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

21 May 2019

Answer Key:

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:])
```

Answer Key:
```
3
Street
```

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

Answer Key:
```
68th
```

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

Answer Key:
```
51
59
68
77
```

(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
```

Answer Key:

```
logo.png map.png
```

ii. What is the output for:
```
$ mkdir homework
$ ls
```

Answer Key:

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

iii. What is the output for:
```
$ ls -l | grep "prog" | wc -l
```

Answer Key:

```
3
```

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):

Answer Key:

	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')

Answer Key:
2

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

Answer Key:
15

What is the output of binaryStringToDecimal('11010')

Answer Key:
26

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

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

Answer Key:
out = True

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

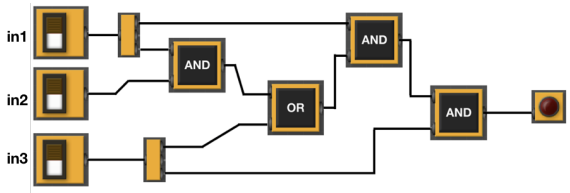
Answer Key:
out = True

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

Answer Key:

```
out = True
```

iv.




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

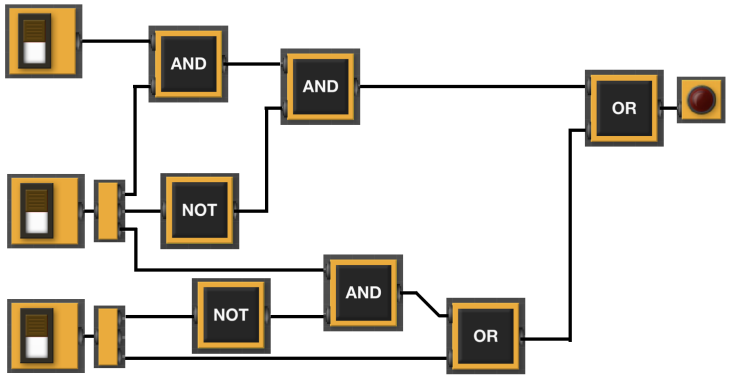
Answer Key:

```
out = True
```

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

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

Answer Key:

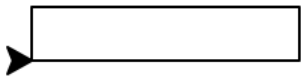


4. (a) Draw the output for the function calls:

```
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()
```

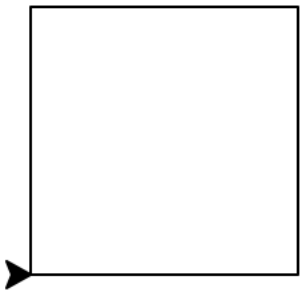
i. `mystery1(taj, 100, 20)`

Answer Key:



ii. `mystery2(taj, 100)`

Answer Key:



(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)`?

Answer Key:

10
10 8
10 8 6
10 8 6 4
10 8 6 4 2

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:

Answer Key: pandas

Input:

Answer Key: The name of the CSV file and the year

Output:

Answer Key: The number of cars.

Process:

Answer Key:

(a) Ask user for file name and year.

(b) Open the file as a dataFrame.

(c) Select all the rows where `'Vehicle Make'` is `'HONDA'` and `'Issue Date'` is after the date entered by the user.

(d) Print out the number of selected rows.

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

Answer Key:

```
#P6,V2: saves the top quarter of an image
```

```
#Import the libraries for storing and displaying images:
import pandas as pd
import matplotlib.pyplot as plt

#Prompt user for input file name:
inFileName = input('Enter input image: ')

#Prompt user for output file name:
outFileName = input('Enter ouput image: ')

#Read image into a numpy array:
img = plt.imread(inFileName)

#Compute the height of the image
height = img.shape[0]

#Compute the width of the image
width = img.shape[1]

# Select top quarter and store in topQuarterImg
topQuarterImg = img[:height//4, : ]

#Save the top quarter image
plt.imsave(outFileName, topQuarterImg)
```

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

Answer Key:

```
import pandas as pd

def readDataFrame():
    inFile = input('Enter input file name: ')
    salaries = pd.read_csv(inFile)
    return(salaries)

def alterDataFrame(df):
    newColName = input('Enter the name of the new column: ')
    df[newColName] = df['Base Salary'] * df['Regular Hours']
```

```
    return(df, newColName)

def printColumnAverage(df, column):
    avg = df[column].mean()
    print(avg)

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

if __name__ == '__main__':
    main()
```

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
```

Answer Key:

```
100
80
60
40
20
```

(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).

Answer Key:

```
#Sample program that loops down from 100
ADDI $s0, $zero, 100 #set s0 to 100
ADDI $s1, $zero, 10 #use to decrement counter, $s0
ADDI $s2, $zero, 0 #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;
}
```

Answer Key:

```
A mind needs books as
a sword needs a whetstone,
if it is to keep its edge.
```

(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;
}
```

Answer Key:

```
Winter is coming Winter is coming Winter is coming !
Nothing burns like the cold.
```

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

Answer Key:

```
XOX
XOX
XOX
```

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

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

Answer Key:

```
//C++ Loop, V2
#include <iostream>
using namespace std;
int main()
{
    int i;
    for (i = 100; i > 0; i=i-10) {
        cout << i << endl;
    }
  return 0;
}
```

(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.

Answer Key:

```
//Prints ticket price for the Met
#include <iostream>
using namespace std;
int main()
{
    cout << "Please enter your age: ";
    int age = 0;
    cin >> age;
    if (age <= 12)
        cout << "Child: $0\n";
    else if (age < 65)
        cout << "Adult: $25\n";
    else
        cout << "Senior: $17\n";
  return 0;
}
```