

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

24 January 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, smart watch, 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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Name:
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EmpID:
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Email:
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Signature:
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1. (a) What will the following Python code print:

```
i. s = "elion,gertrude;cohn,mildred;petters,arlie"
   a = s[-5:]
   print(a.upper())
```

**Output:**

```
ii. names = s.split(';')
    print(names[-1])
```

**Output:**

```
iii. b,c = names[0],names[1]
     print(c[:4])
```

**Output:**

```
iv. for n in names:
     w = n.split(',')
     print(w[1],w[0])
```

**Output:**

- (b) Consider the following shell commands:

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

- i. What is the output for:

**Output:**

```
$ ls *.py
```

- ii. What is the output for:

**Output:**

```
$ ls *.py | wc -l
```

- iii. What is the output for:

**Output:**

```
$ mkdir pythonProgs
$ mkdir biopy
$ ls py* | wc -l
```

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

	Binary:	Decimal:	Hexadecimal:	All Equal
a)	<input type="checkbox"/> 11	<input type="checkbox"/> 3	<input type="checkbox"/> 3	<input type="checkbox"/> <i>All Equal</i>
b)	<input type="checkbox"/> 100	<input type="checkbox"/> 10	<input type="checkbox"/> 11	<input type="checkbox"/> <i>All Equal</i>
c)	<input type="checkbox"/> 1111	<input type="checkbox"/> 30	<input type="checkbox"/> 13	<input type="checkbox"/> <i>All Equal</i>
d)	<input type="checkbox"/> 100001	<input type="checkbox"/> 32	<input type="checkbox"/> 20	<input type="checkbox"/> <i>All Equal</i>
e)	<input type="checkbox"/> 11111100	<input type="checkbox"/> 255	<input type="checkbox"/> FC	<input type="checkbox"/> <i>All Equal</i>

- (b) Fill in the code below to make an image in which a pixel is red if it has an entry of 0 in the array `elevations`. Otherwise, the pixel should be colored purple.

```
# Takes elevation data of NYC and displays coastlines
import numpy as np
import matplotlib.pyplot as plt
elevations = np.loadtxt('elevationsNYC.txt')
#Base image size on shape (dimensions) of the elevations:
mapShape = elevations.shape + (3,)
floodMap = np.zeros(mapShape)

for row in range(mapShape[0]):
    for col in range(mapShape[1]):

#Save the image:
plt.imshow('floodMap.png', floodMap)
```

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

in1 = False

i. in2 = True

out = in1 or in2

out =

in1 = False

ii. in2 = True

out = in1 or (in2 and not in1)

out =

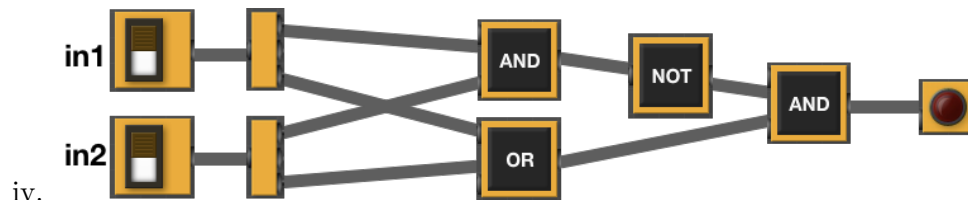
in1 = False

iii. in2 = False or not in1

in3 = in1 or in2

out = in1 and not in3

out =



in1 = False

in2 = True

out =

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

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

4. (a) For the following code:

```
def v4(bryan, esteban):
    if bryan < esteban:
        return esteban
    else:
        return 0
```

```
def startV4(jakub):
    mohammed = 5
    kaiya = 10
    jasmeet = v1(jakub-mohammed,kaiya)
    return jasmeet
```

- i. What are the formal parameters for `v4()`:

- ii. What are the formal parameters for `startV4()`:

- iii. What does `startV4(8)` return:

- (b) Given the function definition:

```
def sorted(ls):
    for i in range(4):
        print(ls)
        for j in range(3):
            if ls[j] > ls[j+1]:
                ls[j],ls[j+1] = ls[j+1],ls[j]
```

- i. What is the output for `sorted([4,3,-1,0])`?

ls[0]	ls[1]	ls[2]	ls[3]

- ii. What is the output for `sorted(["Parakram","Michael","Camryn","Brian"])`?

ls[0]	ls[1]	ls[2]	ls[3]

Name:

EmpID:

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5. Design an algorithm that finds all internships in the current NYC Job Postings using NYC OpenData. Specify the inputs and outputs for your algorithm and give the design in pseudocode. In your pseudocode, specify any libraries that you would need for your design.

Job ID	Agency	Posting T	# O	Business Title	Civil Service	Title Code	Level	Job Category	Full-	Salary Range	Salary Range
246814	DEPT OF INFC	External	1	Senior Architect Cloud Infrastructure D	SENIOR IT AF	6800	0	Information	F	100000	130000
246814	DEPT OF INFC	Internal	1	Senior Architect Cloud Infrastructure D	SENIOR IT AF	6800	0	Information	F	100000	130000
247320	DEPT OF ENVI	Internal	2	MECHANICAL ENGINEERING INTERN	MECHANICA	20403	0	Engineering,	F	52000	52000
247320	DEPT OF ENVI	External	2	MECHANICAL ENGINEERING INTERN	MECHANICA	20403	0	Engineering,	F	52000	52000
269885	DEPT OF ENVI	External	1	MECHANICAL ENGINEERING INTERN	MECHANICA	20403	0	Engineering,	F	52000	52000
269885	DEPT OF ENVI	Internal	1	MECHANICAL ENGINEERING INTERN	MECHANICA	20403	0	Engineering,	F	52000	52000
285120	NYC HOUSINC	External	1	Deputy Director for Engineering	ADMINISTRA	10015	M3	Engineering,	P	115000	130000
285120	NYC HOUSINC	Internal	1	Deputy Director for Engineering	ADMINISTRA	10015	M3	Engineering,	P	115000	130000
287202	DEPT OF ENVI	External	4	MECHANICAL ENGINEERING INTERN	MECHANICA	20403	0	Engineering,	F	52000	52000
287202	DEPT OF ENVI	Internal	4	MECHANICAL ENGINEERING INTERN	MECHANICA	20403	0	Engineering,	F	52000	52000

Input:

Output:

Process:

6. Fill in the Python program that will read:

- prompt the user for the name of a CSV file,
- prompt the user for the name of two columns in that CSV file, and
- print out the maximum value of the first column.
- displays a scatter plot of the two columns entered

```
#P6,V4: prints max of 1st column in a CSV file & makes scatter plot
```

```
#Import the libraries for data frames and displaying images:
```

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

```
#Prompt user for 2 column names:
```

```
df = pd.read_csv(fileName)
```

```
#Compute maximum value of the column:
```

```
print("Maximum of first column is ", M)
```

```
#Display a scatter plot of first column versus second column:
```

7. Complete the following program, by writing the functions:

- `getInput()`: returns the number of turtles the user entered
- `setUpTurtles()`: creates and returns a list of turtles, and
- `stamp()`: makes each turtle in the list stamp.

```
#Intro Programming Lab: A program with herd of turtles
```

```
import turtle
```

```
def getInput():
```

```
    """Prompts & returns the number of turtles the user entered."""
```

```
def setUpTurtles(n):
```

```
    """Creates a list of n turtles and returns the list."""
```

```
    tList = []
```

```
    #Create turtles:
```

```
    return tList
```

```
def moveForward(tList):
```

```
    for t in tList:
```

```
        t.forward(30)
```

```
def stamp(tList):
```

```
    """Make each turtle in the list stamp."""
```

```
def main():
```

```
    numTurtles = getInput()    #Ask for number of turtles
```

```
    turtleList = setUpTurtles(numTurtles) #Make a list of turtles
```

```
    for i in range(10):
```

```
        moveForward(turtleList) #Move each turtle in the list forward
```

```
        stamp(turtleList)      #Stamp where the turtle stopped
```

```
if __name__ == "__main__":
```

```
    main()
```



8. (a) What is the output for a run of this MIPS program:

```
#Loop through every other letter:
ADDI $sp, $sp, -6 # Set up stack
ADDI $t0, $zero, 97 # Start $t0 at 97 (a)
ADDI $s2, $zero, 107 # Use to test when you reach 102 (k)
SETUP: SB $t0, 0($sp) # Next letter in $t0
ADDI $sp, $sp, 1 # Increment the stack
ADDI $t0, $t0, 2 # Increment the letter
BEQ $t0, $s2, DONE # Jump to done if $t0 == 102
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, -6 # 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
```

**Output:**

- (b) Indicate what modifications are needed to the MIPS program (repeated below) so that it prints out the first 10 lower case letters: abcdefghij ?

```
#Loop through every other letter:
ADDI $sp, $sp, -6 # Set up stack
ADDI $t0, $zero, 97 # Start $t0 at 97 (a)
ADDI $s2, $zero, 107 # Use to test when you reach 102 (k)
SETUP: SB $t0, 0($sp) # Next letter in $t0
ADDI $sp, $sp, 1 # Increment the stack
ADDI $t0, $t0, 2 # Increment the letter
BEQ $t0, $s2, DONE # Jump to done if $t0 == 102
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, -6 # 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. What is the output of the following C++ programs?

```
//Lyrics by Lopez & Lopez
#include <iostream>
using namespace std;
int main()
{
  cout << "It's funny how some ";
  cout << "distance\nMakes";
(a)  cout << "everything seem small";
      cout << endl;
      return(0);
}
```

**Output:**

```
//More Elsa
#include <iostream>
using namespace std;
int main()
{
  int count = 2;
  while (count > 0) {
(b)  cout <<"Let it go, ";
      count--;
  }
  cout << "\nCan't hold it ";
  cout << "back anymore\n";
  return(0);
}
```

**Output:**

```
//Stars and srtipes
#include <iostream>
using namespace std;
int main()
{
  int i, j;
  for (i = 1; i <= 5; i++)
  {
(c)  for (j = 0; j < 5; j++)
      if ((i+j) % 2 == 0)
          cout << "*";
      else
          cout << "-";
      cout << endl;
  }
  return(0);
}
```

**Output:**

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

```
#Python Loop, V4:  
for i in range(10,0,-1):  
    print(i)  
print('Blast off!')
```

- (b) Write a **complete C++ program** that prints the change in population of predator and prey following the Lotka-Volterra model:

$$\begin{aligned}r &= 1.5r - .2rf \\ f &= 0.9f + .1rf\end{aligned}$$

where  $r$  is the number of prey (such as rabbits) each year and  $f$  is the number of predators (such as foxes) each year. The rabbit population increases by 50% each year, but  $\frac{rf}{5}$  are eaten by foxes. The fox population decreases by 10% due to old age but increases in proportion to the food supply,  $\frac{rf}{10}$ . Assume that the starting population of prey (rabbits) is 1000 and starting population of predators (foxes) is 25. Your program should print for the first 10 years: the year, the number of prey and the number of predators.