

# CSci 127: Introduction to Computer Science



[hunter.cuny.edu/csci](http://hunter.cuny.edu/csci)

# Frequently Asked Questions

From email and tutoring.

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- ▶ Majors: *CSci 135 (Software Design and Analysis in C++) & CSci 150 (Discrete Structures)*
- ▶ Minors: *CSci 133 (More Python) & CSci 232 (Databases)*

# A few words on Academic Integrity

From our Syllabus.

**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. All incidents of cheating will be reported to the Office of Student Conduct in the Vice President for Student Affairs and Dean of Students office.**

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- *Students will get a PEN grade until the investigation is complete. This may delay registration.*
- *If the student is found in violation by the Office of Student Conduct, they will receive a 0 on the exam, which also means they will fail the class.*

# Today's Topics



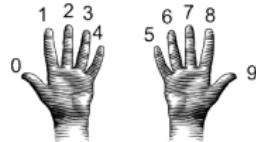
- Recap: Incrementer Design Challenge
- C++: Basic Format & Variables
- I/O and Definite Loops in C++
- More Info on the Final Exam

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- **Recap: Incrementer Design Challenge**
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# Recap: Design Challenge: Incrementers



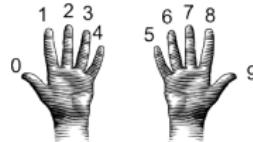
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# Recap: Design Challenge: Incrementers



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*Hint: Convert to numbers, increment, and convert back to strings. That is,*  
"forty one" → 41 → 41 + 1 = 42 → "forty two"

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- Challenge: Write an algorithm for incrementing binary numbers.

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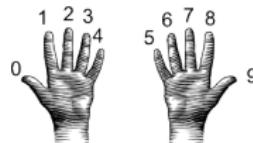
Example: "forty one" → "forty two"

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- Challenge: Write an algorithm for incrementing binary numbers.

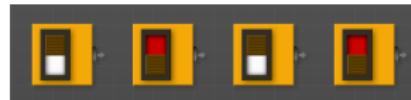
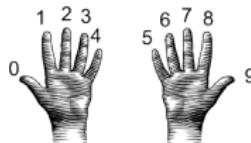
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# Recap: Incrementer Design Challenge



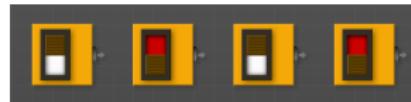
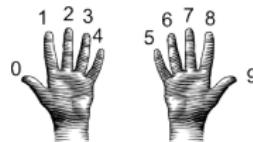
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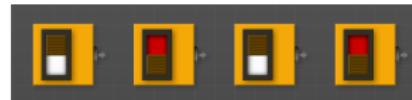
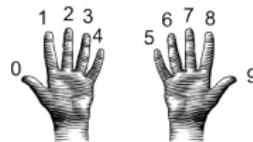


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- "1001" → convert binary number "1001" to decimal number 9 → increase 9 to 10 → convert 10 to binary number "1010" → "1010"

Pseudocode same for both questions:

- ① Get user input.

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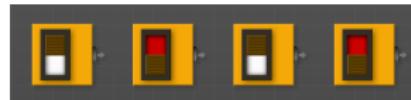
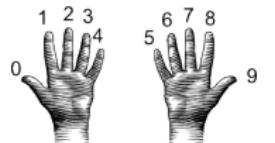


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Pseudocode same for both questions:

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- ② Convert to standard decimal number.

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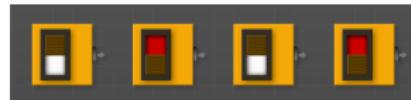
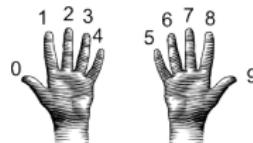


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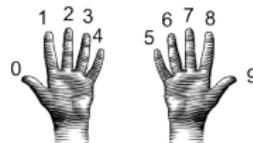


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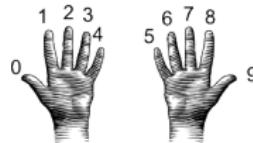


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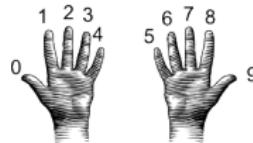


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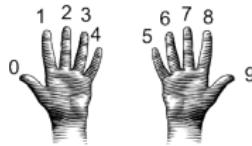


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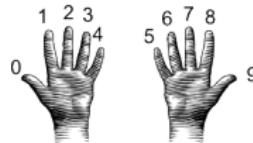


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Pseudocode same for both questions:

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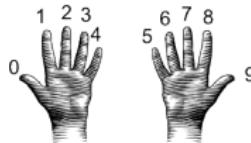


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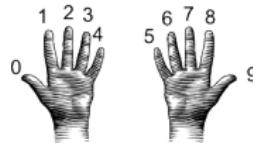


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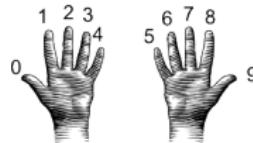


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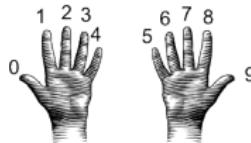


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Pseudocode same for both questions:

- ① Get user input: "1001"
- ② Convert to standard decimal number: 9

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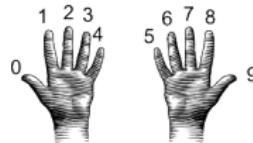


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Pseudocode same for both questions:

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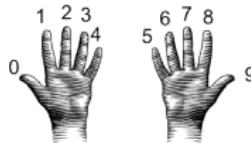


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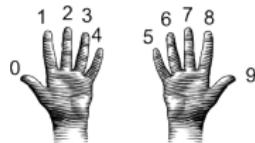


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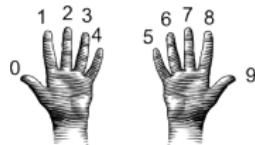
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- ⑤ Print the result.

# Recap: Incrementer Design Challenge



Focus on: Convert to standard decimal number:

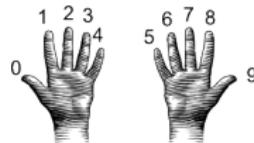
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Focus on: Convert to standard decimal number:

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def convert2Decimal(numString):
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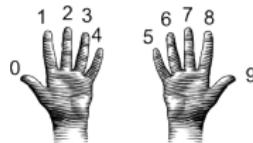
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Focus on: Convert to standard decimal number:

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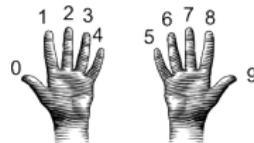
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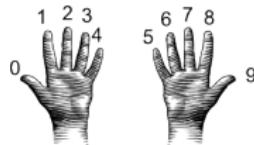
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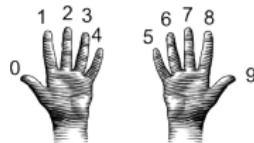
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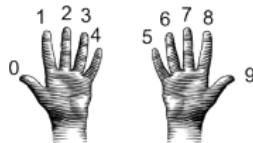
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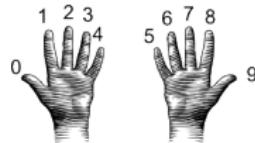


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Will this work?

# Unit Testing: Incrementer Design Challenge

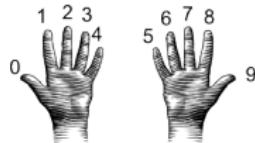


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Will this work? What inputs would find the error(s)?

# Unit Testing: Incrementer Design Challenge



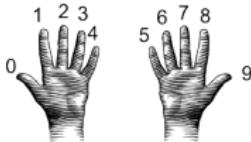
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Will this work? What inputs would find the error(s)?

Unit Testing: testing individual units/functions/blocks of code to verify correctness.

# Unit Testing: Incrementer Design Challenge



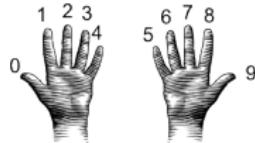
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    #Start with one-digit numbers: zero,one,...,nine
    if numString == "zero":
        return(0)
    elif numString == "one":
        return(1)
    elif numString == "two":
        return(2)
    else:
        return(9)
```

Will this work? What inputs would find the error(s)?

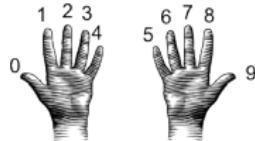
Unit Testing: testing individual units/functions/blocks of code to verify correctness. Often automated (e.g. gradescope).

# Unit Testing: Incrementer Design Challenge



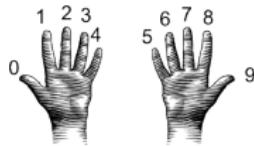
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- To test all branches of code, would need to test all inputs: "zero", "one", ..., "nine", & some bad inputs.

# Unit Testing: Incrementer Design Challenge



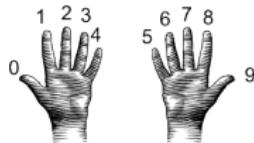
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Also important to test **edge cases**.

# Unit Testing: Incrementer Design Challenge



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Also important to test **edge cases**.
- If large, design automated tests that will “cover” as many branches as possible and use randomly generated inputs:

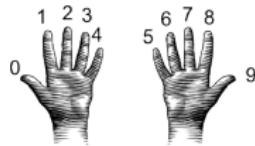
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```
names = ["zero", "one", ..., "nine"]
```

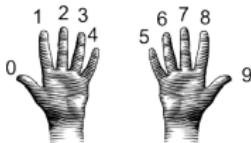
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Also important to test **edge cases**.
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```
names = ["zero", "one", ..., "nine"]  
x = random.randrange(10)
```

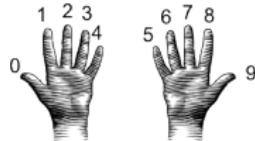
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Also important to test **edge cases**.
- If large, design automated tests that will “cover” as many branches as possible and use randomly generated inputs:

```
names = ["zero", "one", ..., "nine"]
x = random.randrange(10)
if x == convert2Decimal(names[x]):
```

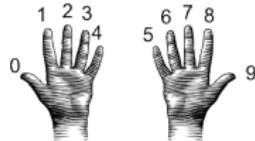
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Also important to test **edge cases**.
- If large, design automated tests that will “cover” as many branches as possible and use randomly generated inputs:

```
names = ["zero", "one", ..., "nine"]
x = random.randrange(10)
if x == convert2Decimal(names[x]):
    #PASS
```

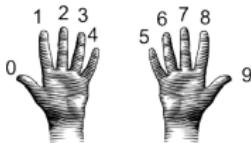
# Unit Testing: Incrementer Design Challenge



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- If large, design automated tests that will “cover” as many branches as possible and use randomly generated inputs:

```
names = ["zero", "one", ..., "nine"]
x = random.randrange(10)
if x == convert2Decimal(names[x]):
    #PASS
else:
```

# Unit Testing: Incrementer Design Challenge



- **Unit Testing:** testing individual units/functions/blocks of code to verify correctness. Often automated (e.g. gradescope).
- To test all branches of code, would need to test all inputs: "zero", "one", ..., "nine", & some bad inputs.  
Also important to test **edge cases**.
- If large, design automated tests that will “cover” as many branches as possible and use randomly generated inputs:

```
names = ["zero", "one", ..., "nine"]
x = random.randrange(10)
if x == convert2Decimal(names[x]):
    #PASS
else:
    #FAIL
```

# Today's Topics



- Recap: Incrementer Design Challenge
- **C++: Basic Format & Variables**
- I/O and Definite Loops in C++
- More Info on the Final Exam

## Challenge:

- Using what you know from Python, predict what the C++ code will do:

```
1 #include <iostream>
2 using namespace std;
3
4 int main ()
5 {
6     int year;
7     cout << "Enter a number: ";
8     cin >> year;
9     cout << "Hello " << year << "!!\n\n";
10    return 0;
11 }
```

# Structure of C++ Program

- ① A simplest C++ program starts with main function. Put code inside the main function, enclosed in matched curly braces { and }.
- ② Need to `#include <iostream>` – similar to import library in python – to use cin and cout.
  - ▶ cin is standard input, like keyboard, `cin >>` means to pull contents from cin to a variable.
  - ▶ cout is standard output, like screen, `cout <<` means to push contents to cout.
  - ▶ Each statement in C++ ends with semicolon (;
- ③ C++ is a strong type language, every variable, when declared, must declare with a type. For example, the return type of main function is int, the type of year is int.

```
1 #include <iostream>
2 using namespace std;
3 int main ()
4 {
5     int year;
6     cout << "Enter a number: ";
7     cin >> year;
8     cout << "Hello " << year << "!\n\n";
9     return 0;
10 }
```

## onlinegdb demo

Online C++ compiler gdb: <https://www.onlinegdb.com/ByzFa5TkG>.

```
1 #include <iostream>
2 using namespace std;
3 int main ()
4 {
5     int year;
6     cout << "Enter a number: ";
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# Introduction to C++

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1 #include <iostream>
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```

- C++ is a popular programming language that extends C.

# Introduction to C++

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1 #include <iostream>
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- C++ is a popular programming language that extends C.
- Fast, efficient, and powerful.

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- C++ is a popular programming language that extends C.
- Fast, efficient, and powerful.
- Used for systems programming (and future courses!).

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```

- C++ is a popular programming language that extends C.
- Fast, efficient, and powerful.
- Used for systems programming (and future courses!).
- Today, we'll introduce the basic structure and simple input/output (I/O) in C/C++.

# Introduction to C++

- Programs are organized in functions.

```
1 #include <iostream>
2 using namespace std;
3 int main ()
4 {
5     int year;
6     cout << "Enter a number: ";
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Example:

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Example:

```
int main()
```

# Introduction to C++

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10 }
```

Example:

```
int main()
{
    cout << "Hello world!";
    return(0);
}
```

# Introduction to C++

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```
1 #include <iostream>
2 using namespace std;
3 int main ()
4 {
5     int year;
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- Variables must be **declared**:

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- Variables must be **declared**:  
int num;
- Many types available:  
int, float, char, ...

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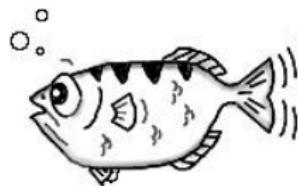
# Challenge:

Predict what the following pieces of code will do:

```
1 //C++ program demonstrating I/O & arithmetic
2 #include <iostream>
3 using namespace std;
4 int main ()
{
    5     float kg, lbs;
    6     cout << "Enter kg: ";
    7     cin >> kg;
    8     lbs = kg * 2.2;
    9     cout << endl << "Lbs: " << lbs << "\n\n";
   10
   11     return 0;
}
```

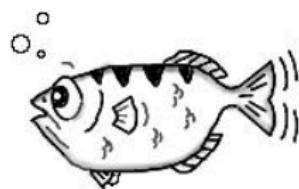
## Side Note: gdb

- Part of Richard Stallman's "GNU is Not Unix" (GNU) project.



[gdb.org](http://gdb.org)

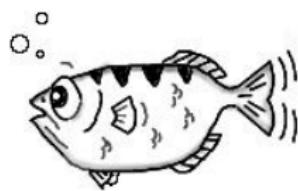
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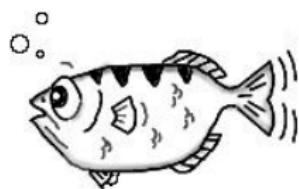
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- Written in 1986, gdb is the GNU debugger and based on dbx from the Berkeley Distribution of Unix.
- Lightweight, widely-available program that allows you to "step through" your code line-by-line.
- Available on-line ([onlinegdb.com](http://onlinegdb.com)) or follow installation instructions in Lab 12.

## C++ Demo

```
1 //C++ program demonstrating I/O & arithmetic
2 #include <iostream>
3 using namespace std;
4 int main ()
5 {
6     float kg, lbs;
7     cout << "Enter kg: ";
8     cin >> kg;
9     lbs = kg * 2.2;
10    cout << endl << "Lbs: " << lbs << "\n\n";
11    return 0;
12 }
```

http://

## Challenge:...

Convert the C++ code to a **Python** program:

```
1 //C++ program demonstrating I/O & arithmetic
2 #include <iostream>
3 using namespace std;
4 int main ()
5 {
6     float kg, lbs;
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12 }
```

## Convert the C++ code to a Python program

```
1 #include <iostream>
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7     cin >> kg;
8     lbs = kg * 2.2;
9     cout << endl << "Lbs: " << lbs << "\n\n";
10    return 0;
11 }
```

```
1 kg = float(input("Enter kg: "))
2 lbs = kg * 2.2
3 print("\nLbs:", lbs, "\n")
```

# Today's Topics



- Recap: Incrementer Design Challenge
- C++: Basic Format & Variables
- **I/O and Definite Loops in C++**
- More Info on the Final Exam

# Challenge:

Predict what code will do: <https://www.onlinegdb.com/HktpcoT1f>

```
1 #include <iostream>
2 using namespace std;
3 int main () {
4     int i,j;
5     //when loop body has only one statement, no need to
6     //enclose it in {}.
7     for (i = 0; i < 4; i++)
8         cout << "The world turned upside down...\n";
9
10    for (j = 10; j > 0; j--)
11        cout << j << " ";
12
13    cout << "Blast off!!" << endl;
14    return 0;
}
```

# C++ Demo

```
//Another C++ program; Demonstrates loops
#include <iostream>
using namespace std;

int main ()
{
    int i,j;
    for (i = 0; i < 4; i++)
    {
        cout << "The world turned upside down...\n";
    }
    for (j = 10; j > 0; j--)
    {
        cout << j << " ";
    }
    cout << "Blast off!!" << endl;
    return 0;
}
```

(Demo with onlinegdb)

# Definite loops

```
//Another C++ program; Demonstrates loops
#include <iostream>
using namespace std;

int main ()
{
    int i,j;
    for (i = 0; i < 4; i++)
    {
        cout << "The world turned upside down...\n";
    }

    for (j = 10; j > 0; j--)
    {
        cout << j << " ";
    }
    cout << "Blast off!!" << endl;

    return 0;
}
```

General format:

```
for ( initialization ; test ; updateAction )
{
    command1;
    command2;
    command3;
    ...
}
```

# Challenge:

Predict what code will do: <https://www.onlinegdb.com/Sy13ToTyG>

```
1 #include <iostream>
2 using namespace std;
3
4 int main ()
5 {
6     int i,j,size;
7     cout << "Enter size: ";
8     cin >> size;
9     for (i = 0; i < size; i++)
10    {
11        for (j = 0; j < size; j++)
12            cout << "*";
13        cout << endl;
14    }
15    cout << "\n\n";
16    for (i = size; i > 0; i--)
17    {
18        for (j = 0; j < i; j++)
19            cout << "*";
20        cout << endl;
21    }
22    return 0;
23 }
```

# Lecture Slips

Which UTA have you spoken with most? Why?

# Lecture Slip:

**Translate** the C++ program into Python:

```
1 #include <iostream>
2 using namespace std;
3
4 int main ()
5 {
6     int population = 100;
7     cout << "Year\tPopulation\n";
8     for (int year = 0; year < 100; year= year+5)
9     {
10         cout << year << "\t" << population << "\n";
11         population = population * 2;
12     }
13
14     return 0;
15 }
```

# Lecture Slip:

**Translate** the C++ program into Python:

```
1 #include <iostream>
2 using namespace std;
3
4 int main ()
{
5     int population = 100;
6     cout << "Year\tPopulation\n";
7     for (int year = 0; year < 100; year= year+5) //In C++, use {} to enclose loop
        body with two or more statements.
8     {
9         cout << year << "\t" << population << "\n";
10        population = population * 2; //same as population *= 2;
11    }
12
13 }
14 return 0;
15 }
```

```
1 population = 100
2 print("Year\tPopulation")
3 for year in range(0, 100, 5): #In Python, use indent to identify loop body
4     print(str(year) + "\t" + str(population))
5     population *= 2
```

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- Input/Output (I/O):

- ▶ `cin >>`
  - ▶ `cout <<`

- Definite loops:

```
for (i = 0; i < 10; i++) {  
    ...  
}
```

# Today's Topics



- Recap: Incrementer Design Challenge
- C++: Basic Format & Variables
- I/O and Definite Loops in C++
- **More Info on the Final Exam**

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- Past exams available on webpage (includes answer keys).

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  - ▶ Rewrite answers & organize by type/question number.
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- Aim to complete 7 to 10 past exams (one a day in the week leading up to the final).

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**All acts of academic dishonesty will be reported to the Office of Academic and Student Affairs and will result in a 0 grade on the exam.**

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- Write a function that, given a DataFrame, returns the minimal value in the “Manhattan” column.

```
def getMin(df):  
    min = df['Manhattan'].min()  
    return(min)
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```
def num2bin(num):  
    binStr = ""  
    while (num > 0):  
        #Divide by 2, and add the remainder to the string  
        r = num %2  
        binString = str(r) + binStr  
        num = num / 2  
    return(binStr)
```

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- If you need help, schedule an appointment for Tutoring in lab 1001G 11:30am-5pm
- Take the Lecture Preview on Blackboard on Monday (or no later than 10:15am on Tuesday)

# Lecture Slips & Writing Boards



- Hand your lecture slip to a UTA.
- Return writing boards as you leave.