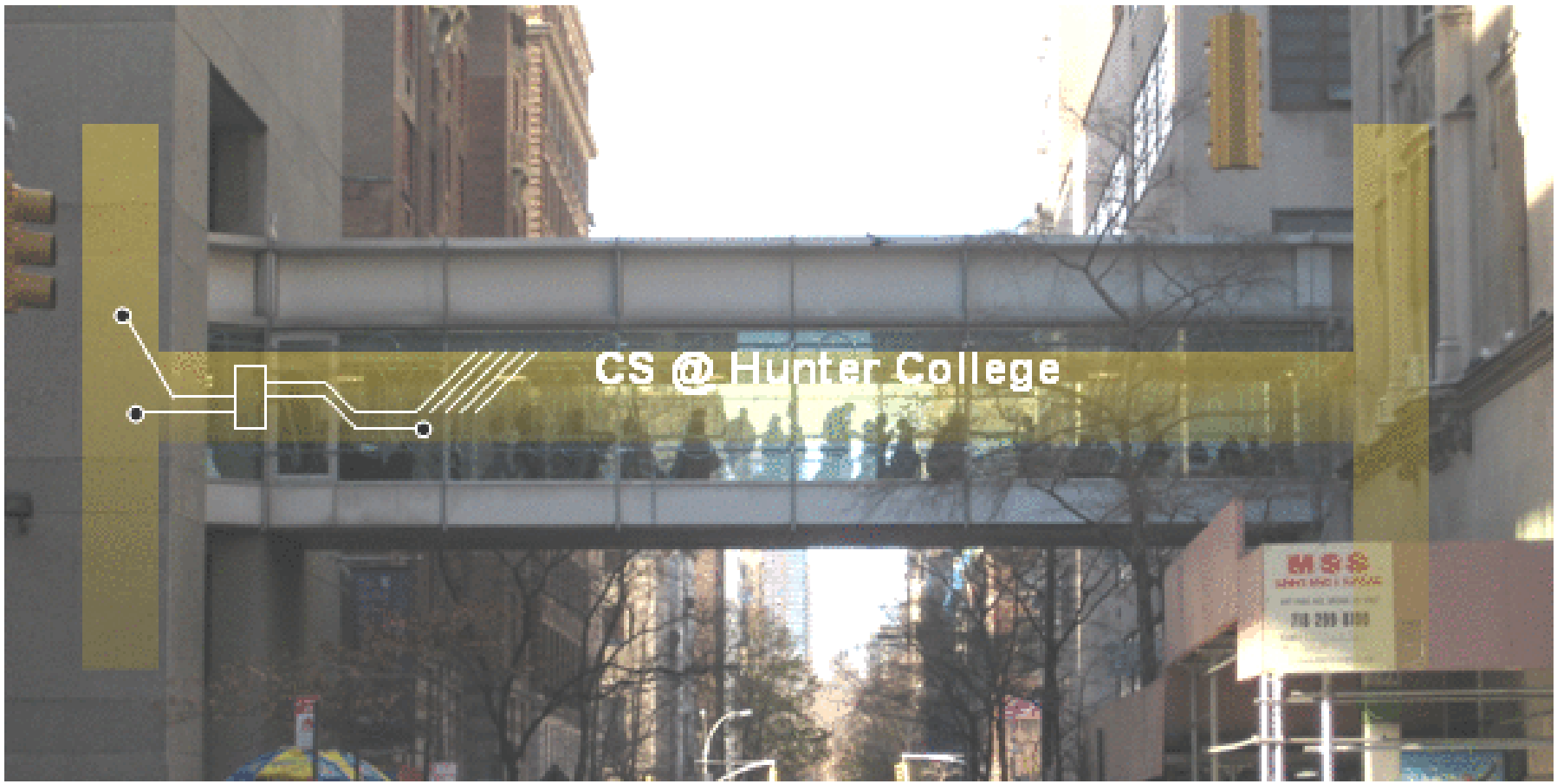
CSci 127: Introduction to Computer Science



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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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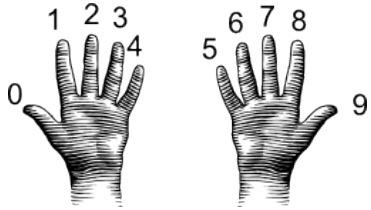
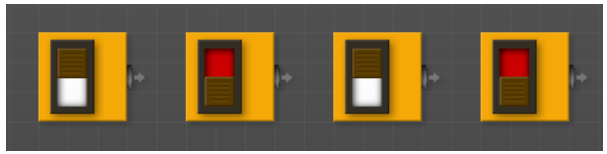
Recap: Design Challenge: Incrementers





- Simplest arithmetic: add one ("increment") a variable.

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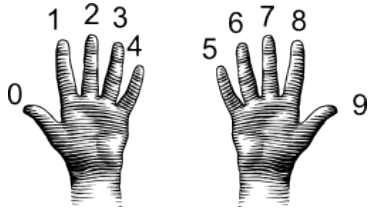

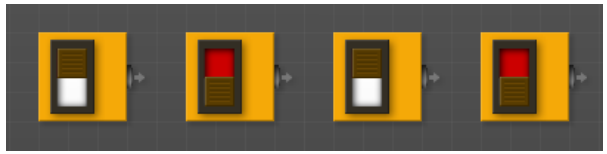

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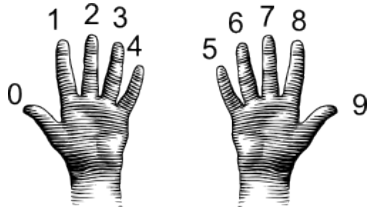

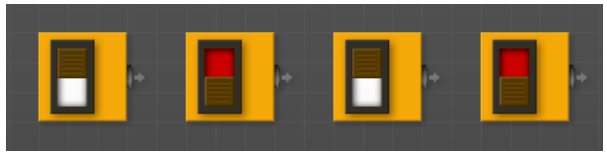

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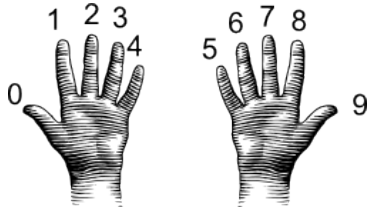

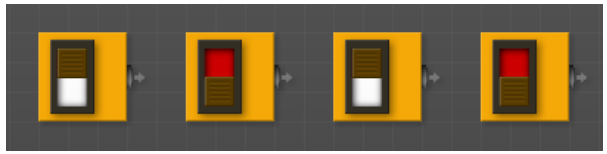

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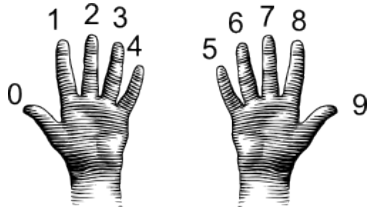

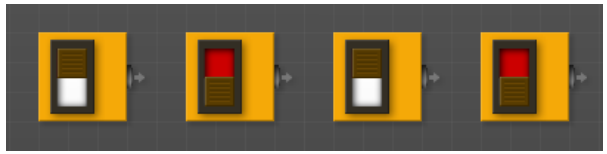

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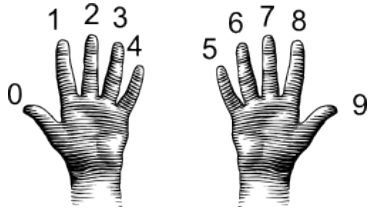

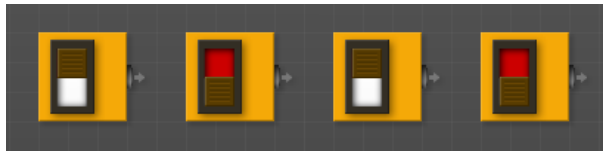

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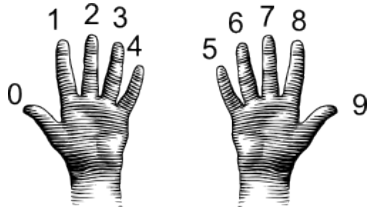

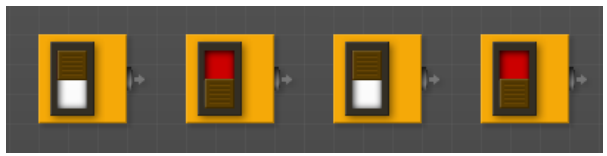

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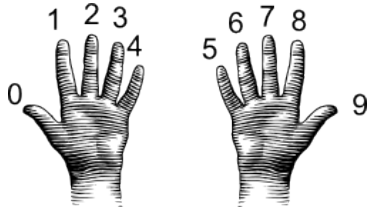

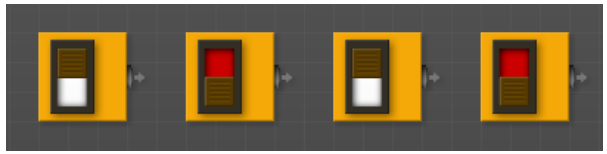

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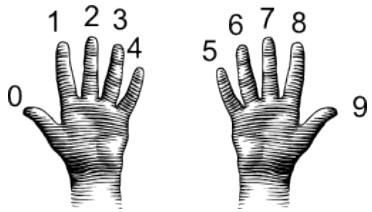

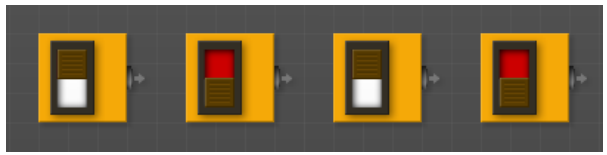

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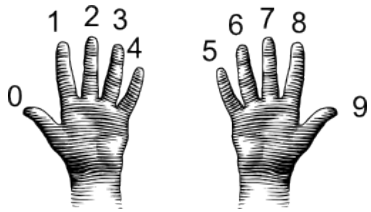

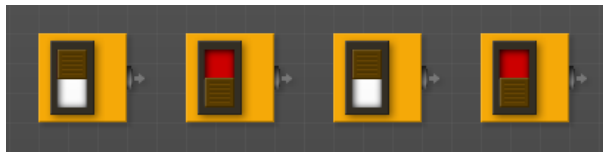

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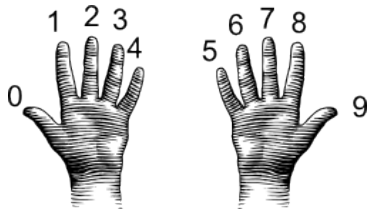

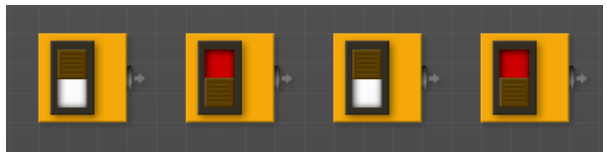

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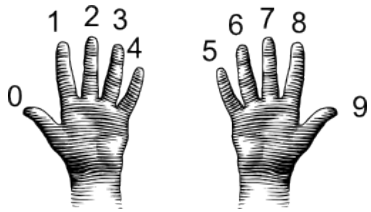

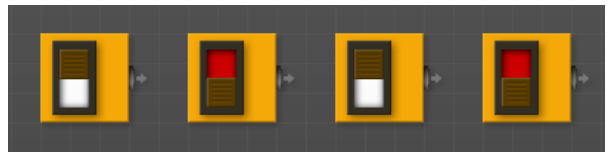

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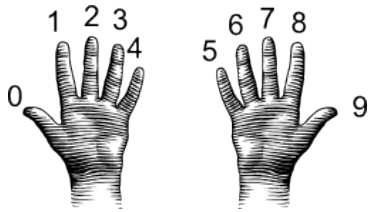

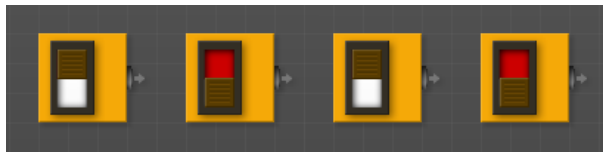

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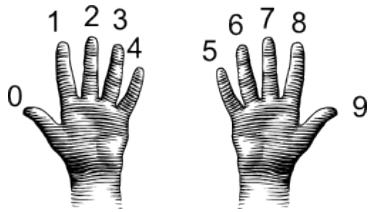

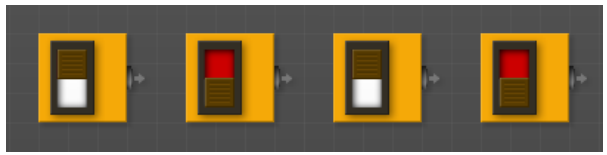

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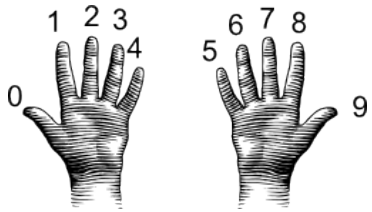

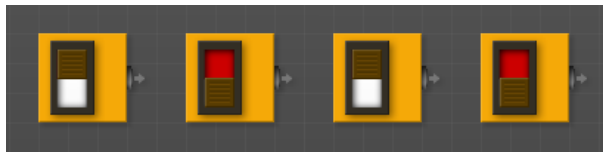

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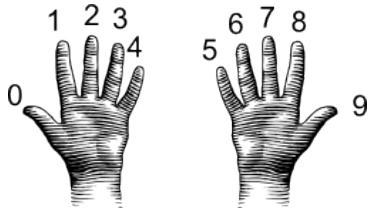

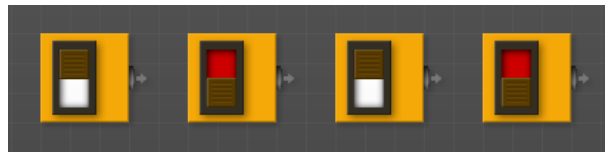

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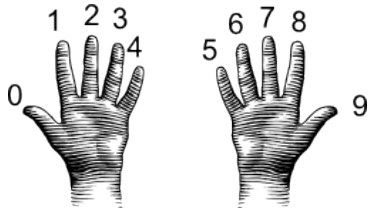

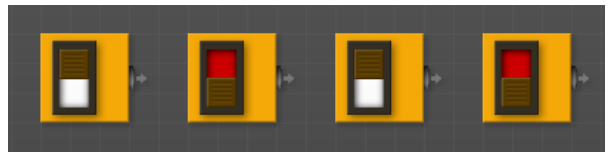

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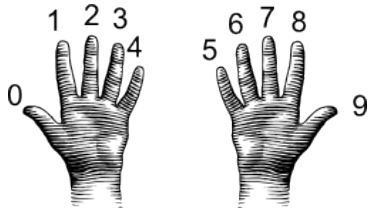

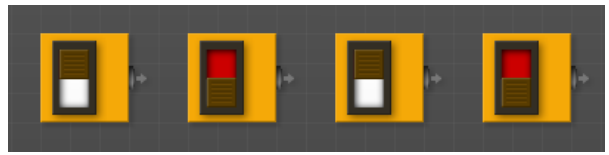

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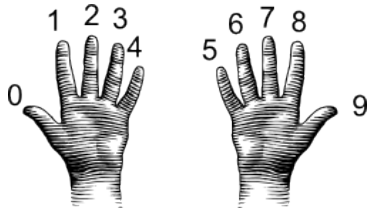

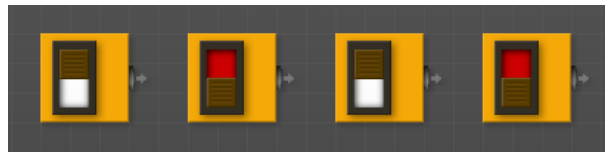

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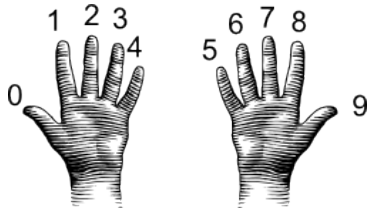

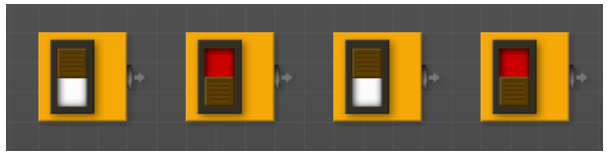

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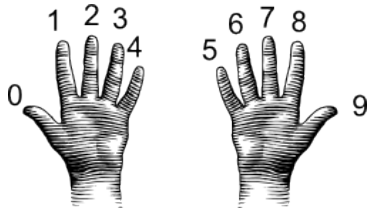
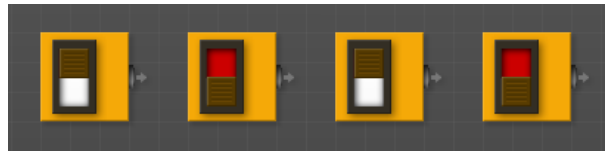
Recap: Incrementer Design Challenge





- Challenge: Write an algorithm for incrementing numbers expressed as words. Example: `"forty one"` $\rightarrow$ `"forty two"`
- Challenge: Write an algorithm for incrementing binary numbers. Example: `"1001"` $\rightarrow$ `"1010"`

Pseudocode same for both questions:

1. Get user input: `"1001"`

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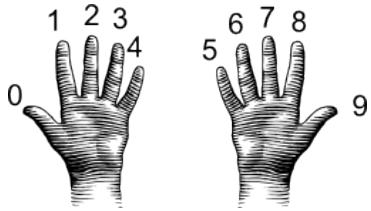

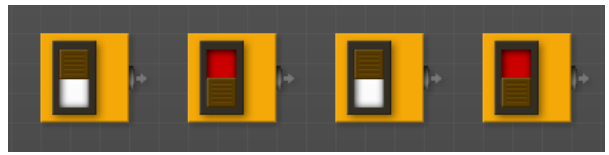

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Pseudocode same for both questions:

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

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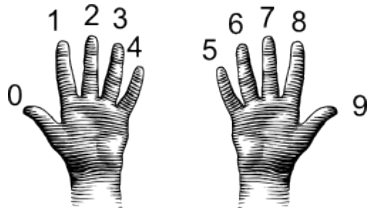

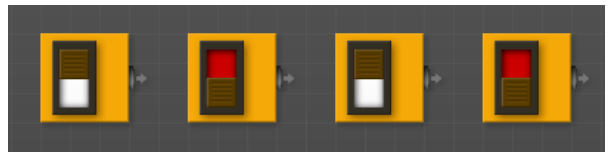

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1. Get user input: `"1001"`
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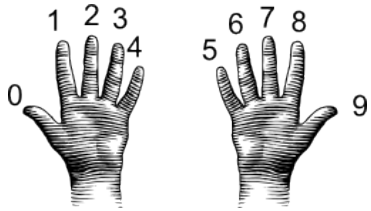

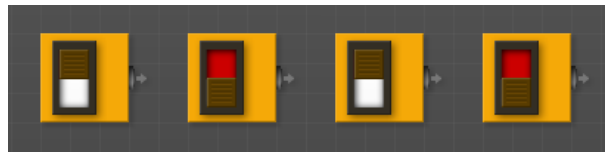

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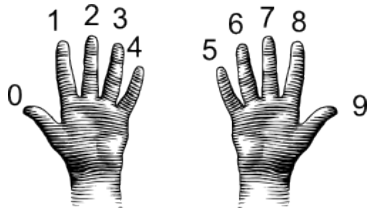

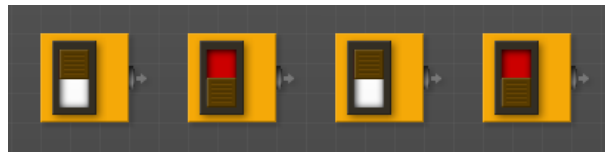

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1. Get user input: `"1001"`
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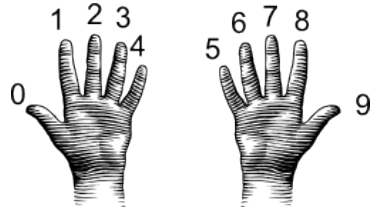
3. Add one (increment) the standard decimal number: 10
4. Convert back to your format: `"1010"`
5. Print the result.

Recap: Incrementer Design Challenge



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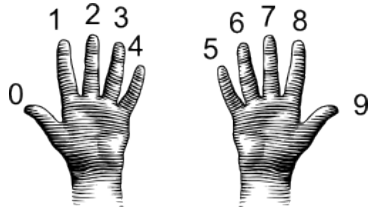

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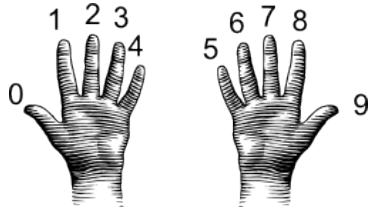

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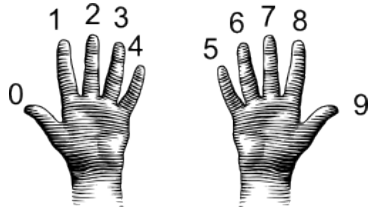

Focus on: Convert to standard decimal number:

```
def convert2Decimal(numString):
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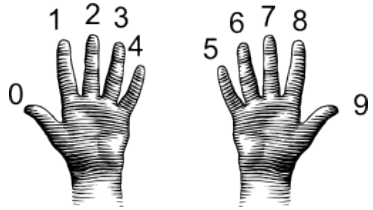

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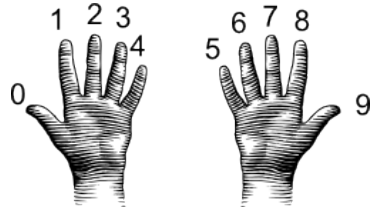

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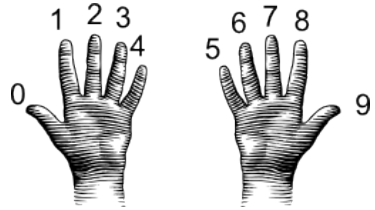

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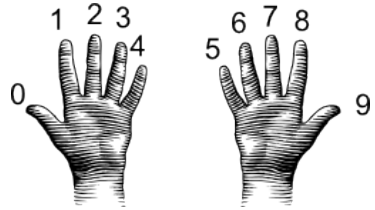

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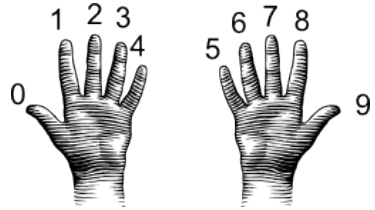

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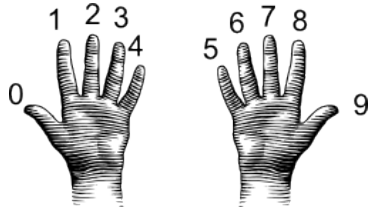
Unit Testing: Incrementer Design Challenge



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

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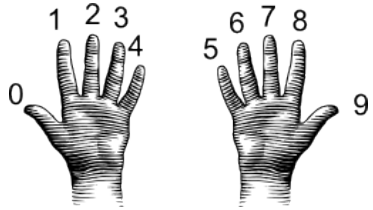

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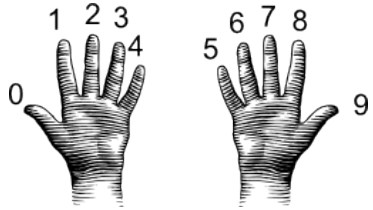

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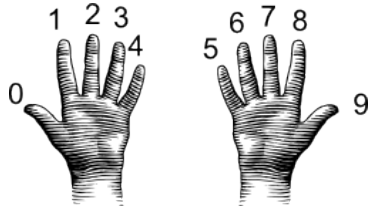

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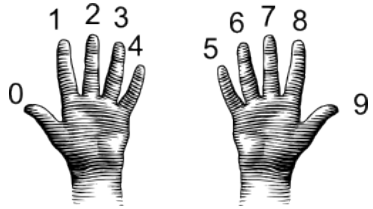

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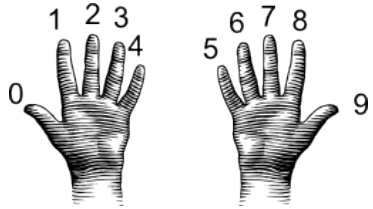

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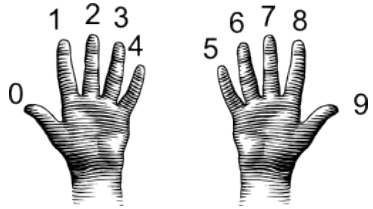

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x = random.randrange(10)
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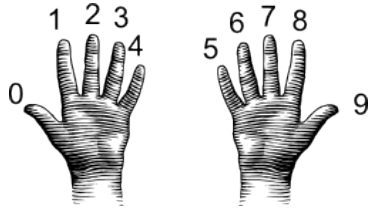

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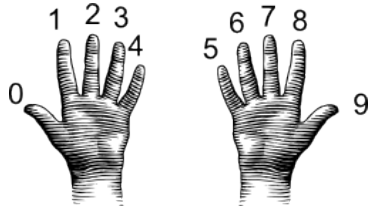

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names = ["zero","one",...,"nine"]
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if x == convert2Decimal(names[x]):
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```

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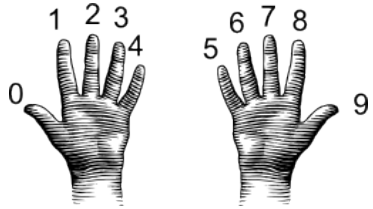

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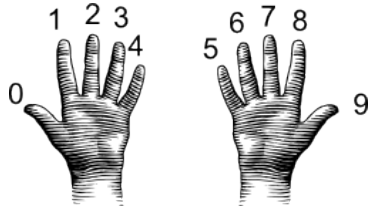

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else:
    #FAIL
```

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  //Another C++ program, demonstrating variables
2  #include <iostream>
3  using namespace std;
4
5  int main ()
6  {
7    int year;
8    cout << "Enter a number: ";
9    cin >> year;
10   cout << "Hello " << year << "!!\n\n";
11   return 0;
12 }
```

onlinegdb demo

```cpp
//Another C++ program, demonstrating variables
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(Demo with `onlinegdb`)

Introduction to C++

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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.

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```

- Programs are organized in functions.

Example:

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

Introduction to C++

- Programs are organized in functions.

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Challenge:

Predict what the following pieces of code will do:

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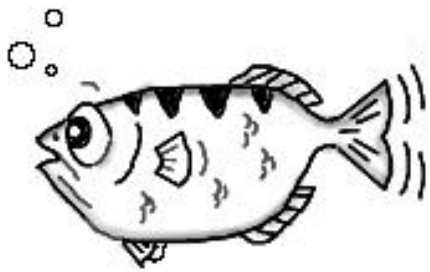
//Another C++ program, demonstrating I/O & arithmetic
#include <iostream>
using namespace std;

int main ()
{
  float kg, lbs;
  cout << "Enter kg: ";
  cin >> kg;
  lbs = kg * 2.2;
  cout << endl << "Lbs: " << lbs << "\n\n";
  return 0;
}
```

Side Note: gdb



gdb.org

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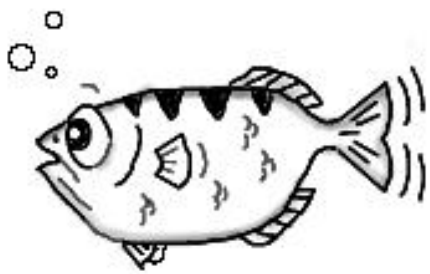

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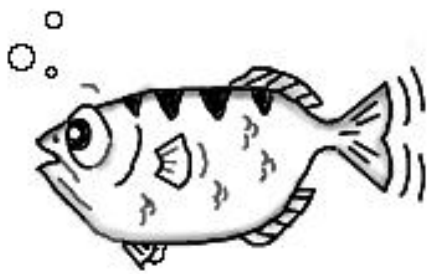

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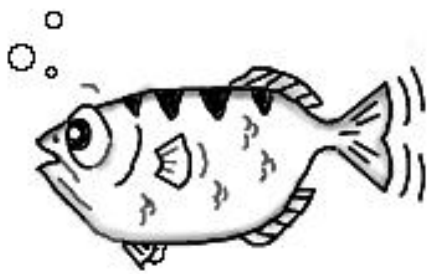

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- Lightweight, widely-available program that allows you to "step through" your code line-by-line.
- Available on the lab machines (via command-line and the IDE `spyder`) and on-line (`onlinegdb.com`).

C++ Demo

```cpp
//Another C++ program, demonstrating I/O & arithmetic
#include <iostream>
using namespace std;

int main ()
{
  float kg, lbs;
  cout << "Enter kg: ";
  cin >> kg;
  lbs = kg * 2.2;
  cout << endl << "Lbs: " << lbs << "\n\n";
  return 0;
}
```

(Demo with `onlinegdb`)

Challenge:...

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

```cpp
//Another C++ program, demonstrating I/O & arithmetic
#include <iostream>
using namespace std;

int main ()
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  float kg, lbs;
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Python Tutor

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

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  cout << endl << "Lbs: " << lbs << "\n\n";
  return 0;
}
```

(Write from scratch in `pythonTutor`.)

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 the following pieces of code will do:

```
//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;
}
```

C++ Demo

```cpp
//Another C++ program; Demonstrates loops
#include <iostream>
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int main ()
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(Demo with `onlinegdb`)

Definite loops

```
//Another C++ program; Demonstrates loops
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      cout << j << " ";
  }
  cout << "Blast off!!" << endl;

  return 0;
}
```

General format:

`for` (*initialization* ; *test* ; *updateAction*)
{

command1;
command2;
command3;
...

}

Challenge:

Predict what the following pieces of code will do:

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

int main ()
{
  int i,j,size;
  cout << "Enter size: ";
  cin >> size;
  for (i = 0; i < size; i++)
  {
    for (j = 0; j < size; j++)
      cout << "*";
    cout << endl;
  }
  cout << "\n\n";
  for (i = size; i > 0; i--)
  {
    for (j = 0; j < i; j++)
      cout << "*";
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  {
    for (j = 0; j < size; j++)
      cout << "*";
    cout << endl;
  }
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  for (i = size; i > 0; i--)
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  }
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```

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Challenge:

Predict what the following pieces of code will do:

```
//Growth example
#include <iostream>
using namespace std;

int main ()
{
  int population = 100;
  cout << "Year\tPopulation\n";
  for (int year = 0; year < 100; year= year+5)
  {
      cout << year << "\t" << population << "\n";
      population = population * 2;

  }
  return 0;
}
```

Challenge:

Translate the C++ program into Python:

```cpp
//Growth example
#include <iostream>
using namespace std;

int main ()
{
  int population = 100;
  cout << "Year\tPopulation\n";
  for (int year = 0; year < 100; year= year+5)
  {
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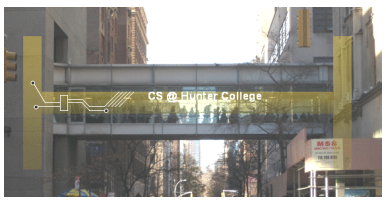
Recap: C++

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



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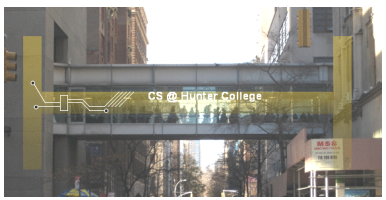

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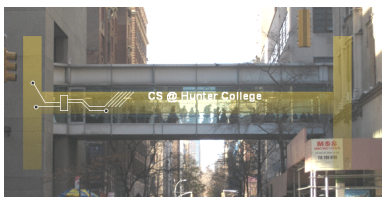

- C++ is a popular programming language that extends C.
- Input/Output (I/O):
  - `cin >>`
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- Definite loops:

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

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- Recap: Incrementer Design Challenge
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Final Exam: When

- The final exam is **Monday, 18 May, 9am-10:30am**, administered via **Gradescope**.

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- **IMPORTANT** let us know your desired exam time and accommodations by answering this survey **by Monday May 11** (Link also provided below video lecture. If you do not answer this survey we will **assume you will take the exam on Monday May 18 at 9am with no accommodations.**)

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- Students will use CUNYfirst to elect the credit/no credit option. Detailed instructions and communications will be provided across multiple channels as part of the communication and implementation plan.

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  - Adjust/rewrite note sheet to include what you wished you had.
- 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

Final Exam Practice Rounds:

For each question, write the function header (name & inputs) and return values (often called the Application Programming Interface (API)):

- **Write a function that takes a weight in kilograms and returns the weight in pounds.**

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```
def kg2lbs(kg):
    ...
    return(lbs)
```

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- **Write a function that takes a weight in kilograms and returns the weight in pounds.**

```
def kg2lbs(kg)
    lbs = kg * 2.2
    return(lbs)
```

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def sLength(str):
    ...
    return(length)
```

Final Exam Practice Rounds:

For each question, write the function header (name & inputs) and return values (often called the Application Programming Interface (API)):

- **Write a function that takes a string and returns its length.**

```
def sLength(str):
    length = len(str)
    return(length)
```

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

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

```
def getMin(df):
    ...
    return(min)
```

Final Exam Practice Rounds:

For each question below, write the function header (name & inputs) and return values (often called the Application Programming Interface (API)):

- **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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For each question, write the function header (name & inputs) and return values (often called the Application Programming Interface (API)):

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- **Write a function that takes a whole number and returns the corresponding binary number as a string.**

```
def num2bin(num):
    ...
    return(bin)
```

Final Exam Practice Rounds:

For each question, write the function header (name & inputs) and return values (often called the Application Programming Interface (API)):

- **Write a function that takes a whole number and returns the corresponding binary number as a string.**

```
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)
```

Final Exam Practice Rounds:

For each question, write the function header (name & inputs) and return values (often called the Application Programming Interface (API)):

- **Write a function that computes the total monthly payment when given the initial loan amount, annual interest rate, number of years of the loan.**

Final Exam Practice Rounds:

For each question, write the function header (name & inputs) and return values (often called the Application Programming Interface (API)):

- **Write a function that computes the total monthly payment when given the initial loan amount, annual interest rate, number of years of the loan.**

```
def computePayment(loan,rate,year):
    ....
    return(payment)
```

Final Exam Practice Rounds:

For each question below, write the function header (name & inputs) and return values (often called the Application Programming Interface (API)):

- **Write a function that computes the total monthly payment when given the initial loan amount, annual interest rate, number of years of the loan.**

```
def computePayment(loan,rate,year):
    (Some formula for payment)
    return(payment)
```

Educational Psychology Study

- If you have consented to participate in the **Educational Psychology study**, please fill in the 3-question survey
- Clickable link also below the video.
- Thank you for your participation!!!