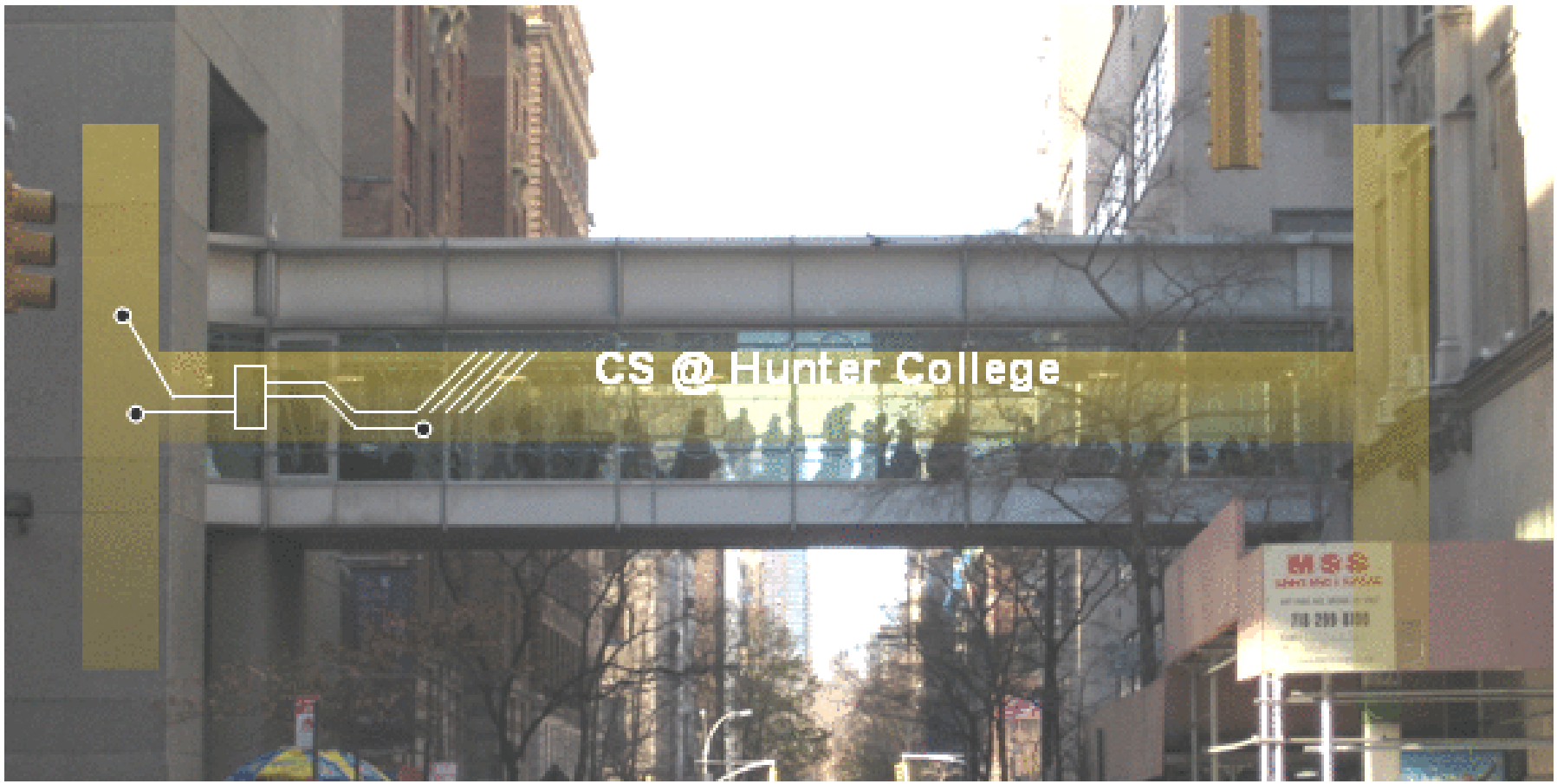
CSci 127: Introduction to Computer Science



hunter.cuny.edu/csci

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  - *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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- *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++
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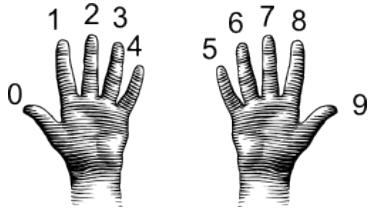

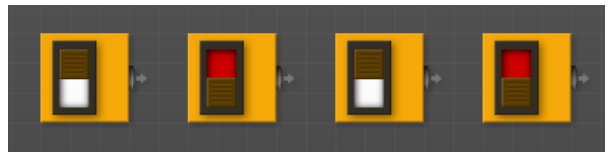

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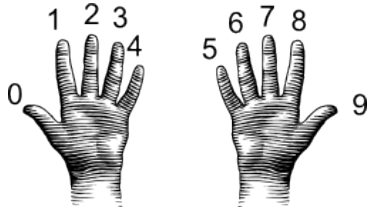

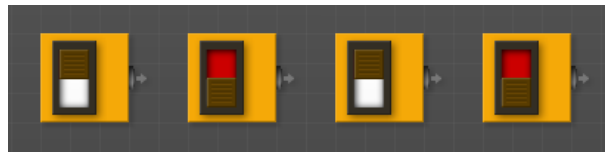

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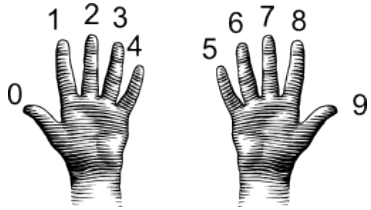

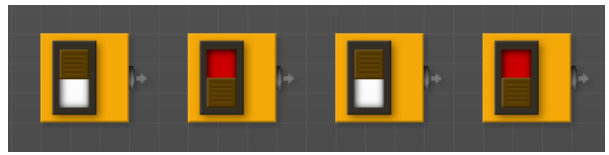

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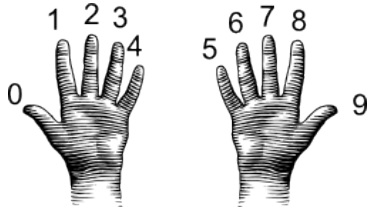

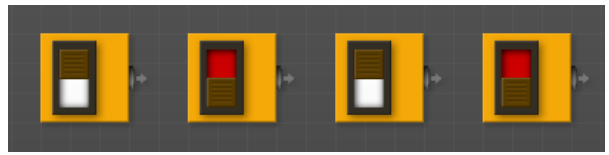

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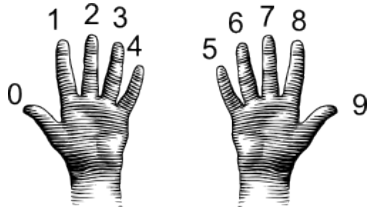

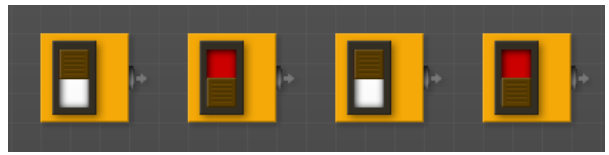

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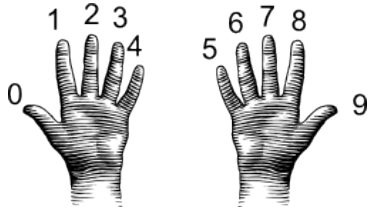

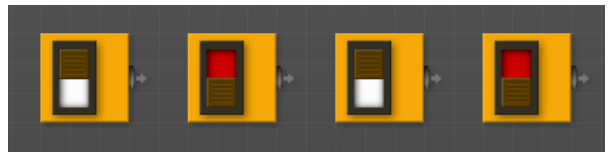

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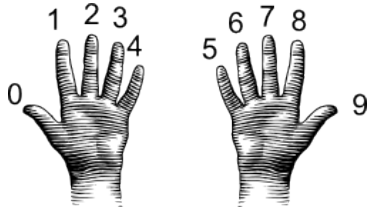

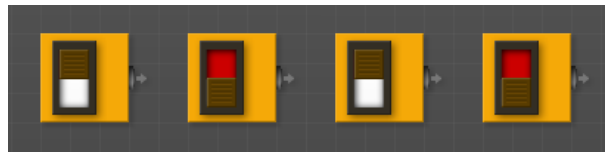

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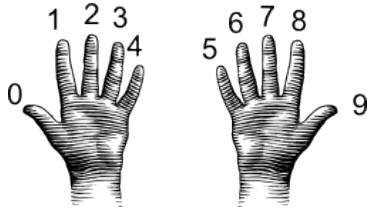

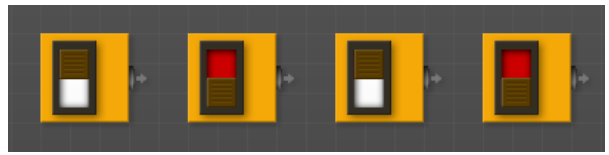

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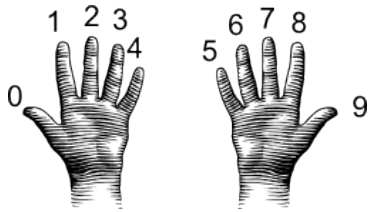

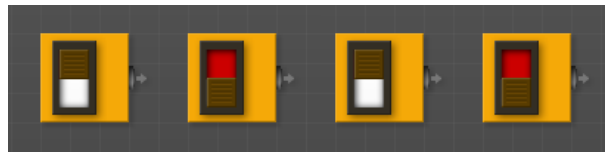

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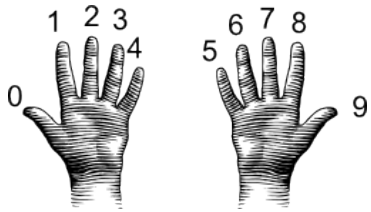

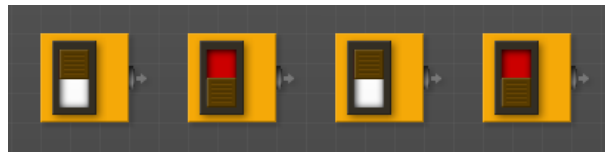

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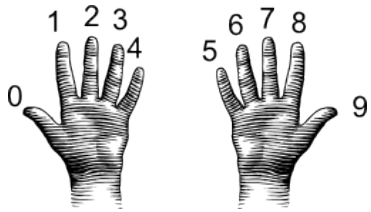

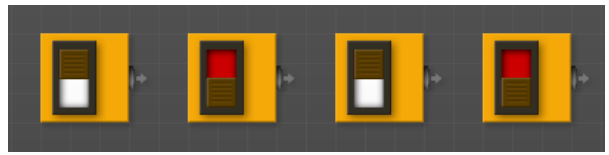

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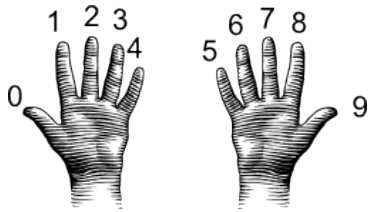

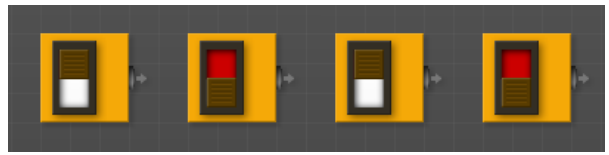

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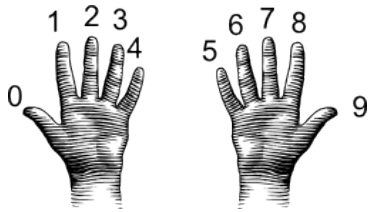

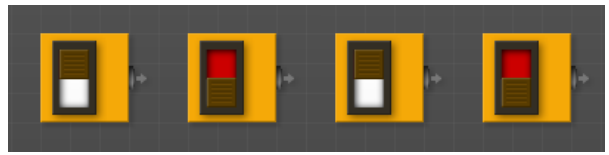

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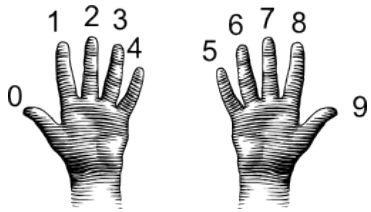

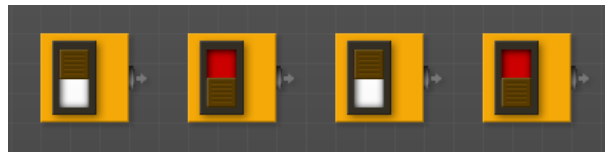

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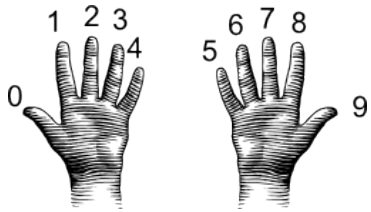

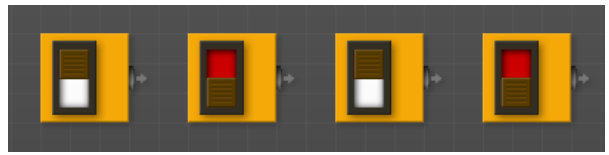

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5. Print the result.

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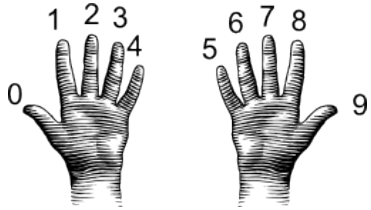

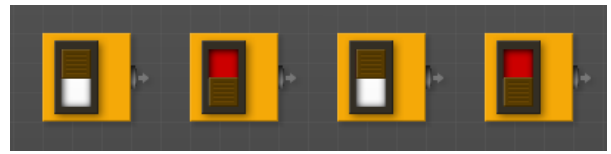

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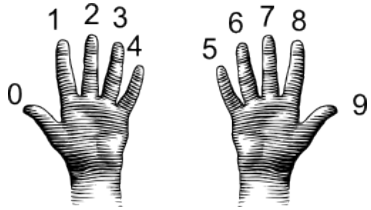

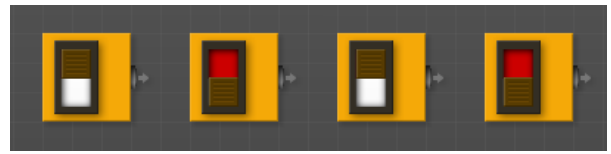

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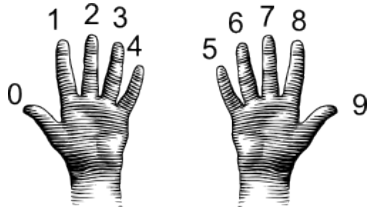
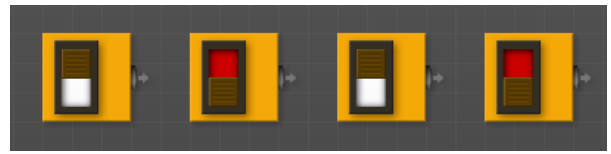
- Challenge: Write an algorithm for incrementing binary numbers. Example: `"1001"` $\rightarrow$ `"1010"`

Pseudocode same for both questions:

1. Get user input: `"forty one"`
2. Convert to standard decimal number: `41`

Recap: Incrementer Design Challenge





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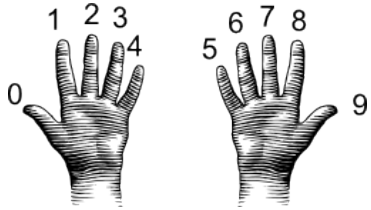
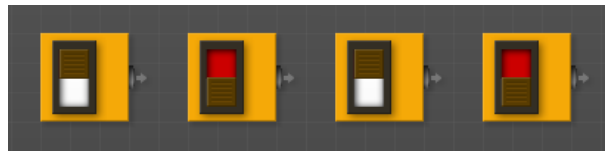
Pseudocode same for both questions:

1. Get user input: `"forty one"`
2. Convert to standard decimal number: `41`
3. Add one (increment) the standard decimal number: `42`

Recap: Incrementer Design Challenge





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Pseudocode same for both questions:

1. Get user input: `"forty one"`
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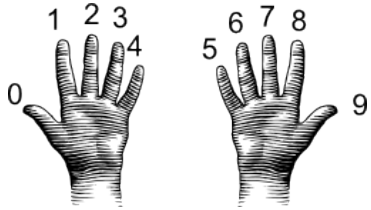
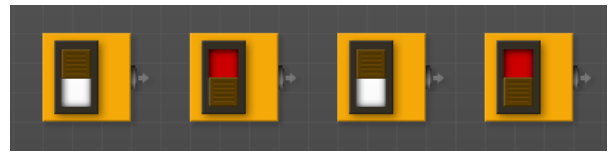
Recap: Incrementer Design Challenge





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1. Get user input: `"forty one"`
2. Convert to standard decimal number: `41`
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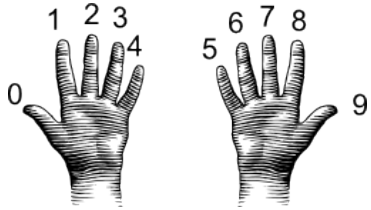
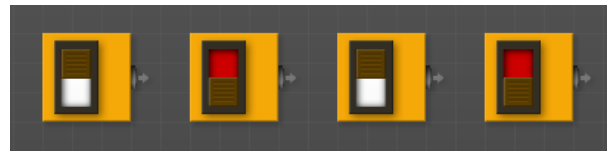
4. Convert back to your format: `"forty two"`
5. Print the result.

Recap: Incrementer Design Challenge





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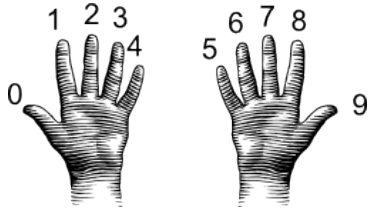
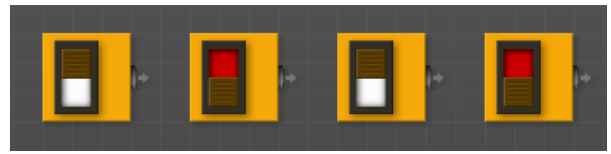
1. Get user input: `"1001"`

Recap: Incrementer Design Challenge





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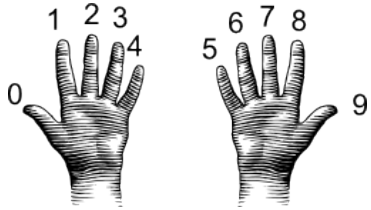
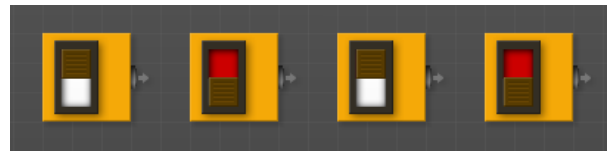
Pseudocode same for both questions:

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

Recap: Incrementer Design Challenge





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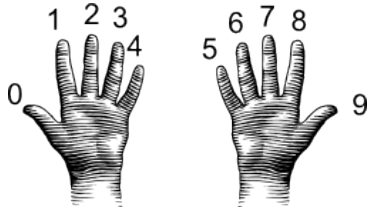
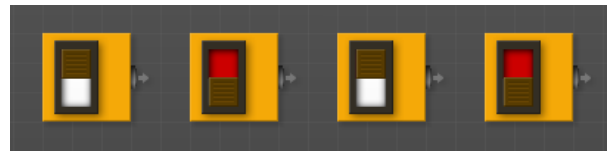
Pseudocode same for both questions:

1. Get user input: `"1001"`
2. Convert to standard decimal number: 9
3. Add one (increment) the standard decimal number: 10

Recap: Incrementer Design Challenge





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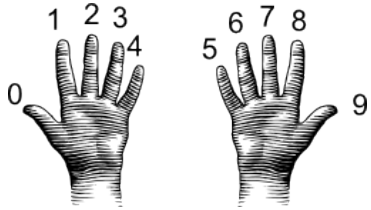
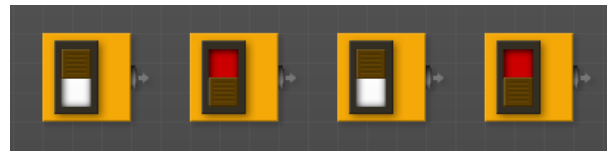
Recap: Incrementer Design Challenge





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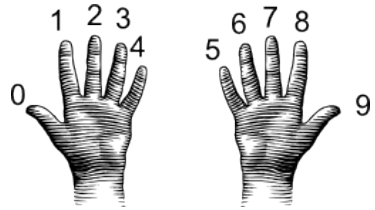
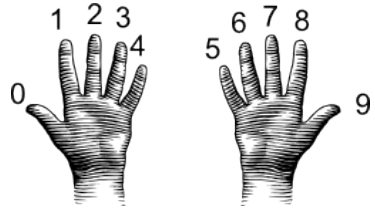
Recap: Incrementer Design Challenge



Focus on: Convert to standard decimal number:

Recap: Incrementer Design Challenge



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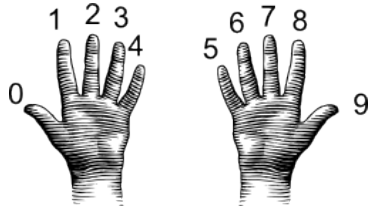
```
def convert2Decimal(numString):
```

Recap: Incrementer Design Challenge



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```
def convert2Decimal(numString):
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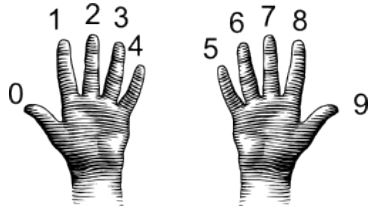
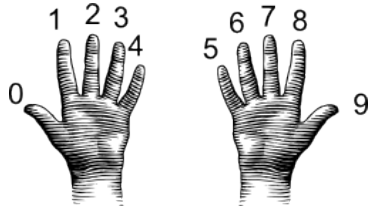
Recap: Incrementer Design Challenge



Focus on: Convert to standard decimal number:

```
def convert2Decimal(numString):
    #Start with one-digit numbers:  zero,one,...,nine
    if numString == "zero":
        return(0)
```

Recap: Incrementer Design Challenge



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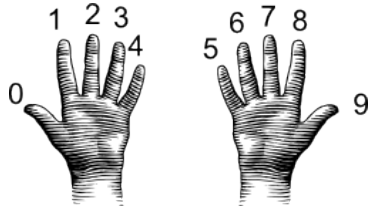

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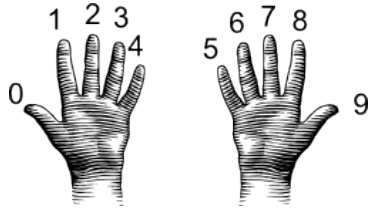
Recap: Incrementer Design Challenge



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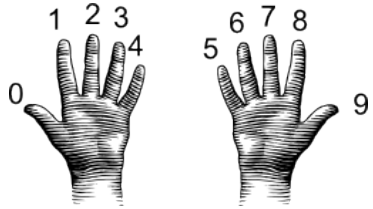

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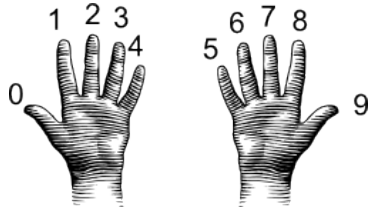
Will this work?

Unit Testing: Incrementer Design Challenge



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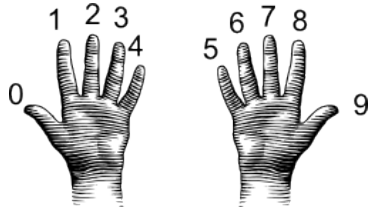
Will this work? What inputs would find the error(s)?

Unit Testing: Incrementer Design Challenge



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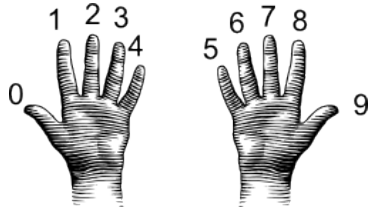
Unit Testing: testing individual units/functions/blocks of code to verify correctness.

Unit Testing: Incrementer Design Challenge



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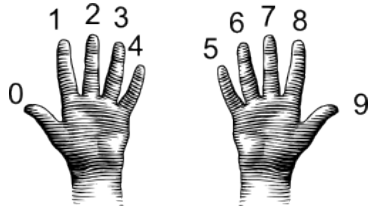
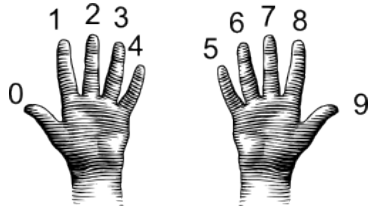


- Unit Testing: testing individual units/functions/blocks of code to verify correctness. Often automated (e.g. gradescope).
- To test all branches of code, would need to test all inputs: `"zero"`, `"one"`,..., `"nine"`, & some bad inputs.

Unit Testing: Incrementer Design Challenge



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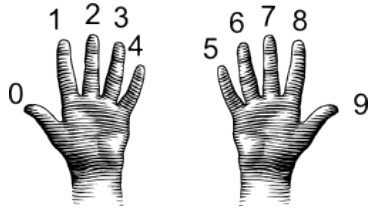

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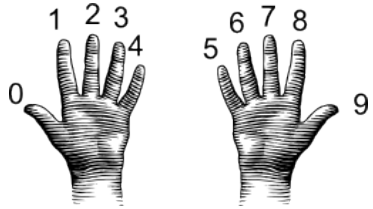
- If large, design automated tests that will "cover" as many branches as possible and use randomly generated inputs:

Unit Testing: Incrementer Design Challenge



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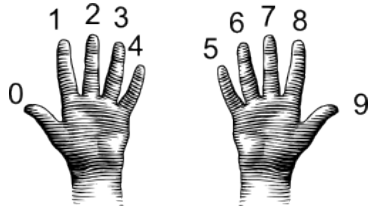
```
names = ["zero","one",...,"nine"]
```

Unit Testing: Incrementer Design Challenge



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```
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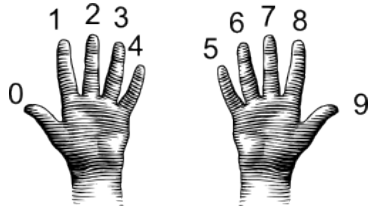
x = random.randrange(10)
```

Unit Testing: Incrementer Design Challenge



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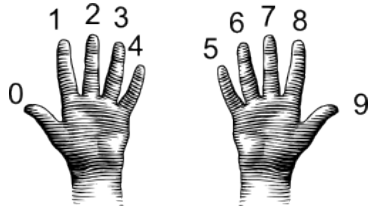
```
names = ["zero","one",...,"nine"]
x = random.randrange(10)
if x == convert2Decimal(names[x]):
```

Unit Testing: Incrementer Design Challenge



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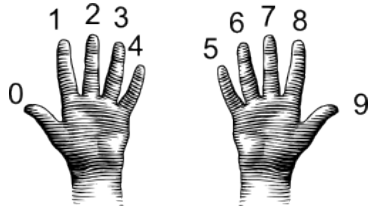
- If large, design automated tests that will "cover" as many branches as possible and use randomly generated inputs:

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

Unit Testing: Incrementer Design Challenge



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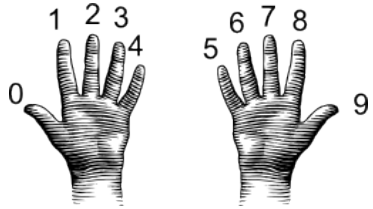
Unit Testing: Incrementer Design Challenge



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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:

```
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  //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
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```

(Demo with `onlinegdb`)

Introduction to C++

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

Introduction to C++

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int main ()
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- C++ is a popular programming language that extends C.
- Fast, efficient, and powerful.

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.

```
1  //Another C++ program, demonstrating variables
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Introduction to C++

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Example:

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Introduction to C++

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Example:

`int main()`

Introduction to C++

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Example:

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

Introduction to C++

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  `#include <iostream>`
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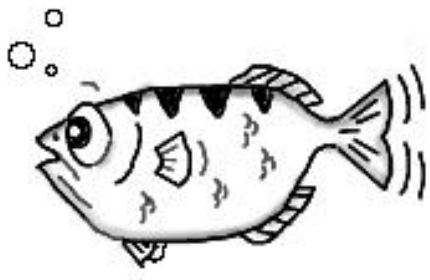
Challenge:

Predict what the following pieces of code will do:

```
//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

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

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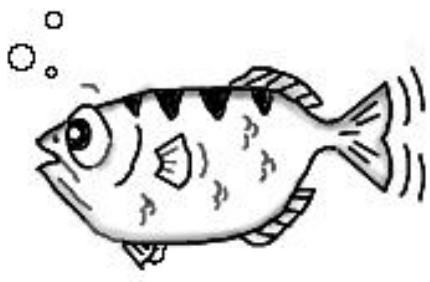

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- Written in 1986, gdb is the GNU debugger and based on dbx from the Berkeley Distribution of Unix.

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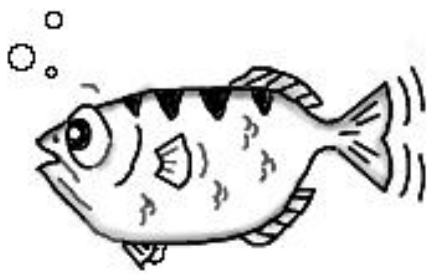

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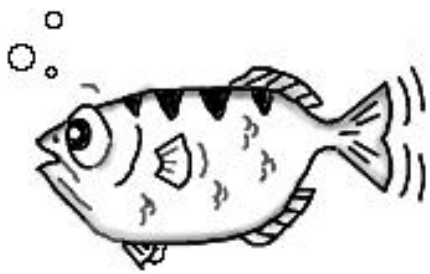

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- Lightweight, widely-available program that allows you to "step through" your code line-by-line.
- Available on-line (`onlinegdb.com`) or follow installation instructions in Lab 12.

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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  return 0;
}
```

Python Tutor

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

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  cin >> kg;
  lbs = kg * 2.2;
  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>
using namespace std;

int main ()
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  int i,j;
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  return 0;
}
```

(Demo with `onlinegdb`)

Definite loops

```
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int main ()
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  int i,j;
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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 << "*";
    cout << endl;
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  return 0;
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C++ Demo

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    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 << "*";
    cout << endl;
  }
  return 0;
}
```

(Demo with `onlinegdb`)

Lecture Slips

Which UTA have you spoken with most? Why?

Lecture Slip:

Translate the C++ program into Python:

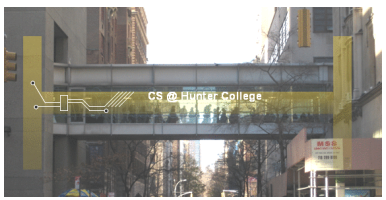
```cpp
//Growth example
#include <iostream>
using namespace std;

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

  }
  return 0;
}
```

Recap: C++

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



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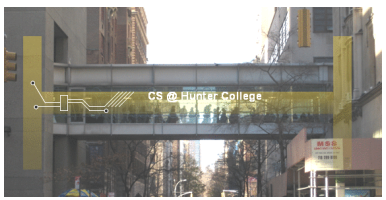

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  - `cin >>`
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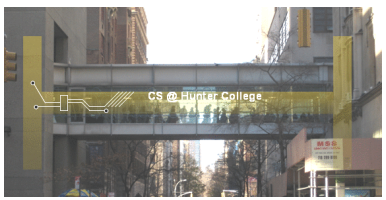

- C++ is a popular programming language that extends C.
- Input/Output (I/O):
  - `cin >>`
  - `cout <<`
- Definite loops:

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

Today's Topics

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Final Overview: Format

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  - With notes, examples, programs: what will help you on the exam.
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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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def kg2lbs(kg)
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- **Write a function that, given a DataFrame, returns the minimal value in the "Manhattan" column.**

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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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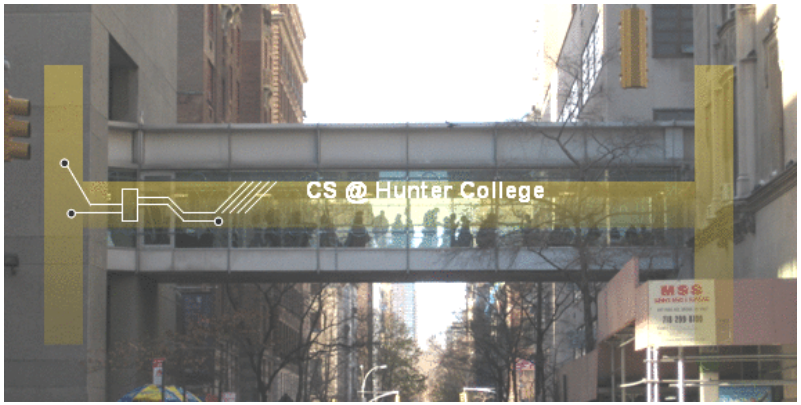
Weekly Reminders!



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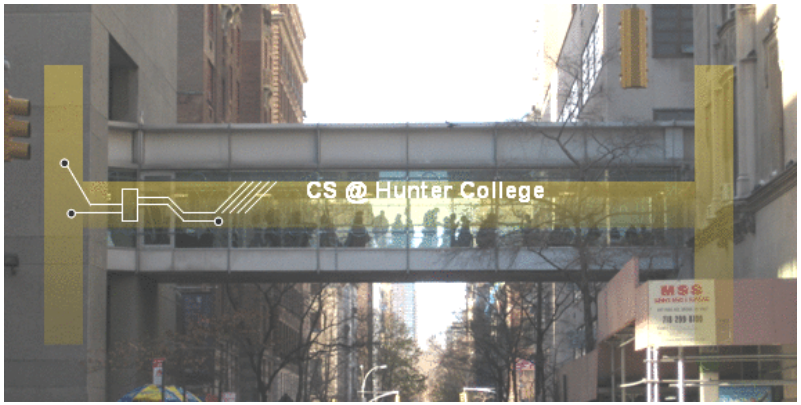

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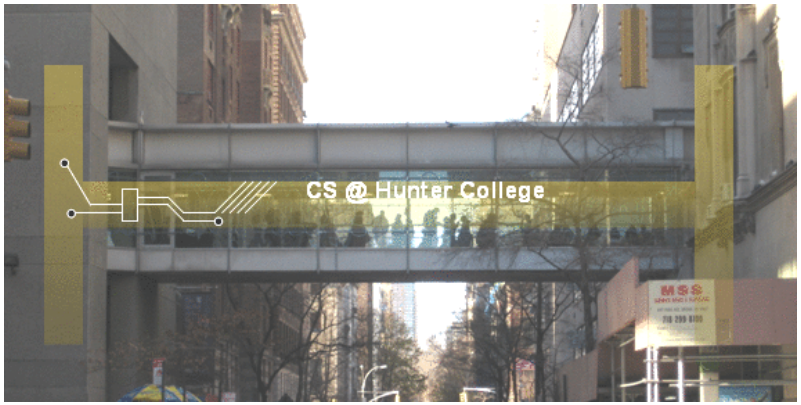

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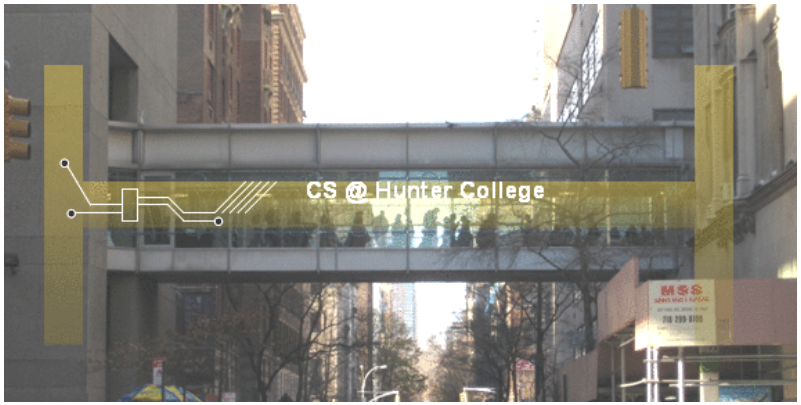

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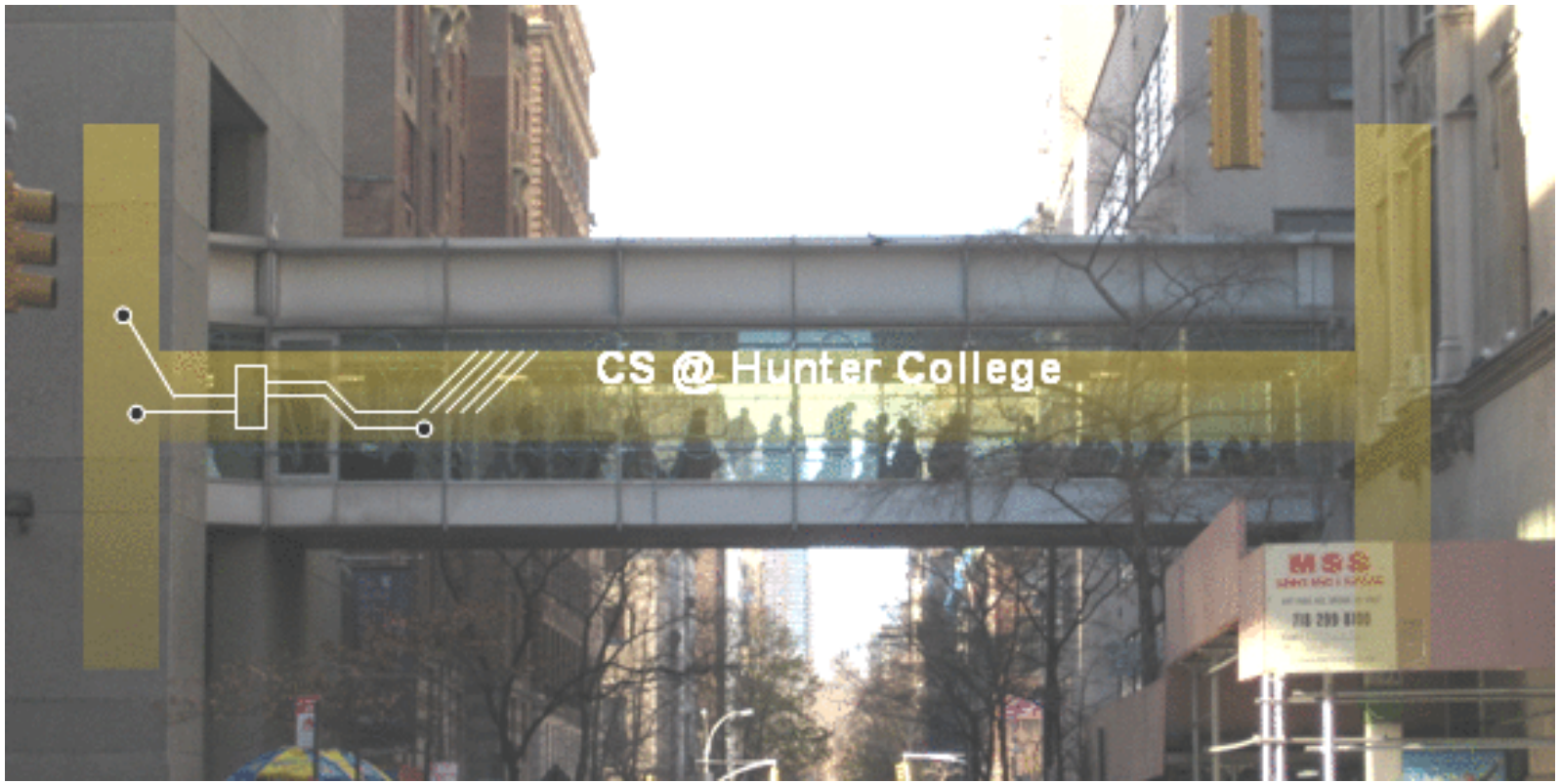
- Take the Lecture Preview on Blackboard on Monday (or no later than 10:15am on Tuesday)

Lecture Slips & Writing Boards



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