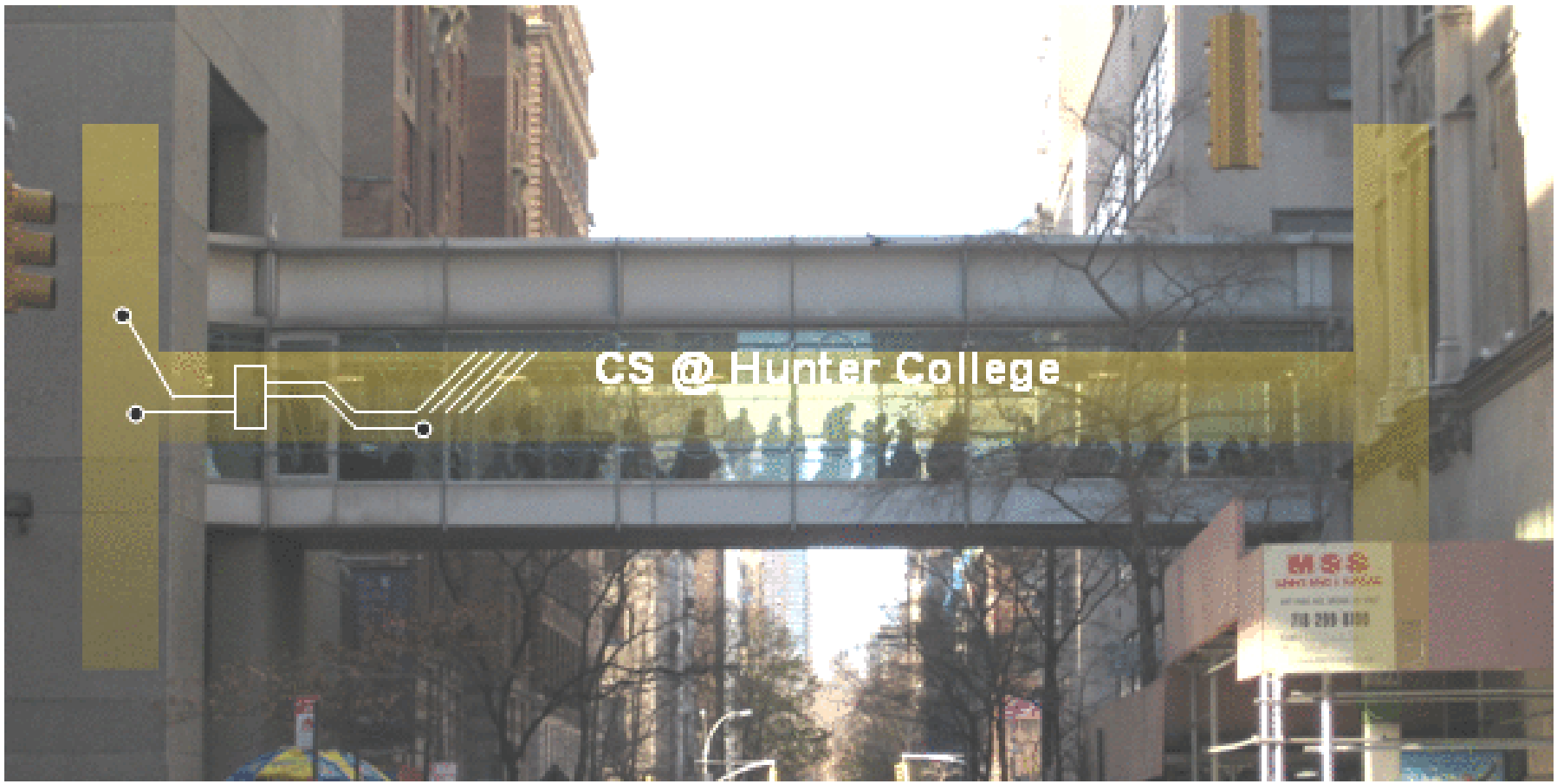
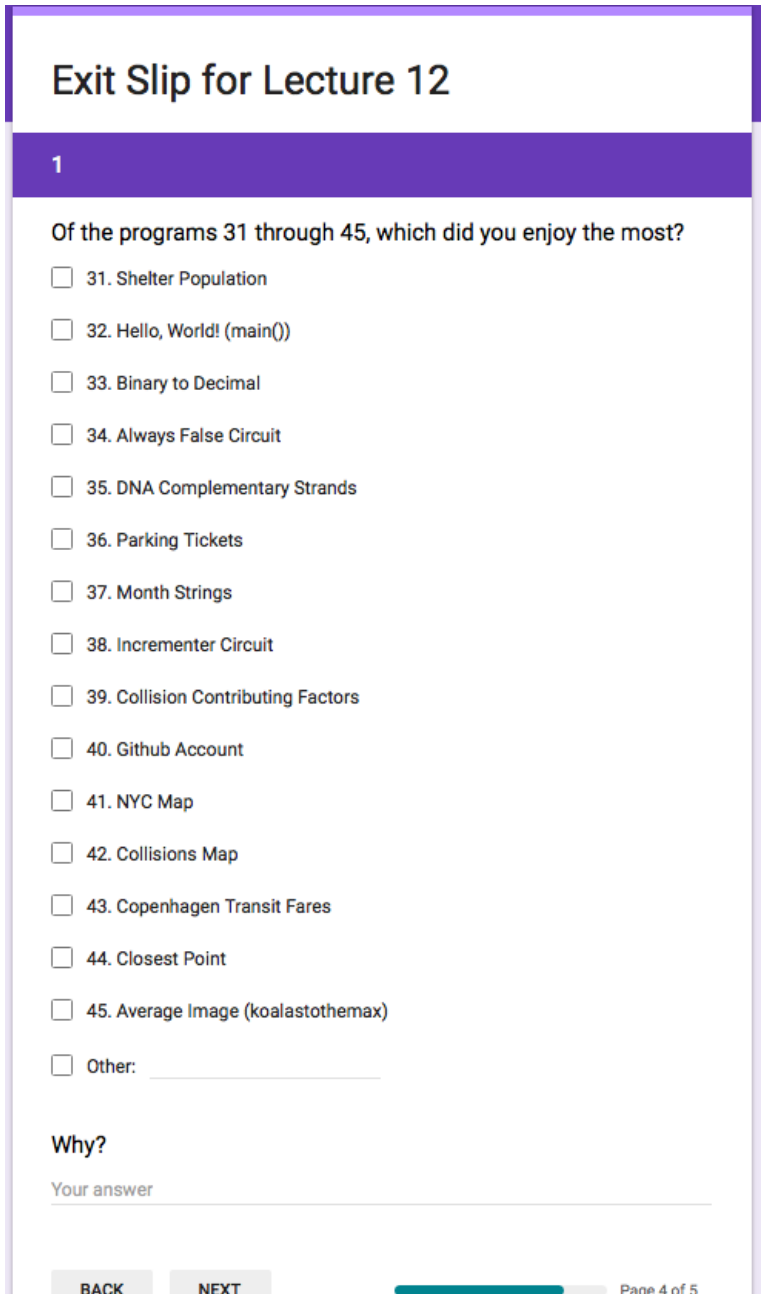
CSci 127: Introduction to Computer Science



hunter.cuny.edu/csci

Lecture Slips: `tinyurl.com/ycrcn3k6`



Exit Slip for Lecture 12

1

Of the programs 31 through 45, which did you enjoy the most?

- [ ] 31. Shelter Population
- [ ] 32. Hello, World! (main())
- [ ] 33. Binary to Decimal
- [ ] 34. Always False Circuit
- [ ] 35. DNA Complementary Strands
- [ ] 36. Parking Tickets
- [ ] 37. Month Strings
- [ ] 38. Incrementer Circuit
- [ ] 39. Collision Contributing Factors
- [ ] 40. Github Account
- [ ] 41. NYC Map
- [ ] 42. Collisions Map
- [ ] 43. Copenhagen Transit Fares
- [ ] 44. Closest Point
- [ ] 45. Average Image (koalastothemax)
- [ ] Other:

Why?

Your answer

BACK NEXT

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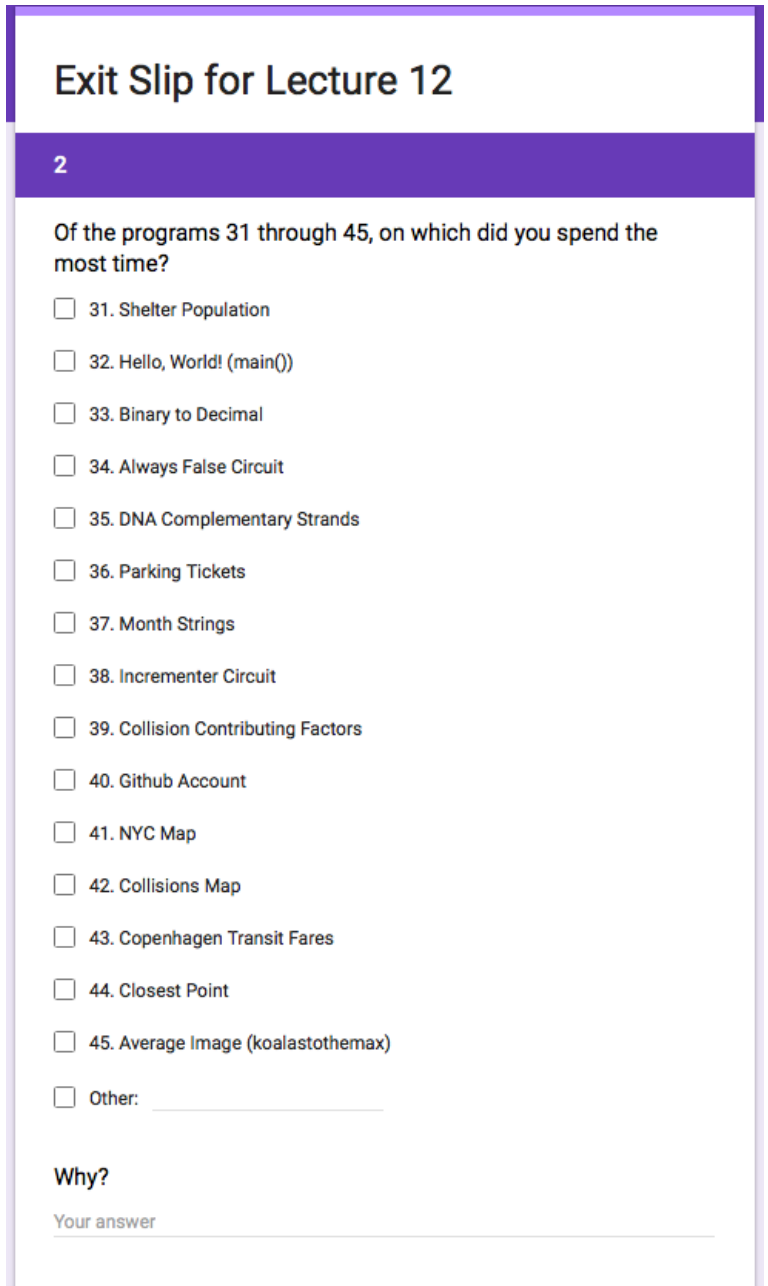

Exit Slip for Lecture 12

2

Of the programs 31 through 45, on which did you spend the most time?

- [ ] 31. Shelter Population
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Why?

Your answer

Announcements

- There's 7 additional sections for the second semester programming lab CSci 136 open for next term.

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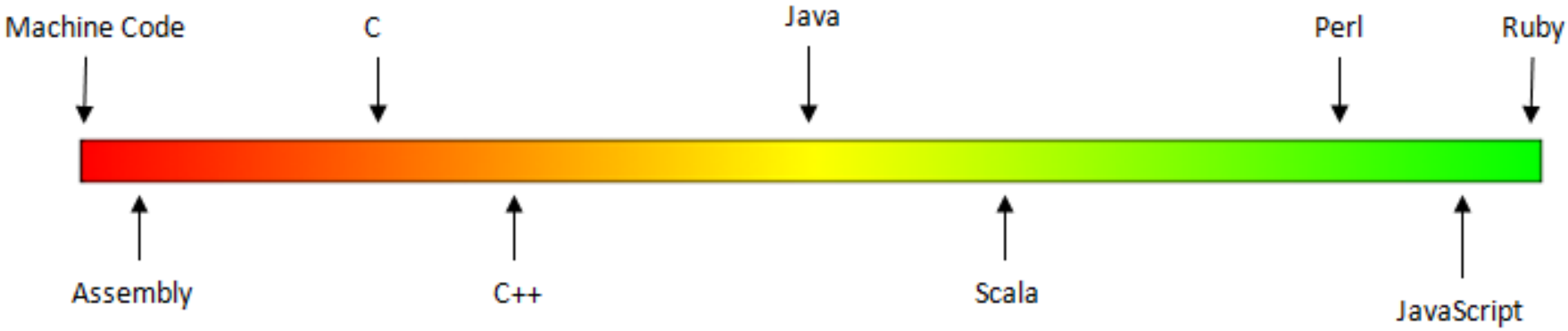
- There's 7 additional sections for the second semester programming lab CSci 136 open for next term.
- Today's lecturers include:
  - Prof. Sakas (department chair),
  - Genady Maryash (adjunct coordinator),
  - Katherine Howitt (tutor coordinator).

Today's Topics

- Recap of Low-Level Programming
- Introducing C++
- Hello, World in C++
- I/O and Definite Loops in C++
- Final Exam Overview

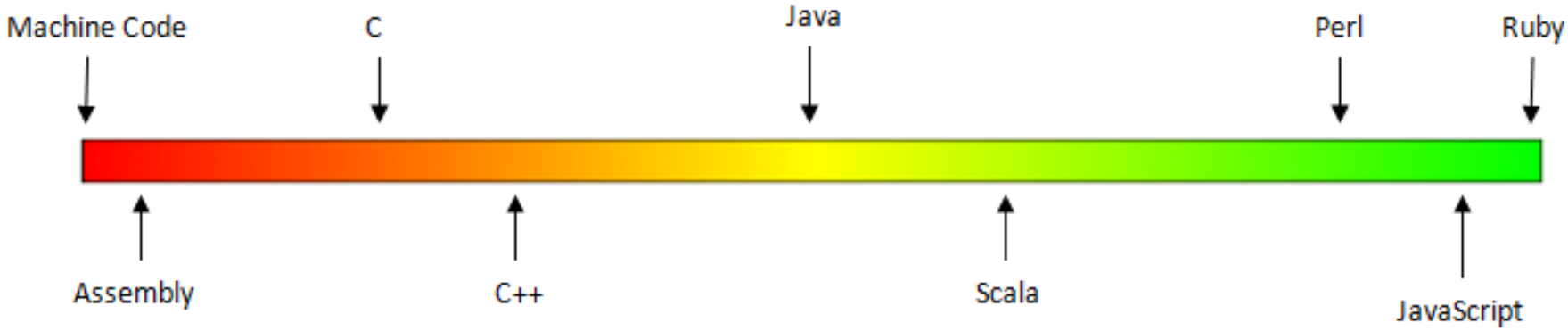
Low-Level vs. High-Level Languages



(codeCommit)

- Can view programming languages on a continuum.

Low-Level vs. High-Level Languages



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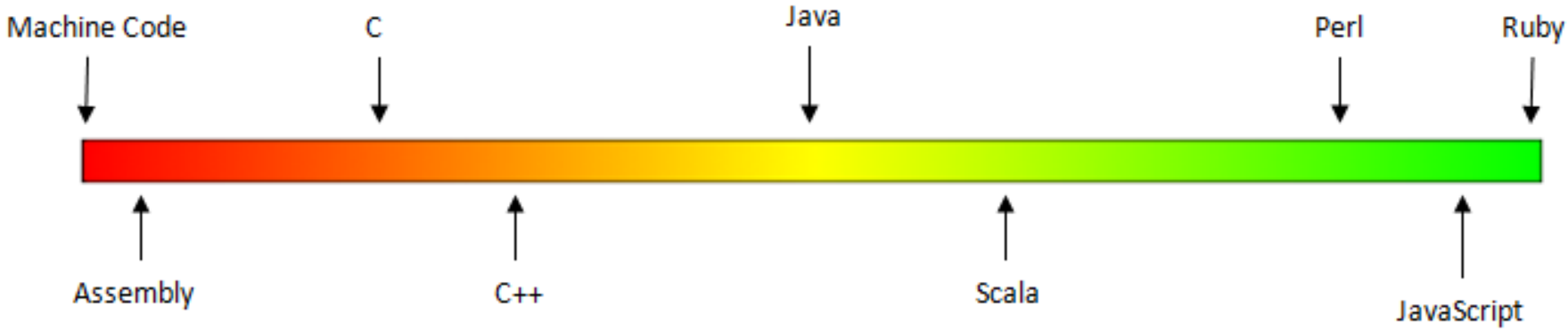
- Can view programming languages on a continuum.
- Those that directly access machine instructions & memory and have little abstraction are **low-level languages**

Low-Level vs. High-Level Languages



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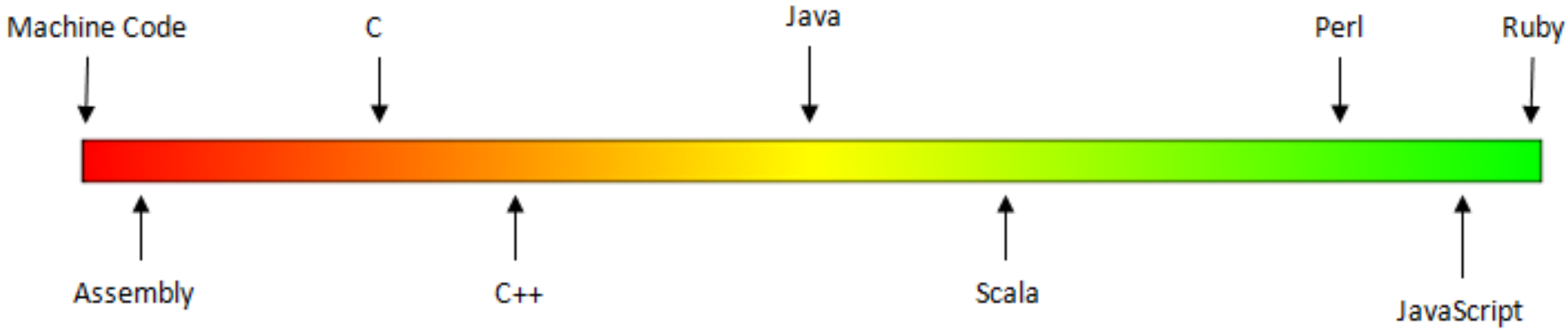
Low-Level vs. High-Level Languages



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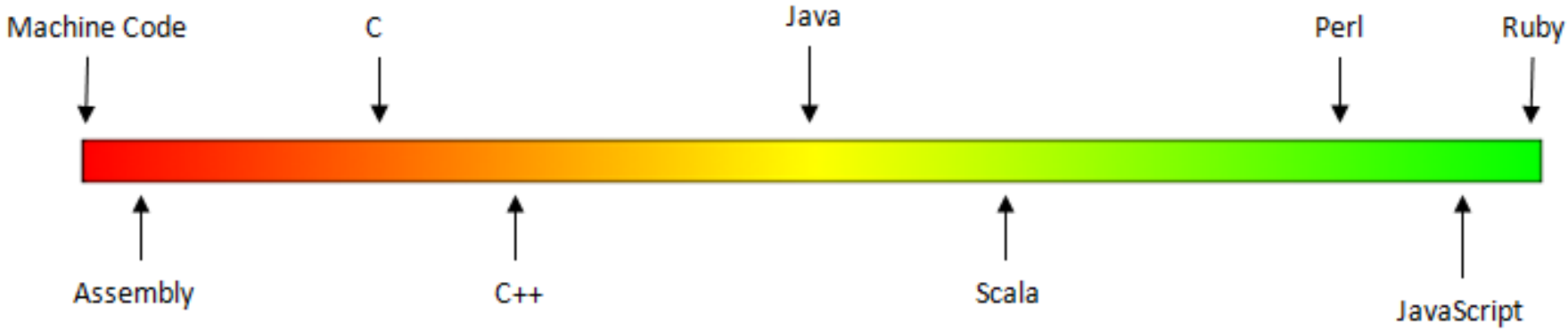
- Can view programming languages on a continuum.
- Those that directly access machine instructions & memory and have little abstraction are **low-level languages** (e.g. machine language, assembly language).
- Those that have strong abstraction (allow programming paradigms independent of the machine details, such as complex variables, functions and looping that do not translate directly into machine code) are called **high-level languages**.

Low-Level vs. High-Level Languages



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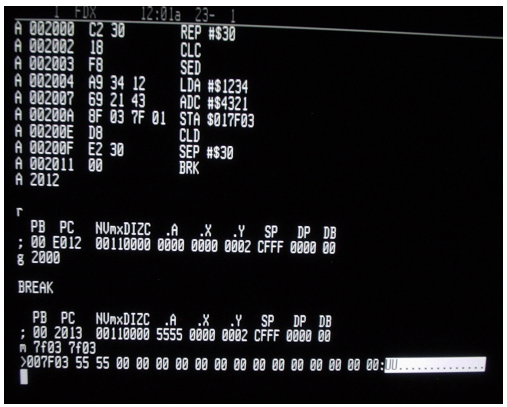
- Those that have strong abstraction (allow programming paradigms independent of the machine details, such as complex variables, functions and looping that do not translate directly into machine code) are called **high-level languages**.
- Some languages, like C, are in between– allowing both low level access and high level data structures.

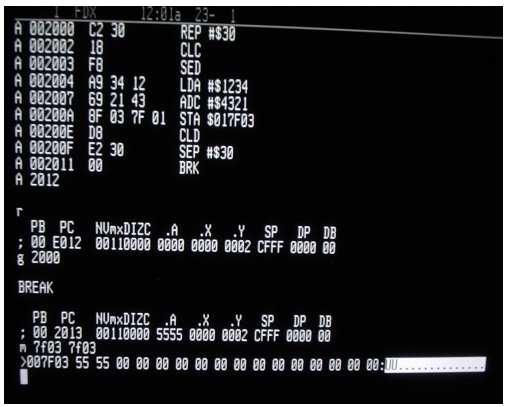
Machine Language



(wiki)

- We will be writing programs in a simplified machine language, WeMIPS.

Machine Language



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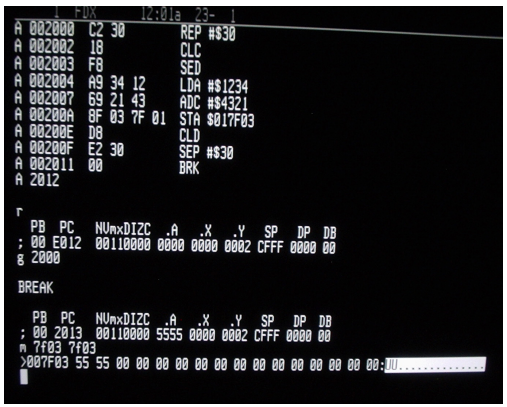
- It is based on a reduced instruction set computer (RISC) design, originally developed by the MIPS Computer Systems.

Machine Language



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- We will be writing programs in a simplified machine language, WeMIPS.
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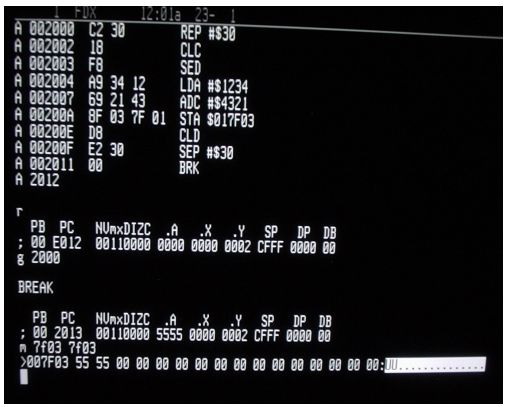
- Due to its small set of commands, processors can be designed to run those commands very efficiently.

Machine Language



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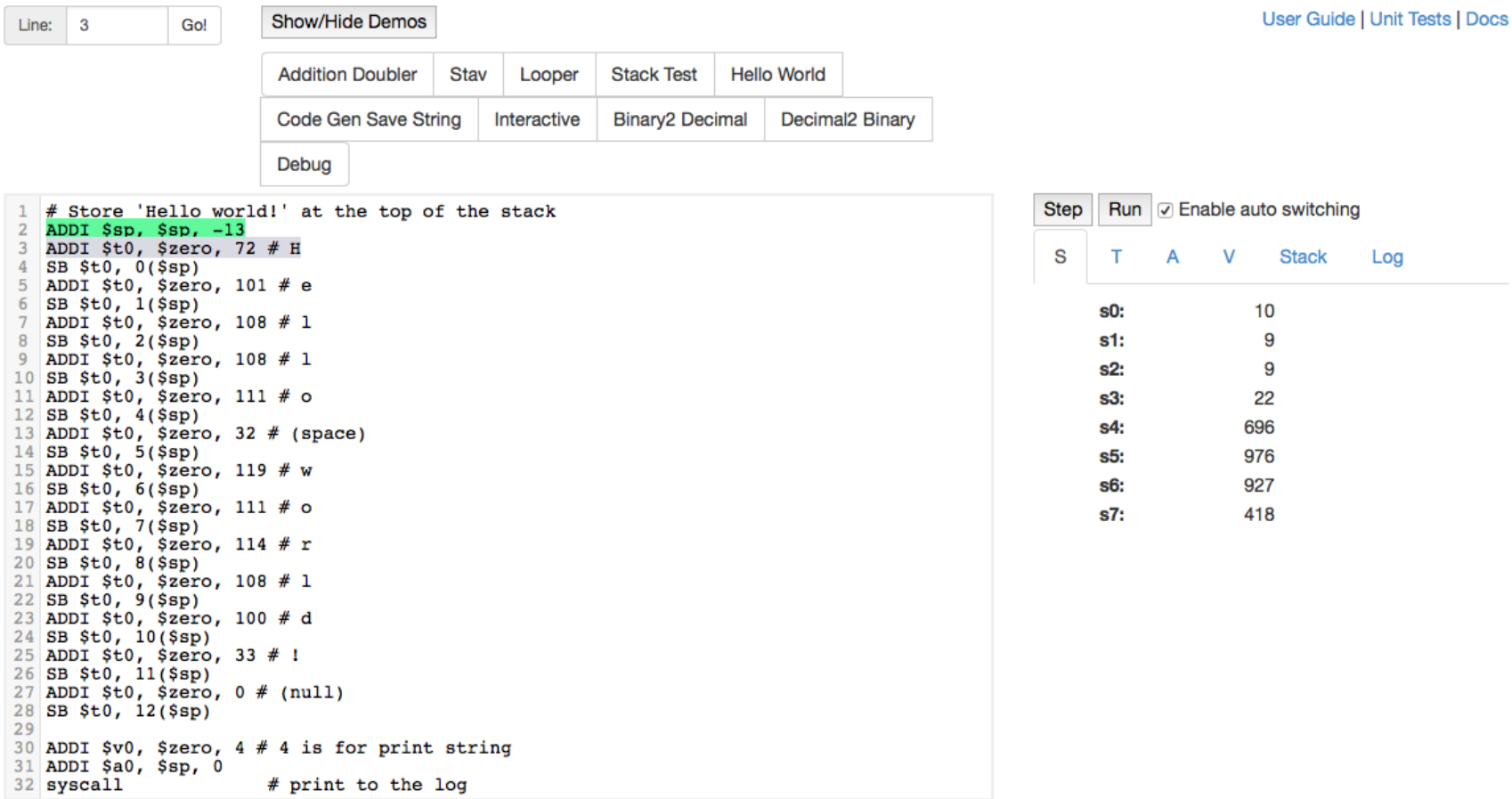
- We will be writing programs in a simplified machine language, WeMIPS.
- It is based on a reduced instruction set computer (RISC) design, originally developed by the MIPS Computer Systems.
- Due to its small set of commands, processors can be designed to run those commands very efficiently.
- More in future architecture classes....

“Hello World!” in Simplified Machine Language



(WeMIPS)

In Pairs or Triples:

Predict what the code will do:

```
1  # This is the same as the doubler, except the jumps cause the order
2  # to change drastically, therefore all of the values will be different.
3  CHANGE_S: ADDI $t0, $zero, 2
4  BEQ $s0, $t0, EXIT
5  ADD $s1, $s0, $s0 # double s0 by adding it to itself, should be 4
6  ADD $s2, $s1, $s1 # double s1 by adding it to itself, should be 8
7  ADD $s3, $s2, $s2 # double s2 by adding it to itself, should be 16
8  ADD $s4, $s3, $s3 # double s3 by adding it to itself, should be 32
9  ADD $s5, $s4, $s4 # double s4 by adding it to itself, should be 64
10 ADD $s6, $s5, $s5 # double s5 by adding it to itself, should be 128
11 ADD $s7, $s6, $s6 # double s6 by adding it to itself, should be 256
12 J CHANGE_V
13
14 CHANGE_T: ADD $t0, $s7, $s7
15 ADD $t1, $t0, $t0
16 ADD $t2, $t1, $t1
17 ADD $t3, $t2, $t2
18 ADD $t4, $t3, $t3
19 ADD $t5, $t4, $t4
20 ADD $t6, $t5, $t5
21 ADD $t7, $t6, $t6
22 ADD $t8, $t7, $t7
23 ADD $t9, $t8, $t8
24 J CHANGE_S
25
26 CHANGE_A: ADD $a0, $t9, $t9
27 ADD $a1, $a0, $a0
28 ADD $a2, $a1, $a1
29 ADD $a3, $a2, $a2
30 J CHANGE_S
31
32 CHANGE_V: ADD $v0, $a3, $a3
33 ADD $v1, $v0, $v0
34 J CHANGE_A
```

WeMIPS

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CHANGE_V: ADD $v0, $a3, $a3
ADD $v1, $v0, $v0
J CHANGE_A
```

(Demo with `WeMIPS`)

In Pairs or Triples:

- Write a complete **Python program** that converts kilograms to pounds.
- *Predict what the 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 }
```

Python Tutor

- Write a complete **Python program** that converts kilograms to pounds.

(Write from scratch in `pythonTutor`.)

onlinegdb demo

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

int main ()
{
  int year;
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(Demo with `onlinegdb`)

Introduction to C++

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

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- Produces fast, efficient, and powerful.

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- C++ is a popular programming language that extends C.
- Produces 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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Introduction to C++

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- Many types available: `int`, `float`, `char`, `...`

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- To use those I/O functions, we put at the top of the program:

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  `int num;`
- Many types available: `int`, `float`, `char`, ...
- To print, we'll use `cout <<`:
  `cout << "Hello!!"`
- To get input, we'll use `cin >>`:
  `cin >> num`
- To use those I/O functions, we put at the top of the program:
  `#include <iostream>`
  `using namespace std;`

In Pairs or Triples:

Predict what the following pieces of code will do:

```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;
}
```

```cpp
//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, 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`)

In Pairs or Triples:

Predict what the following pieces of code will do:

```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;
}
```

```cpp
//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;
  }
  return 0;
}
```

C++ Demo

```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;
}
```

(Demo with C++)

Definite loops

```cpp
//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;
  }
  return 0;
}
```

General format:

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

command1;
command2;
command3;
...

}

Final Overview (Cont'd from Last Lecture)

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

- Write a function that takes a whole number and returns the corresponding binary number as a string.
- Write a function that takes a weight in kilograms and returns the weight in pounds.
- Write a function that, given a DataFrame, returns the minimal value in the "Manhattan" column.
- Write a function that computes the total monthly payment when given the initial loan amount, annual interest rate, number of years of the loan.
- Write a function that takes a string and returns its length.

(Hint: highlight key words, make list of inputs, list of outputs, then put together.)

Final Overview

For each question below, 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):
    ...
    return(bin)
```

Final Overview

For each question below, 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 Overview

For each question below, 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)
```

Final Overview

For each question below, 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 Overview

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.

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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 Overview

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):
    mM = df['Manhattan'].min()
    return(mM)
```

Final Overview

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.

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

Final Overview

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)
```

Final Overview

For each question below, 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):
    ...
    return(length)
```

Final Overview

For each question below, 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)
```

Recap: C++

```cpp
//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++ is a popular programming language that extends C.

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- Input/Output (I/O):
  - `cin >>`
  - `cout <<`

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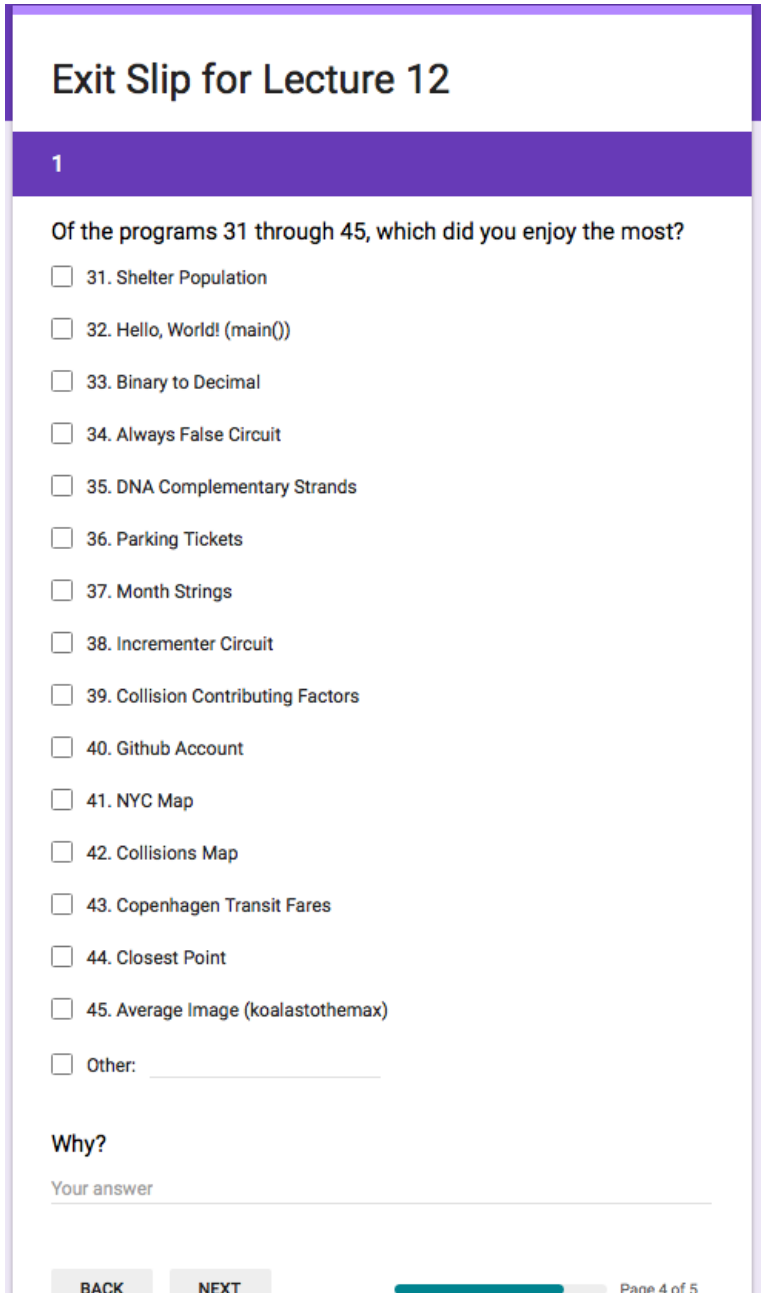
- C++ is a popular programming language that extends C.
- Input/Output (I/O):
  - `cin >>`
  - `cout <<`
- Definite loops:
  `for (i = 0; i < 10; i++)`

Lecture Slips: tinyurl.com/ycrcn3k6



Exit Slip for Lecture 12

1

Of the programs 31 through 45, which did you enjoy the most?

- [ ] 31. Shelter Population
- [ ] 32. Hello, World! (main())
- [ ] 33. Binary to Decimal
- [ ] 34. Always False Circuit
- [ ] 35. DNA Complementary Strands
- [ ] 36. Parking Tickets
- [ ] 37. Month Strings
- [ ] 38. Incrementer Circuit
- [ ] 39. Collision Contributing Factors
- [ ] 40. Github Account
- [ ] 41. NYC Map
- [ ] 42. Collisions Map
- [ ] 43. Copenhagen Transit Fares
- [ ] 44. Closest Point
- [ ] 45. Average Image (koalastothemax)
- [ ] Other: _____

Why?

Your answer

BACK NEXT

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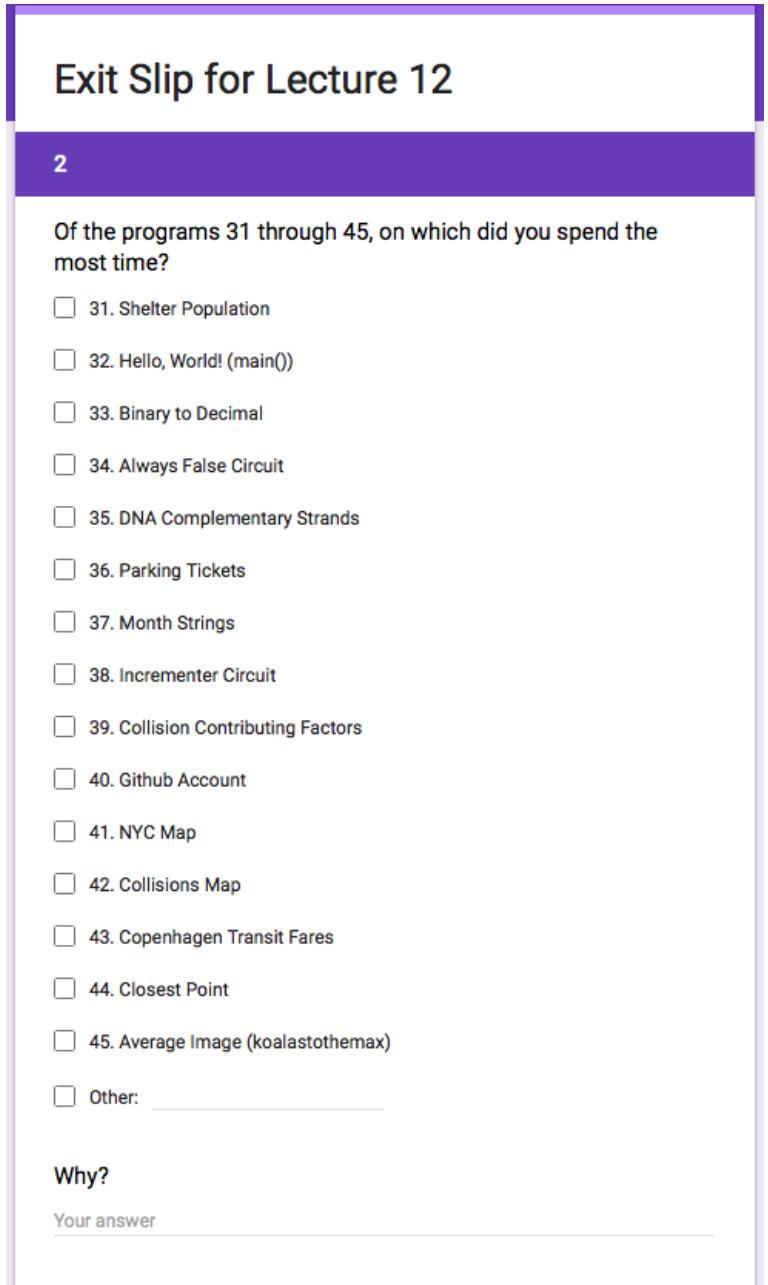

Exit Slip for Lecture 12

2

Of the programs 31 through 45, on which did you spend the most time?

- [ ] 31. Shelter Population
- [ ] 32. Hello, World! (main())
- [ ] 33. Binary to Decimal
- [ ] 34. Always False Circuit
- [ ] 35. DNA Complementary Strands
- [ ] 36. Parking Tickets
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Why?

Your answer