

FINAL EXAM V2
CSCI 127: Introduction to Computer Science
Hunter College, City University of New York

May 20, 2024

Exam Rules

- Show all your work. Your grade will be based on the work shown.
- The exam is closed book and closed notes.
- When taking the exam, you may have with you pens, pencils, and an 8 1/2" x 11" piece of paper filled with notes, programs, etc.
- You may not use a computer, calculator, tablet, smart watch, or other electronic device.
- Do not open this exam until instructed to do so.

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| 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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| Signature: |
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If you earn a D in the class and would rather have an F, put an X in this box.
(This will not affect your grade if you earn a C or better.)

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. `banana = "CDEfghE123Ehello"`
`print(banana.count("e"))`

Output:

ii. `B = banana.split("E")`
`print(B[-1])`

Output:

iii. `low = B[0].lower()`
`print(low)`

Output:

iv. `for c in low:`
`print(c.upper())`

Output:

(b) Consider the contents of the current directory, Users/Bob:

`banana.csv` `banana.py` `carrot.csv` `clementine.py` `dragonfruit`

i. What is the output for:

```
$ ls *c*
```

Output:

ii. What is the output for:

```
$ mv *.py ./dragonfruit
$ mkdir hello
$ ls
```

Output:

iii. What is the output for:

```
$ cd ./dragonfruit
$ pwd
```

Output:

2. Complete the Python program below:

```
#import the libraries for image processing
```

```
#get a number for the color channel from user input
```

```
#create an all-black image with a height of 50 and a width of 30
```

```
if color > 2:
```

```
    exit() #exits the program
```

```
#else if the color channel is less than 0, exit the program
```

```
#else modify the image such that the even rows become the color entered
```

```
#save the image in a file called "final.png"
```

3. (a) Select the correct option.

i. What color is tina after this command? `tina.color(0.0, 1.0, 0.0)`

- black red white gray green

ii. Select the SMALLEST binary number:

- 1011 1101 0111 0010 1001

iii. Select the SMALLEST hexadecimal number:

- FD EA AF CF CD

iv. What is the binary number equivalent to the decimal number 18?

- 01011 10010 11100 10111 10011

v. What is the hexadecimal number equivalent to the decimal number 60?

- 34 32 2C 3C 3D

(b) i. What is the value (True/False):

in1 = True

A. in2 = False

out = (not (in1 or in2)) and in2

out =

in1 = False

B. in2 = True

out = not in1 and (in2 or not in2)

out =

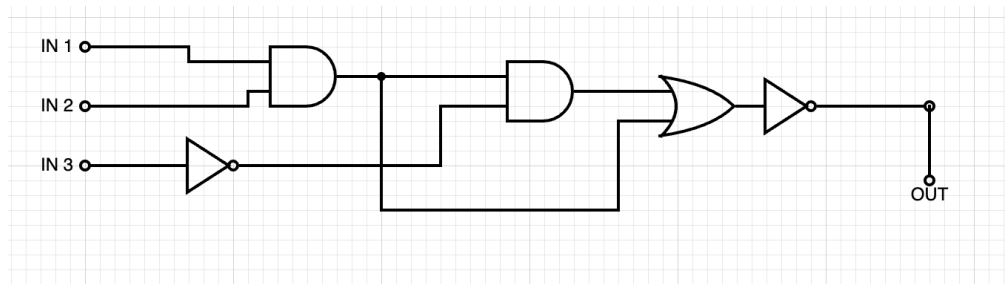
in1 = True

C. in2 = True and not in1

in3 = (in1 and in2) or False

out = in1 and not in3

out =



D.

in1 = False

in2 = True

in3 = True

out =

ii. Design a circuit that implements the logical expression:

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

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

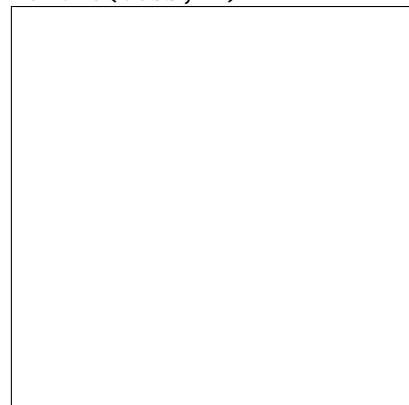
```
import turtle
tess = turtle.Turtle()
tess.shape("turtle")

def ramble(t, side):
    if side == 0:
        t.right(90)
        t.forward(50)
        t.stamp()
    else:
        for i in range(side):
            t.forward(50)
            t.left(360/side)
```

- i. `ramble(tess, 0)`



- ii. `ramble(tess, 4)`



- (b) What is the output:

```
#Another mystery program...
def mystery(num):
    send = chr(num)
    if num < ord("e"):
        send += "X"
    return send

def enigma(letters):
    data = ""
    for x in letters:
        n = ord(x)
        c = "E"
        if n > 101:
            c = mystery(n)
        data += c
    return data

word = input("Enter a word: ")
s = enigma(word)
print(s)
```

- i. When the user enters: cba?

Output:

- ii. When the user enters: adult?

Output:

- iii. When the user enters: child?

Output:

5. Fill in the Python program below.

```
#imports the library for random numbers and the library for turtles
```

```
colors = ["aliceblue", "burlywood", "cornflowerblue"]
```

```
tina = turtle.Turtle()
```

```
tina.shape("turtle")
```

```
#generates a random integer representing the valid indices of the colors array
```

```
rand_color=
```

```
#applies that color to the turtle
```

```
tina.color(colors[rand_color])
```

```
#generates a random integer representing the number of sides for
```

```
#a triangle, square, or pentagon
```

```
rand_shape=
```

```
#for-loop to draw the shape
```

```
#move tina forward 50 steps
```

```
#turn tina left the correct number of degrees
```


6. Consider the following main function that analyzes tree data:

```
import pandas as pd
def main():
    trees = pd.read_csv("trees.csv")
    avgOak = avgHeight(trees, "Oak")
    topTrees = topK(trees, "circumference")
```

Define the functions below:

```
def avgHeight(data, species):
    """
    Takes a DataFrame and a string as input
    First, group by "Species" then get group species
    Return the average height of the group by using the "Height" column
    """
```

```
def topK(data, colName):
    """
    Takes a DataFrame and a string as input
    Asks the user for an integer value, k
    Returns the top k values in the given column and DataFrame
    """
```

7. Fill in the Python program below that asks the user for the name of a .png (image) file and **turns the top half of the image blue**. The new image should then be displayed to the user.

```
#import the libraries for image processing
```

```
#get user input
```

```
infile = 
```

```
#read the image file
```

```
img = 
```

```
#get the height of the image
```

```
height = 
```

```
#set the red and green channels to 0.0
```

```
#set the blue channel to 1.0
```

```
#load the image into pyplot
```

```
#display the image
```

8. (a) Consider the following MIPS program:

```
ADDI $s1, $zero, 6
ADD $s2, $s1, $s1
ADDI $s2, $s2, 1
ADDI $s3, $s2, 5
```

After the program runs, what is the value stored in:

- i. register \$s1

- ii. register \$s2

- iii. register \$s3

- (b) What is the output for a run of this MIPS program:

Output:

```
#Loop through five letters:
ADDI $sp, $sp, -6           # Set up stack
ADDI $t0, $zero, 80        # Start $t0 at 80 (P)
ADDI $s2, $zero, 85        # Use to test when you reach 85 (U)
SETUP: SB $t0, 0($sp)      # Next letter in $t0
ADDI $sp, $sp, 1           # Increment the stack
ADDI $t0, $t0, 1           # Increment the letter
BEQ $t0, $s2, DONE         # Jump to done if $t0 == 85
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. Translate the following Python program into a complete C++ program:

```
dividend = float(input("Enter a number: "))
divisor = float(input("Enter a number: "))

while divisor != 0:
    print("The quotient is: ", dividend/divisor)
    divisor = float(input("Enter a number: "))

print("Cannot divide by zero")
```

```
//include library for input/output and declare namespace
```

```
//main function signature
```

```
{
```

```
    //main function body
```

```
    return 0;
}
```

10. (a) Write a complete C++ program that prompts the user to enter a number representing an exam grade. The program should print "Pass" when the value is greater than or equal to 60 and "Fail" otherwise. Validate the user's input so that the number entered is between 0 and 100 inclusive.

```
//include library for input/output and declare namespace
```

```
//main function signature
```

```
{
```

```
    //main function body
```

```
    return 0;  
}
```

(b) Write a complete C++ program that prints the first 10 numbers of the Fibonacci sequence using a for-loop. Use the following pseudocode to implement your main function:

1. Declare three integers: a, b, and c. Initialize a to 0 and b to 1.
2. Print out a and then b, separated by newline characters
3. For i = 2, 3, 4, ... , 9:
 c = a + b
 Print c followed by a newline
 a = b
 b = c

```
//include library for input/output and declare namespace
```

```
//main function signature
```

```
{
```

```
    //calculate and print first 10 Fibonacci numbers
```

```
    return 0;
```

```
}
```