

Row:	SEAT:

FINAL EXAM, VERSION 1
CSci 127: Introduction to Computer Science
Hunter College, City University of New York
 20 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.**

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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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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:

Sunday Monday

ii. `day_list = workdays[] .split()`

`print("Our week has", len(), "days.")`

Output:

Our week has 4 days.

iii. `for day in []`
`print()`

Output:

MONDAY
TUESDAY
WEDNESDAY
THURSDAY

- (b) Consider the following shell commands:

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

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

Output:

ii. What is the output for:

```
$ mkdir c++
$ mv *.cpp c++
$ ls
```

Output:

iii. What is the output for:

```
$ cd c++
$ mkdir p50_60
$ mkdir pp_5
$ ls | grep pp
```

Output:

2. (a) Select the correct option.

- i. What color is tina after this command? `tina.color(0.0,0.0,0.0)`
 black red white gray purple
- ii. Select the LARGEST Binary number:
 0110 1001 1101 1011 0000
- iii. Select the SMALLEST Hexadecimal number:
 0A 22 A0 FF CD
- iv. What is the Binary number equivalent to decimal 22?
 11010 01110 10110 00011 10101
- v. What is the Hexadecimal number equivalent to decimal 20?
 14 A1 F0 1F 18

(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:

```
76 23 98
```

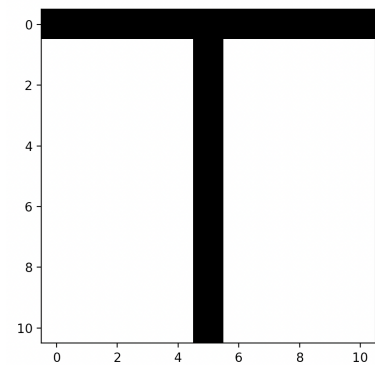
ii. `for j in range(, ,):`
`print(nums[j], end=" ")`

Output:

```
45 23 45 4
```

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):

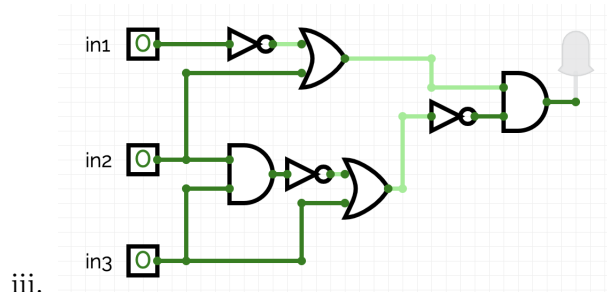
in1 = False

i. in2 = True True False

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

in1 = False

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



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 in3)

4. Consider the following functions:

```
def jig(n, m):  
    for i in range(n):  
        if(i % 3 == 0):  
            print(saw(i, m))
```

```
def saw(i, m):  
    for j in range(i):  
        m+=1  
    return m
```

```
def main():  
    jig(10, 5)
```

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

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

(c) How many calls are made to `saw()` after calling `main()`?

(d) What is the output after calling `main()`?

Output:

5. A palindrome is a string (word or sentence, e.g. "madam" or "nurses run") that reads the same backward as forward. Design an algorithm that reads a string and outputs whether it is a palindrome or not. 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 the `art_library.csv` from the **Art Garfunkel's Library** from kaggle. **Each row in the dataset corresponds to a book.** A snapshot of the data is given in the image below:

Date Read	Author	Books	Year Published	Pages	Favorite
Jun-68	Jean-Jacques Rousseau	The Confessions	1781	606	1
Jun-68	Erich Fromm	The Art of Loving	1956	146	1
Jun-68	Mark Twain	The Adventures of Huckleberry Finn	1884	288	0
Jul-68	James Thurber	My Life and Hard Times	1933	115	0
■ ■ ■					
Jan-22	James Michener	Caravans	1963	320	0
Jan-22	Abraham Lincoln	The Spiritual Growth of a Public Man	1973	47	0
Feb-22	Joe Scarborough	Saving Freedom	2020	272	0

Fill in the Python program below:

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

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

```
csvFile = 
```

```
#Read input data into data frame:
```

```
lib = 
```

```
#Print the number of applications for date
```

```
print()
```

```
#Group the data by author to extract books written by Jean-Jacques Rousseau
#use groupby and get_group
```

```
rousseau = 
```

```
#Print the latest year a Rousseau book was published
```

```
print()
```


7. Fill in the following functions that are part of a program that extracts data from a CSV file:

- `getData()`: asks the user for the name of the CSV and returns a DataFrame of the contents.
- `extract()`: computes and returns the maximum, minimum and average value of the input column
- `getList()`: returns a list of length $(\text{max}-\text{min})/\text{avg}$, containing equally spaced numbers in range `[min, max]`

```
import pandas as pd
```

```
def getData():
```

```
    """
```

```
    Asks the user for the name of the CSV and
```

```
    Returns a dataframe of the contents.
```

```
    """
```

```
def extract(df, col):
```

```
    """
```

```
    Computes and returns the maximum, minimum and average values
```

```
    of the column col in dataframe df
```

```
    """
```

```
def getList(max, min, avg):
```

```
    """
```

```
    Creates and returns a list of equally spaced numbers in range [min, max].
```

```
    The length of the list is  $(\text{max}-\text{min})/\text{avg}$ 
```

```
    """
```

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

Output:

- (b) Modify the program to print out "ACEGIK". 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, 65 # Set \$t0 at 65 (A)
- 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.

```

#include <iostream>
using namespace std;
int main()
{
    for( [ ] ; i <=15; [ ] ){
(a)      cout << i+2 << endl;
    }
    return 0;
}

```

Output:

```

6
8
10
12
14
16

```

```

#include <iostream>
using namespace std;
int main()
{
    int n=-4, m=10;
    while(n+m [ ] ){
(b)      n--;
          m+=2;
          cout << n << " " << m << endl;
    }
    return 0;
}

```

Output:

```

-5 12
-6 14
-7 16
-8 18

```

```

#include <iostream>
using namespace std;
int main(){
    for ( [ ] ){
(c)      for ( [ ] ){
          cout << i << i+j << " ";
        }
        cout << endl;
    }
    return 0;
}

```

Output:

```

515 514 513 512 511 510
616 615 614 613 612
717 716 715 714
818 817 816
919 918

```

10. (a) Write a **complete C++ program** that repeatedly asks the user for their age until the age is in range [18, 65], then it outputs the age:

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

```
//main function signature
```

```
{  
  //variable initialization
```

```
//repeatedly ask for age until in [18, 65]
```

```
//output age
```

```
  return 0;  
}
```

- (b) The global population has grown from 1 billion in 1800 at a rate of approximately 1.1% per year.

Write a **complete C++ program** that asks the user for a year after 1800 and returns the global population (in billions) in that year.

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

```
//main function signature
```

```
{
```

```
  //declare variables
```

```
  //obtain input
```

```
  //compute the population at 1.1% yearly increase
```

```
  //Output the global population (in billions) during the year entered by the user
```

```
  return 0;
```

```
}
```

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