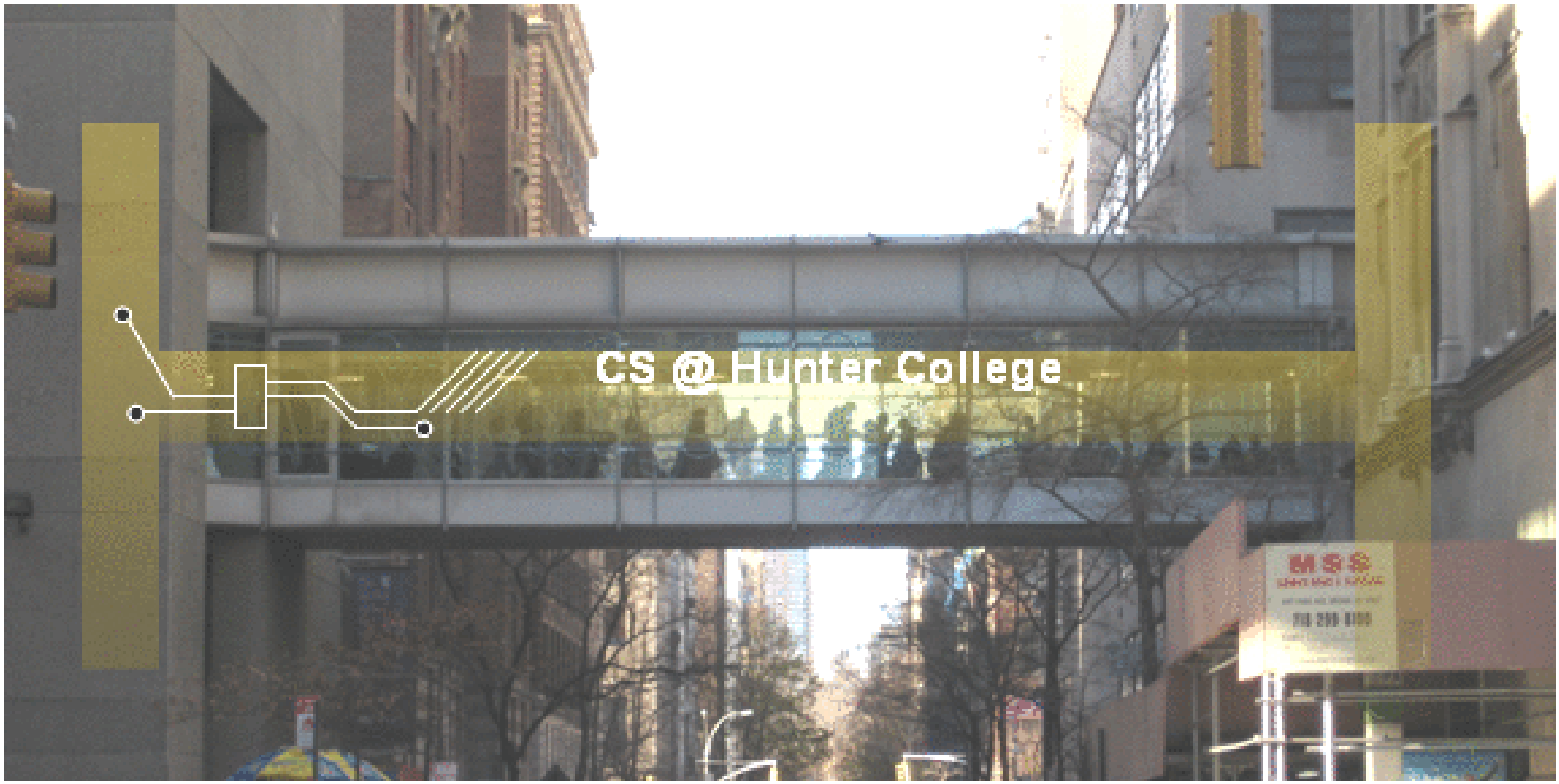
CSci 127: Introduction to Computer Science



hunter.cuny.edu/csci

- This lecture will be recorded

Frequently Asked Questions

From email and tutoring.

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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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- *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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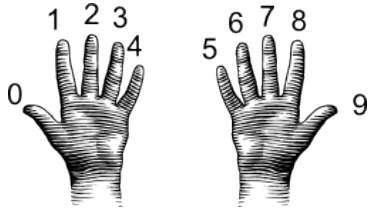

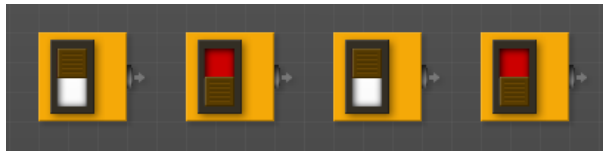

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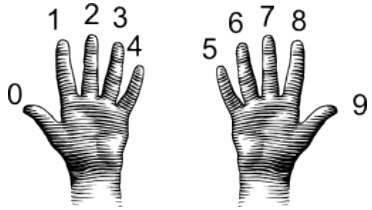

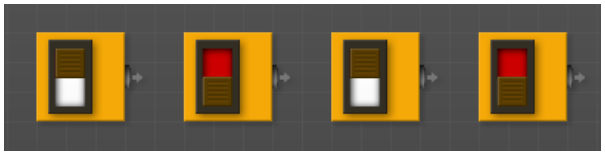

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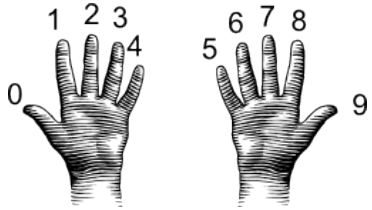

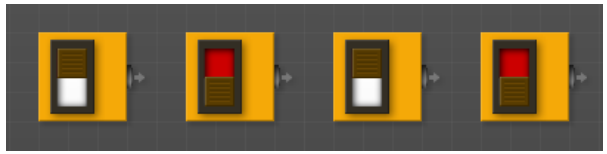

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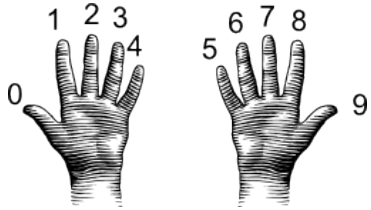

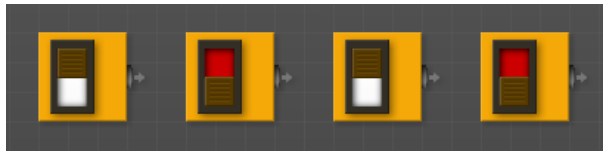

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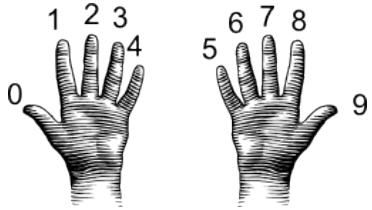

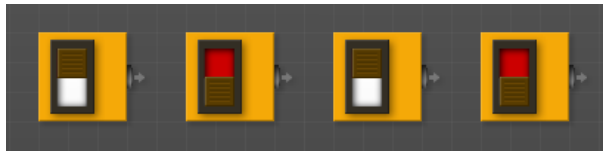

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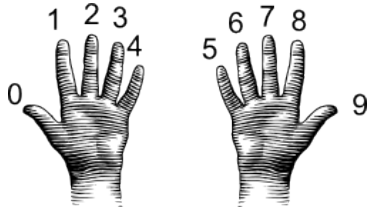

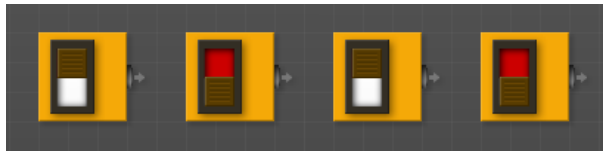

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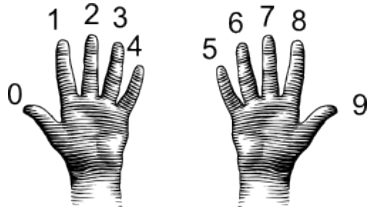

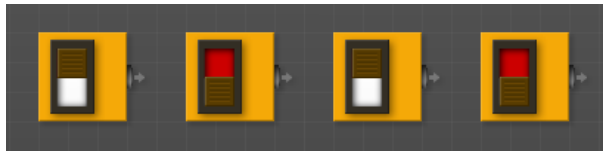

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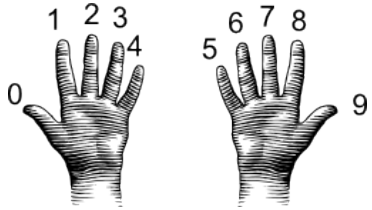

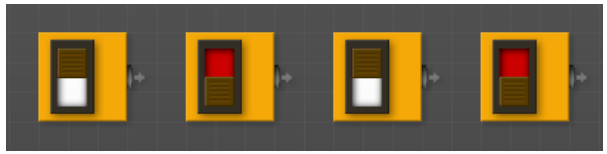

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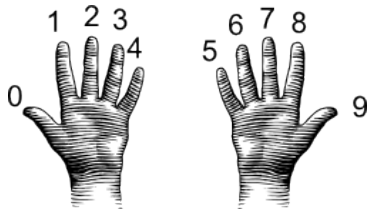

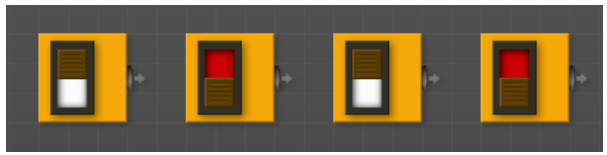

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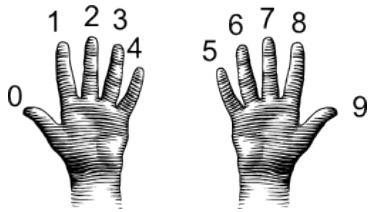

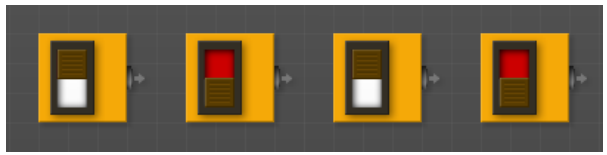

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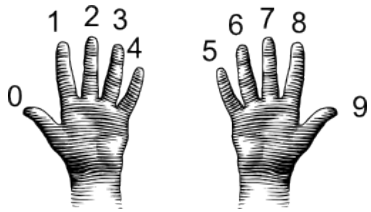

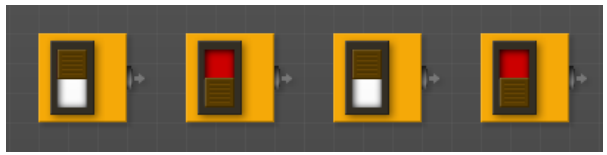

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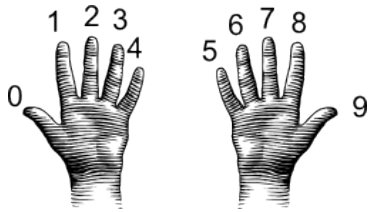

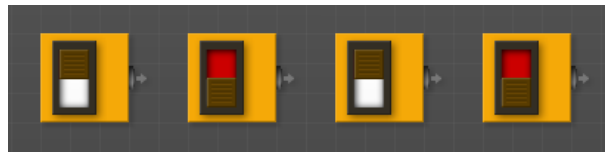

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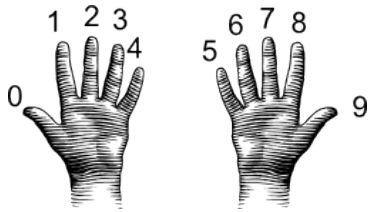

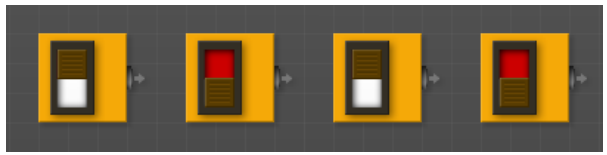

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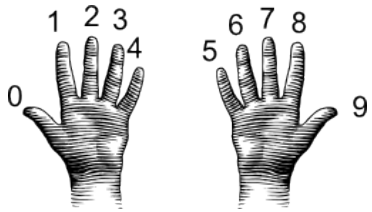

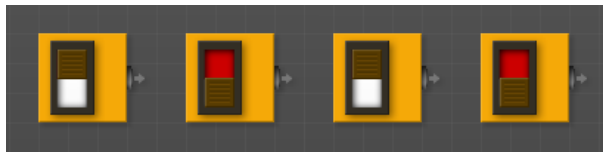

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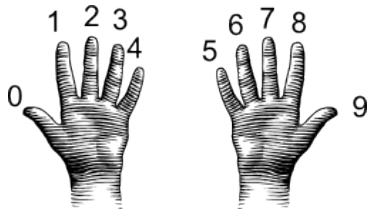

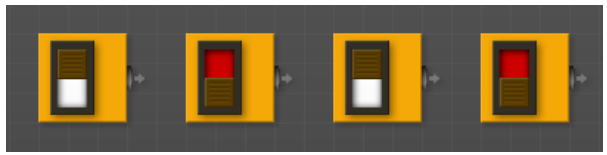

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5. Print the result.

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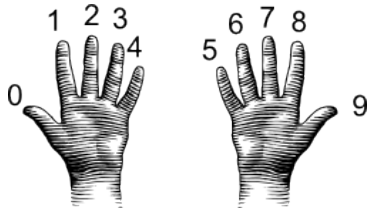

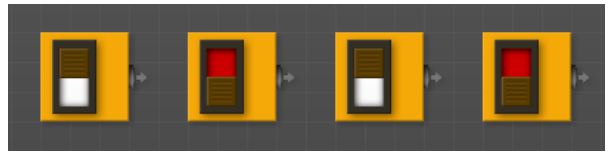

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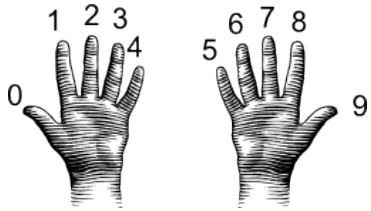

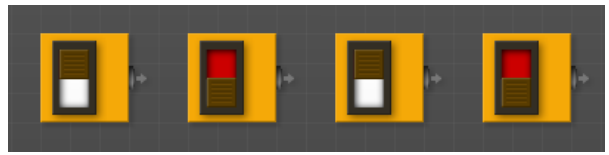

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1. Get user input: `"forty one"`
2. Convert to standard decimal number: `41`

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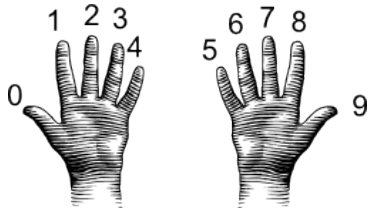

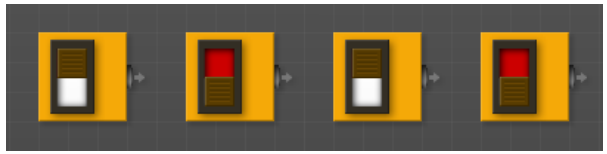

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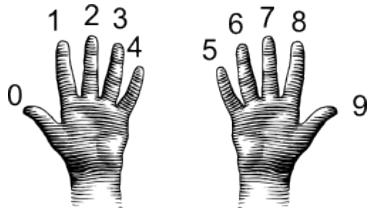

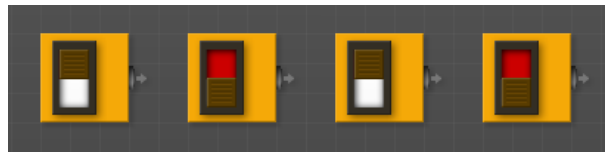

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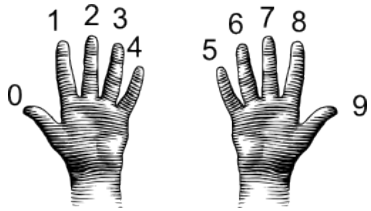
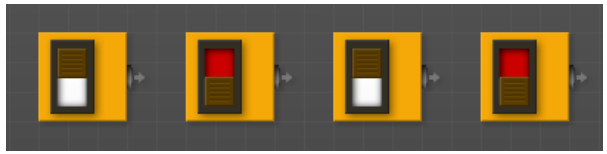
4. Convert back to your format: `"forty two"`

Recap: Incrementer Design Challenge



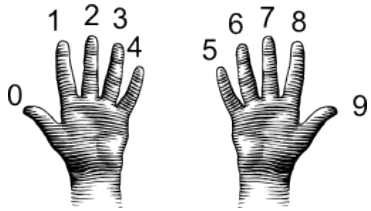


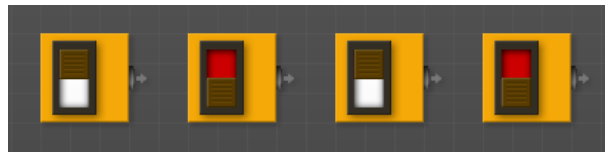
- Challenge: Write an algorithm for incrementing numbers expressed as words. Example: `"forty one"` $\rightarrow$ `"forty two"`
- Challenge: Write an algorithm for incrementing binary numbers. Example: `"1001"` $\rightarrow$ `"1010"`

Pseudocode same for both questions:

1. Get user input: `"forty one"`
2. Convert to standard decimal number: `41`
3. Add one (increment) the standard decimal number: `42`
4. Convert back to your format: `"forty two"`
5. Print the result.

Recap: Incrementer Design Challenge





- Challenge: Write an algorithm for incrementing numbers expressed as words. Example: `"forty one"` $\rightarrow$ `"forty two"`
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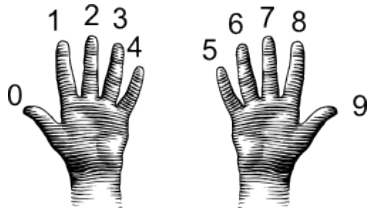
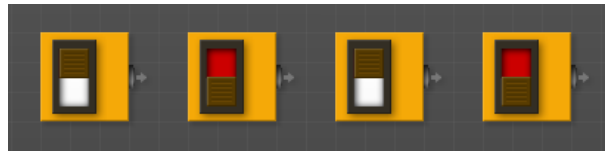
Pseudocode same for both questions:

1. Get user input: `"1001"`

Recap: Incrementer Design Challenge



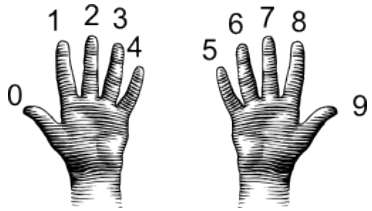


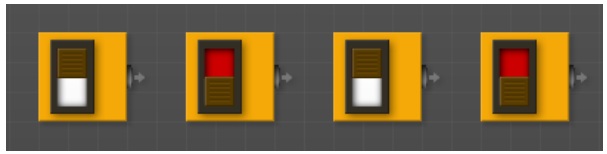
- Challenge: Write an algorithm for incrementing numbers expressed as words. Example: `"forty one"` $\rightarrow$ `"forty two"`
- Challenge: Write an algorithm for incrementing binary numbers. Example: `"1001"` $\rightarrow$ `"1010"`

Pseudocode same for both questions:

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

Recap: Incrementer Design Challenge



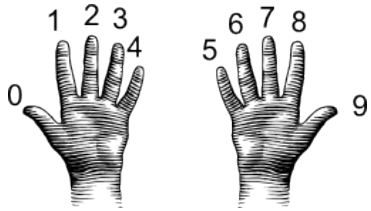


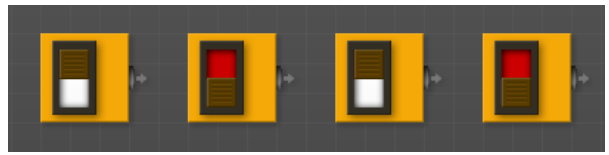
- Challenge: Write an algorithm for incrementing numbers expressed as words. Example: `"forty one"` $\rightarrow$ `"forty two"`
- Challenge: Write an algorithm for incrementing binary numbers. Example: `"1001"` $\rightarrow$ `"1010"`

Pseudocode same for both questions:

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

Recap: Incrementer Design Challenge





- Challenge: Write an algorithm for incrementing numbers expressed as words. Example: `"forty one"` $\rightarrow$ `"forty two"`
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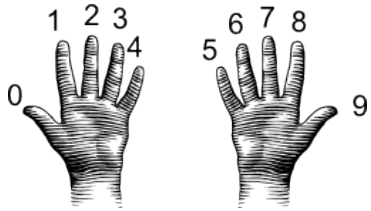
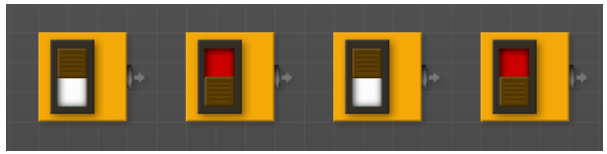
Pseudocode same for both questions:

1. Get user input: `"1001"`
2. Convert to standard decimal number: 9
3. Add one (increment) the standard decimal number: 10
4. Convert back to your format: `"1010"`

Recap: Incrementer Design Challenge



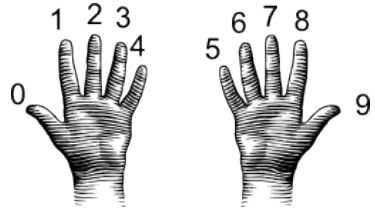


- Challenge: Write an algorithm for incrementing numbers expressed as words. Example: `"forty one"` $\rightarrow$ `"forty two"`
- Challenge: Write an algorithm for incrementing binary numbers. Example: `"1001"` $\rightarrow$ `"1010"`

Pseudocode same for both questions:

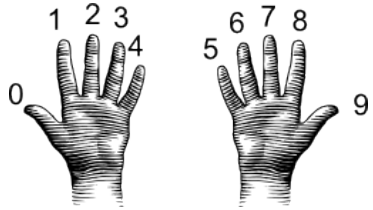
1. Get user input: `"1001"`
2. Convert to standard decimal number: 9
3. Add one (increment) the standard decimal number: 10
4. Convert back to your format: `"1010"`
5. Print the result.

Recap: Incrementer Design Challenge



Focus on: Convert to standard decimal number:

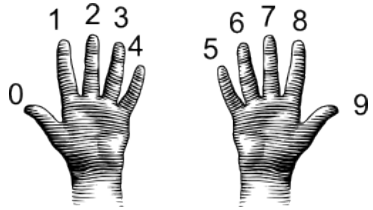
Recap: Incrementer Design Challenge



Focus on: Convert to standard decimal number:

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

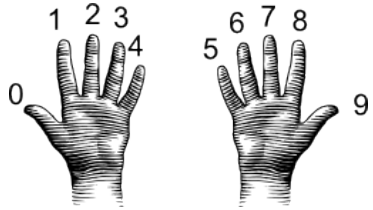
Recap: Incrementer Design Challenge



Focus on: Convert to standard decimal number:

```
def convert2Decimal(numString):
    #Start with one-digit numbers:  zero,one,...,nine
```

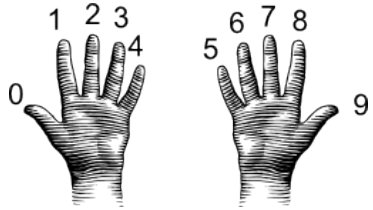
Recap: Incrementer Design Challenge



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



Focus on: Convert to standard decimal number:

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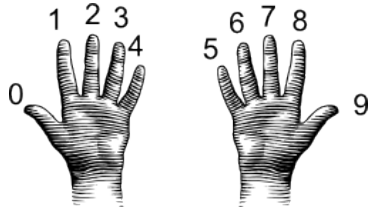
def convert2Decimal(numString):
    #Start with one-digit numbers:  zero,one,...,nine
    if numString == "zero":
        return(0)
    elif numString == "one":
        return(1)
```

Recap: Incrementer Design Challenge



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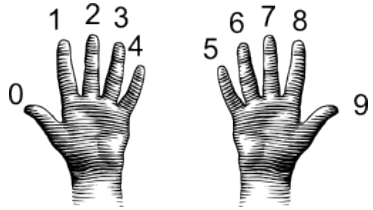
Recap: Incrementer Design Challenge



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        return(1)
    elif numString == "two":
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    else:
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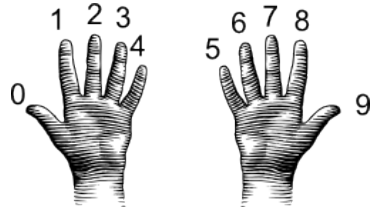
```

Recap: Incrementer Design Challenge



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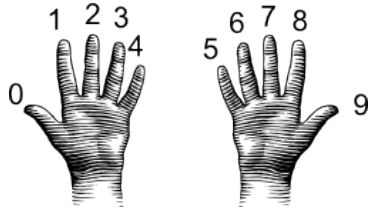
```

Will this work?

Unit Testing: Incrementer Design Challenge



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```

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

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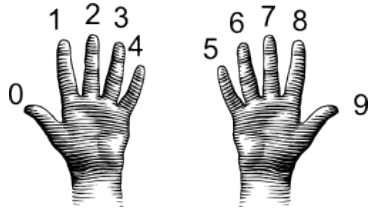

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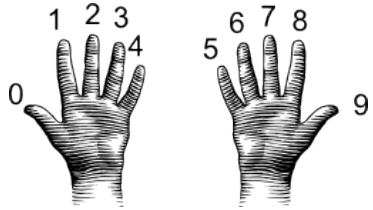
Unit Testing: testing individual units/functions/blocks of code to verify correctness.

Unit Testing: Incrementer Design Challenge



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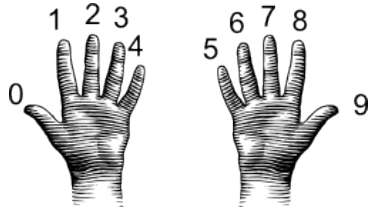
Unit Testing: Incrementer Design Challenge



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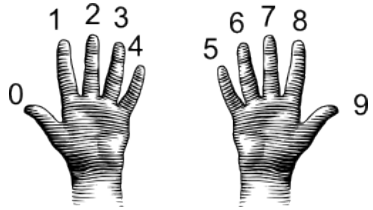
- To test all branches of code, would need to test all inputs: `"zero"`, `"one"`,..., `"nine"`, & some bad inputs.

Unit Testing: Incrementer Design Challenge



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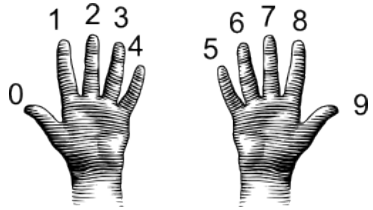
  Also important to test **edge cases**.

Unit Testing: Incrementer Design Challenge



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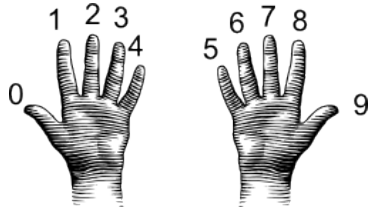
- If large, design automated tests that will "cover" as many branches as possible and use randomly generated inputs:

Unit Testing: Incrementer Design Challenge



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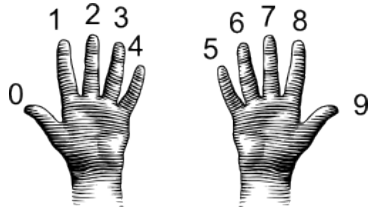
```
names = ["zero","one",...,"nine"]
```

Unit Testing: Incrementer Design Challenge



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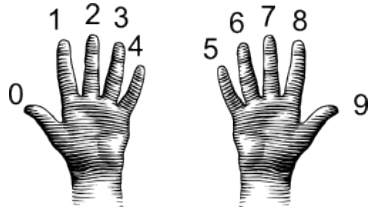
```
names = ["zero","one",...,"nine"]
x = random.randrange(10)
```

Unit Testing: Incrementer Design Challenge



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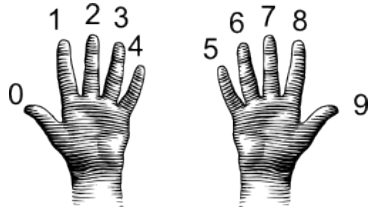
```
names = ["zero","one",...,"nine"]
x = random.randrange(10)
if x == convert2Decimal(names[x]):
```

Unit Testing: Incrementer Design Challenge



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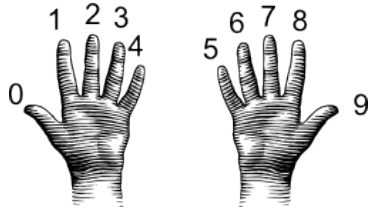
```
names = ["zero","one",...,"nine"]
x = random.randrange(10)
if x == convert2Decimal(names[x]):
    #PASS
```

Unit Testing: Incrementer Design Challenge



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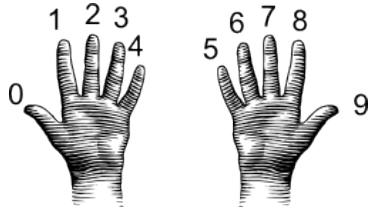
    #PASS
else:
```

Unit Testing: Incrementer Design Challenge



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```
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
//Another C++ program, demonstrating variables
#include <iostream>
using namespace std;

int main ()
{
  int year;
  cout << "Enter a number: ";
  cin >> year;
  cout << "Hello " << year << "!!\n\n";
  return 0;
}
```

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

Introduction to C++

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int main ()
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  int year;
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- 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  //Another C++ program, demonstrating variables
2  #include <iostream>
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5  int main ()
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Introduction to C++

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Example:

```
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5  int main ()
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Introduction to C++

```
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5  int main ()
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```

- Programs are organized in functions.

  Example:

  `int main()`

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Example:

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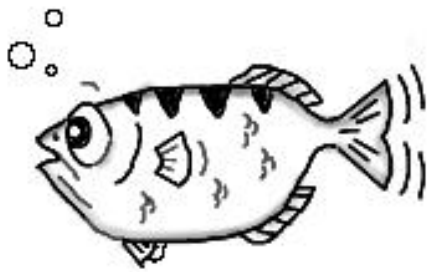

Side Note: gdb



gdb.org

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

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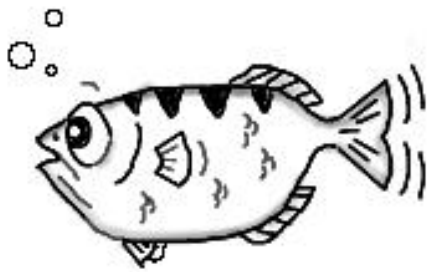

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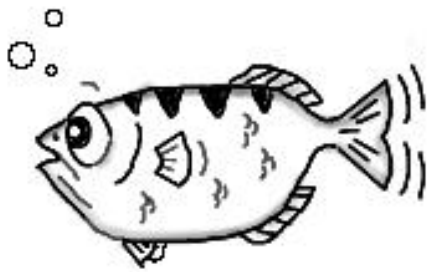

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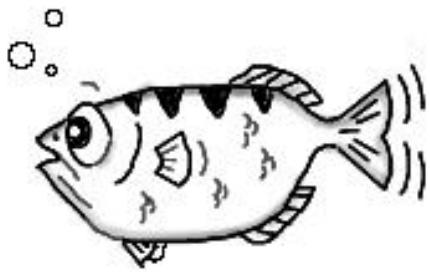

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- Lightweight, widely-available program that allows you to "step through" your code line-by-line.
- Available on-line (`onlinegdb.com`) or follow installation instructions in Lab 12.

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>
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int main ()
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Python Tutor

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

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  return 0;
}
```

(Write from scratch in `pythonTutor`.)

Lecture Quiz

- Log-in to Gradescope
- Find LECTURE 12 Quiz
- Take the quiz
- **You have 3 minutes**

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

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

Definite 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++)
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  }
  return 0;
}
```

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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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```
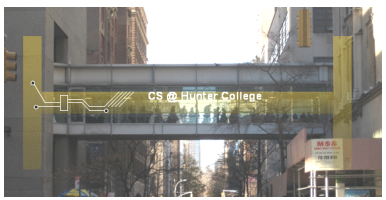

Recap: C++

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



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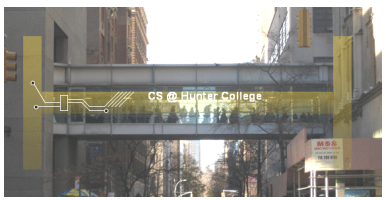

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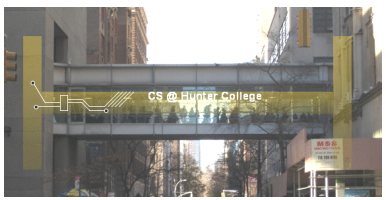

- C++ is a popular programming language that extends C.
- Input/Output (I/O):
  - `cin >>`
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```
for (i = 0; i < 10; i++) {
    ...
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- Aim to complete 7 to 10 past exams (one a day in the week leading 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.

Final Exam Practice Rounds:

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

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

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.**

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

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.**

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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)
```

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, 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)
```

Final Exam Practice Rounds:

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

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```
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.**

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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)
```

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Before next lecture, don't forget to:

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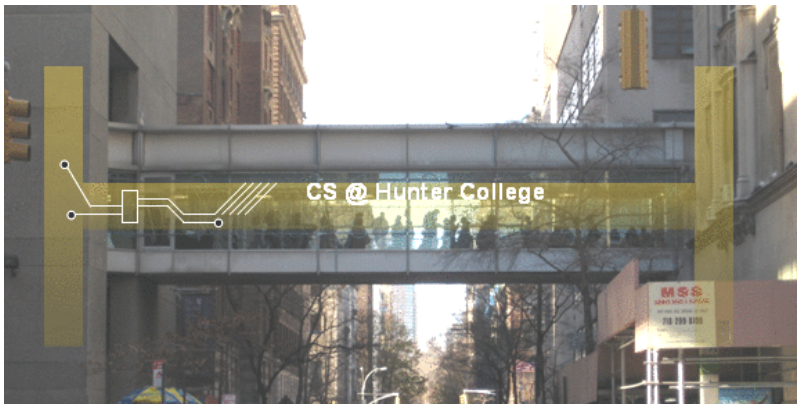
Weekly Reminders!



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- Happy Thanksgiving!