python
$ ls
```
Output:

iii. What is the output for:
```
$ cd python
$ mkdir p50_60
$ mkdir py_5
$ ls | grep py
```
Output:

2. (a) Select the correct option.

   i. What color is tina after this command? `tina.color(0.5,0.5,0.5)`
   ☐ black ☐ red ☐ white ☐ gray ☐ purple

   ii. Select the SMALLEST Binary number:
   ☐ 0110 ☐ 1001 ☐ 1101 ☐ 1011 ☐ 0000

   iii. Select the LARGEST Hexadecimal number:
   ☐ 0A ☐ 22 ☐ A0 ☐ FF ☐ CD

   iv. What is the decimal number equivalent to binary 10110?
   ☐ 16 ☐ 25 ☐ 24 ☐ 22 ☐ 18

   v. What is the decimal number equivalent to hexadecimal 18?
   ☐ 24 ☐ 19 ☐ 28 ☐ 13 ☐ 23

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

```
nums = [ 23, 45, 76, 23, 98, 45 , 11, 4, 33, 29, 5, 66]
```

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

Output:
```
45 11 4 33 29 5
```

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

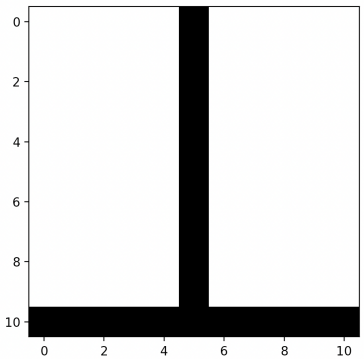
Output:
```
23 23 11 29
```

iii.
```
import numpy as np
import matplotlib.pyplot as plt
img = np.ones( (11,11,3) )

img[____ , ____ , :]  = 0 # black row

img[____ , ____ , :]  = 0 # black column
plt.imshow(img)
plt.show()
```

Output:

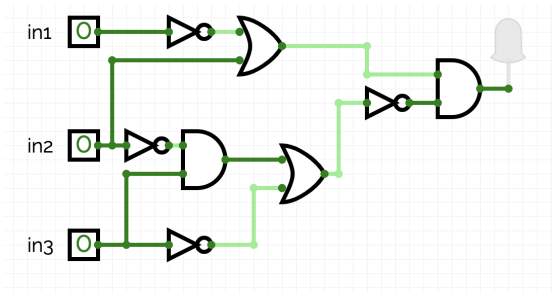


3. (a) What is the value (True/False):

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

ii.
```
in1 = False
in2 = False
in3 = ( not in1 ) or ( not in2 )
out = (not in1 or not in2) and (not in2 or in3)
```
☐ True ☐ False

iii.




```
in1 = True
in2 = True
in3 = False
```
☐ True ☐ False

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

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

4. Consider the following functions:

```
def meow(n, ch):
   for i in range(1,n):
      woof(i, ch)
      print()
```

```
def woof(i, l):
    for j in range(i):
      print(l, end='')


def main():
      meow(6, 'X')
```

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

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

(c) How many calls are made to `woof()` 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 csv file and the name of a column, then returns the number values in that column that repeat more than once. For example, if the column contains values [a, b, b, a, c, c, c, d, e, f], the program returns 3, because a, b and c are repeated, while d, e and f occur only once. You must write detailed **pseudocode** as a precise list of steps that completely and precisely describe the algorithm.

Libraries (if any):

Input:

Output:

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, if any, have already been imported.)

6. Consider `apple_stocks.csv` from the Apple Stock Price dataset from kaggle, reporting Apple's stock prices (in USD $) from December 1980 to May 2022. **Each row in the dataset corresponds to the stock values for one day of trading**. A snapshot of the data is given in the image below:

Date	Open	High	Low	Close	Volume
1980-12-12	0.128348	0.128906	0.128348	0.128348	469033600
1980-12-15	0.122210	0.122210	0.121652	0.121652	175884800
1980-12-16	0.113281	0.113281	0.112723	0.112723	105728000
1980-12-17	0.115513	0.116071	0.115513	0.115513	86441600
...					
2022-04-28	159.25000	164.52000	158.92999	163.63999	130216800
2022-04-29	161.83999	166.19999	157.25000	157.64999	131587100
2022-05-02	156.71000	158.22999	153.27000	157.96000	123055300

Fill in the Python program below:

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

[                                                    ]

#Prompt user for input file name:

in_file = [                                          ]

#Read input data into data frame:

apple = [                                            ]

#Print the highest opening value

print( [                                             ] )

#Print the average closing value

print( [                                             ] )

#Print the difference between the last (2022-05-02) and first (1980-12-12) High values

print( [                                             ] )

#Plot the closing values against the date

apple.[                                              ]

plt.show()
```

7. Fill in the following functions that are part of a program that maps GIS data :

   - `getData()`: asks the user for latitude and longitude of the user's current location and returns those as floating points numbers
   - `mark()`: creates and returns a folium marker at coordinates lat, lon
   - `saveMap()`: adds mark to a map and saves it with name "my_map.html"

```
import folium
def getData():
     """
     Asks the user for latitude and longitude of the user's current location
     Returns lat, lon as floating points numbers
     """
```

```
def mark(lat, lon):
     """
     Creates and returns a folium marker at coordinates lat, lon
     """
```

```
def saveMap(mark):
     """
     Adds mark to a map and saves it with name "my_map.html"
     """
```

8. (a) What is printed by the MIPS program below:

Output:

(b) Modify the program to print out "ADGJ". Shade in the box for each line that needs to be changed and rewrite the instruction below, or add instructions where necessary.

```
☐ ADDI $sp, $sp, -15      # Set up stack

☐ ADDI $s3, $zero, 1      # Store 1 in a register

☐ ADDI $t0, $zero, 66      # Set $t0 at 66 (B)

☐ ADDI $s2, $zero, 15      # Use to test when you reach 15

☐ SETUP: SB $t0, 0($sp)    # Next letter in $t0

☐ ADDI $sp, $sp, 1         # Increment the stack

☐ ADDI $s3, $s3, 1         # Increment the counter by 1

☐ BEQ $s3, $s2, DONE       # Jump to done if $s3 == 15

☐ J SETUP                  # If not, jump back to SETUP for loop

☐ DONE: ADDI $t0, $zero, 0 # Null (0) to terminate string

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

☐ ADDI $sp, $sp, -14      # Set up stack to print

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

☐ ADDI $a0, $sp, 0         # Set $a0 to stack pointer for printing

☐ syscall                  # Print to the log
```

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

(a)

```
#include <iostream>
using namespace std;
int main()
{
    for(        ; i <=35;        ){
       cout << i+3  << endl;
    }
    return 0;
}
```

Output:

```
5
10
15
20
25
30
35
```

(b)

```
#include <iostream>
using namespace std;
int main()
{
     int n=-14, m=10;

    while(n+m      ){
        cout << n << " " << m << endl;
        n+=2;
        m--;
    }
    return 0;
}
```

Output:

```
-14 10
-12 9
-10 8
```

(c)

```
#include <iostream>
using namespace std;
int main(){
for (                                  ){
    for(                                  ){
            cout << i << j-i << " ";
        }
        cout << endl;
    }
    return 0;
}
```

Output:

```
28 27 26 25 24 23 22 21 20
37 36 35 34 33 32 31 30
46 45 44 43 42 41 40
55 54 53 52 51 50
64 63 62 61 60
73 72 71 70
```

10. (a) Write a **complete C++ program** that repeatedly asks the user for two amounts until their sum is positive, then it outputs the sum:

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

```
//main function signature
```

```
{
  //variable initialization
```

```
  //repeatedly ask for amounts until sum is positive
```

```
  //output sum
```

```
    return 0;
}
```

(b) Write a **complete C++ program** that asks the user for an amount and computes the number of years it takes to double the amount, if it is subject to an increase of 25% each year.

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

```
//main function signature
```

```
{
  //declare variables
```

```
  //obtain input
```

```
  //compute number of years it takes to double amount at 25% yearly increase
```

```
  //Output number of years and doubled amount
```

```
   return 0;
}
```

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