# Final Exam, Version 1
## CSci 127: Introduction to Computer Science
## Hunter College, City University of New York

15 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. |
|---|
| Name: |
| 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:

```
s = "Robb,Stark;Tyrion,Lannister;Jon,Snow;Euron,Greyjoy"
```
i.
```
print(s.count(';'))
print(s[-7:])
```

**Output:**

ii.
```
kings = s.split(';')
js = kings[2]
words =  js.split(',')
print(words[1].upper())
```

**Output:**

iii.
```
for king in kings:
    w = king.split(',')
    print(w[1],w[0])
```

**Output:**

(b) Consider the following shell commands:

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

i. What is the output for:
```
$ mv p55.cpp prog55.cpp
$ ls
```

**Output:**

ii. What is the output for:

```
$ ls  | *.csv
```

**Output:**

iii. What is the output for:
```
$ pwd
/Users/yourlogin
$ echo "hello, $USER."
```

**Output:**

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

|  | Decimal: | Hexadecimal: | Equal |
|---|---|---|---|
| a) | □ 16 | □ 16 | □ *Equal* |
| b) | □ 18 | □ 12 | □ *Equal* |
| c) | □ 256 | □ FF | □ *Equal* |
| d) | □ 20 | □ 15 | □ *Equal* |
| e) | □ 13 | □ D | □ *Equal* |

(b) Given the function below

```
def octStringToDec(octString):
    decNum = 0
    for c in octString:
        n = int(c)
        decNum = (decNum * 8) + n
    print(decNum)
```

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

**Output:**

ii. What is the output of octStringToDec('15')

**Output:**

What is the output of octStringToDec('101')

**Output:**

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

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

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

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



iv.
            `in1 = False`
            `in2 = True`                    out =
            `in3 = False`

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

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

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

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

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

     i. `mystery(tori, 3)`

     ii. what are the formal parameters of mystery?

(b) Given the function definition:

```
def enigma(n):                    def help(x):
    for i in range(n,0,-1):           for j in range(i):
        help(i)                           print(j % 2, end=' ')
        print()
```

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

5. Design an algorithm that prints out the number of 311 calls to the NYPD 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.

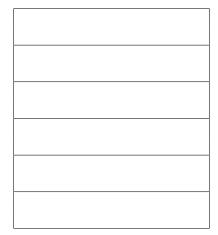| Unique Key | Created Date | Closed Date | Agency | Agency Name | Complaint Type |
|---|---|---|---|---|---|
| 42102569 | 04/01/2019 12:00:14 AM | 04/01/2019 07:43:05 AM | NYPD | New York City Police Department | Noise - Residential |
| 42101059 | 04/01/2019 12:00:21 AM | 04/01/2019 06:12:11 AM | NYPD | 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 **left quarter** of the image and save it to the output file

```
#P6,V1: saves the left 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 an array:
```




```
#Compute the height of the image
```




```
#Compute the width of the image
```




```
# Select left quarter and store in leftQuarterImg
```




```
#Save the left quarter image
```

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

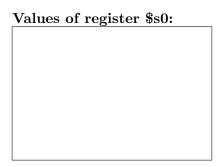| Fiscal Year | Agency Name | Agency Start Date | Work Location Borough | Title Description | Base Salary | Pay Basis | Regular Hours | OT Hours |
|---|---|---|---|---|---|---|---|---|
| 2018 | BOARD OF ELECTION | 07/28/2014 | MANHATTAN | TEMPORARY CLERK | 13.79 | per Hour | 234.18 | 75.75 |
| 2018 | 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 overtime paid  salary
    (base salary * 1.5 * 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 100
ADDI $s0, $zero, 20 #set s0 to 20
ADDI $s1, $zero, 20 #use to increment counter, $s0
ADDI $s2, $zero, 100 #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, 20 #set s0 to 20

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

☐ ADDI $s2, $zero, 100 #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 << "Never forget what you are, ";
  cout << "for \nsurely the world ";
  cout << "will not." << endl;
  cout << "Make it your strength, ";
  cout << endl << "then it can never ";
  cout << "be your weakness.";
  return 0;
}
```

**Output:**

(b)
```
//More GOT
#include <iostream>
using namespace std;
int main()
{
  int count = 3;
  while (count > 0) {
    cout <<"Every flight\n";
    count--;
  }
  cout << "\nbegins with a fall.";
  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 << "X";
            else
                cout << "O";
        }
        cout << endl;
    }
  return 0;
}
```

**Output:**

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

```
#Python Loops, V1:
for i in range(5,55,5):
    print('X -', i, '- X')
```

(b) Assume the coastline erodes 1.5% 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 (sea level is considered to be 0).