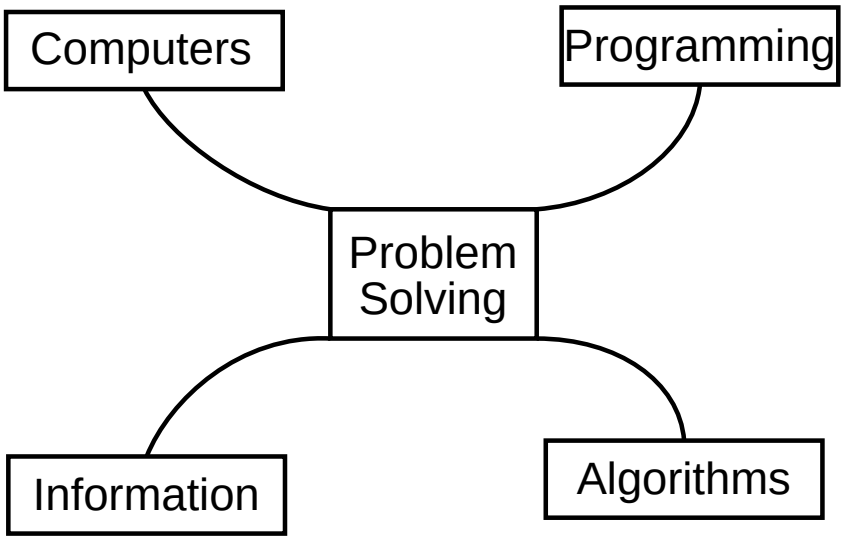
Announcements

- Windows and Unix machines at the Trottier lab
- Account creation only for Unix

Road map

Road map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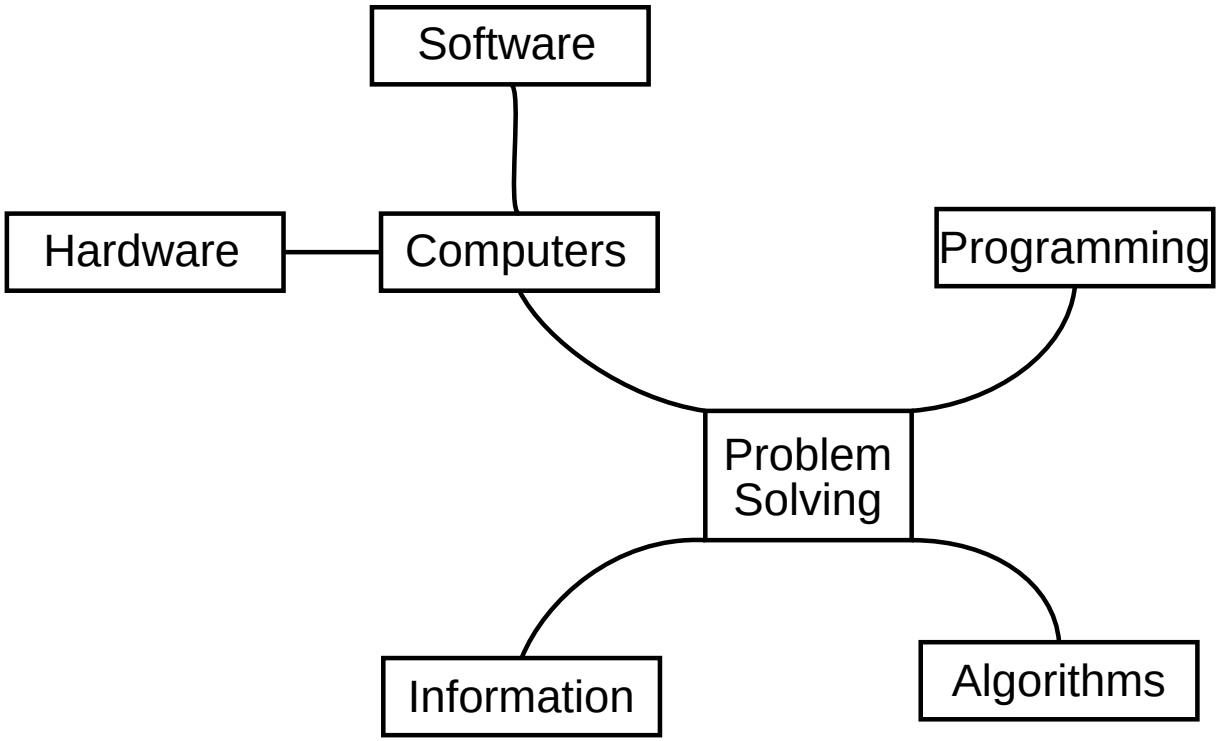
Problem Solving
Information
Algorithms

Road map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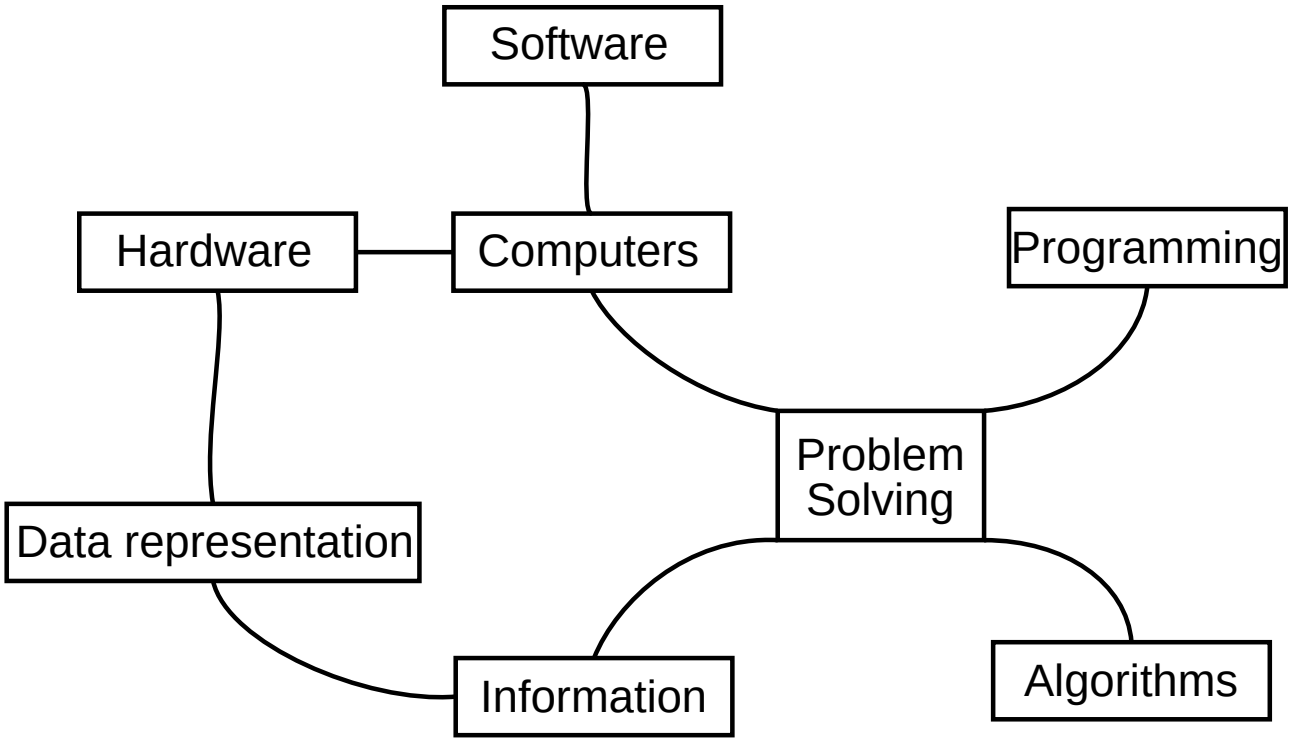
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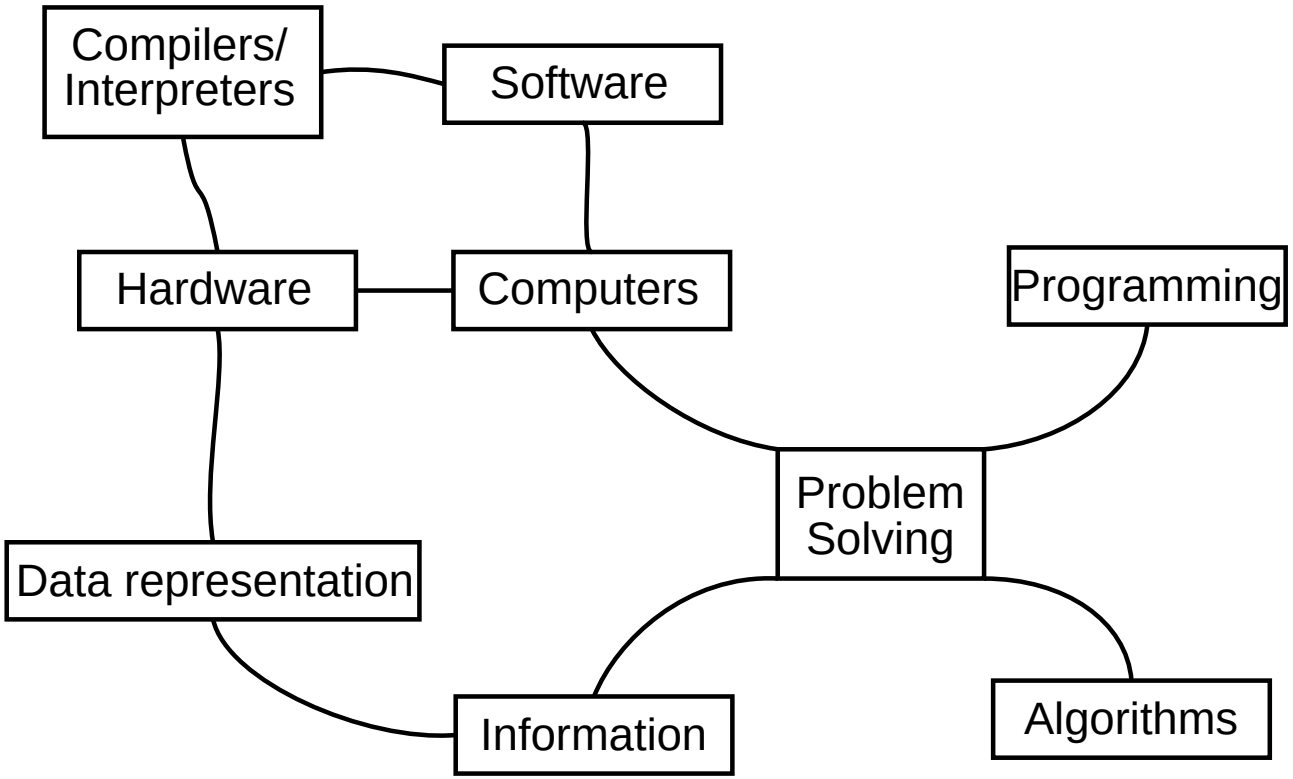
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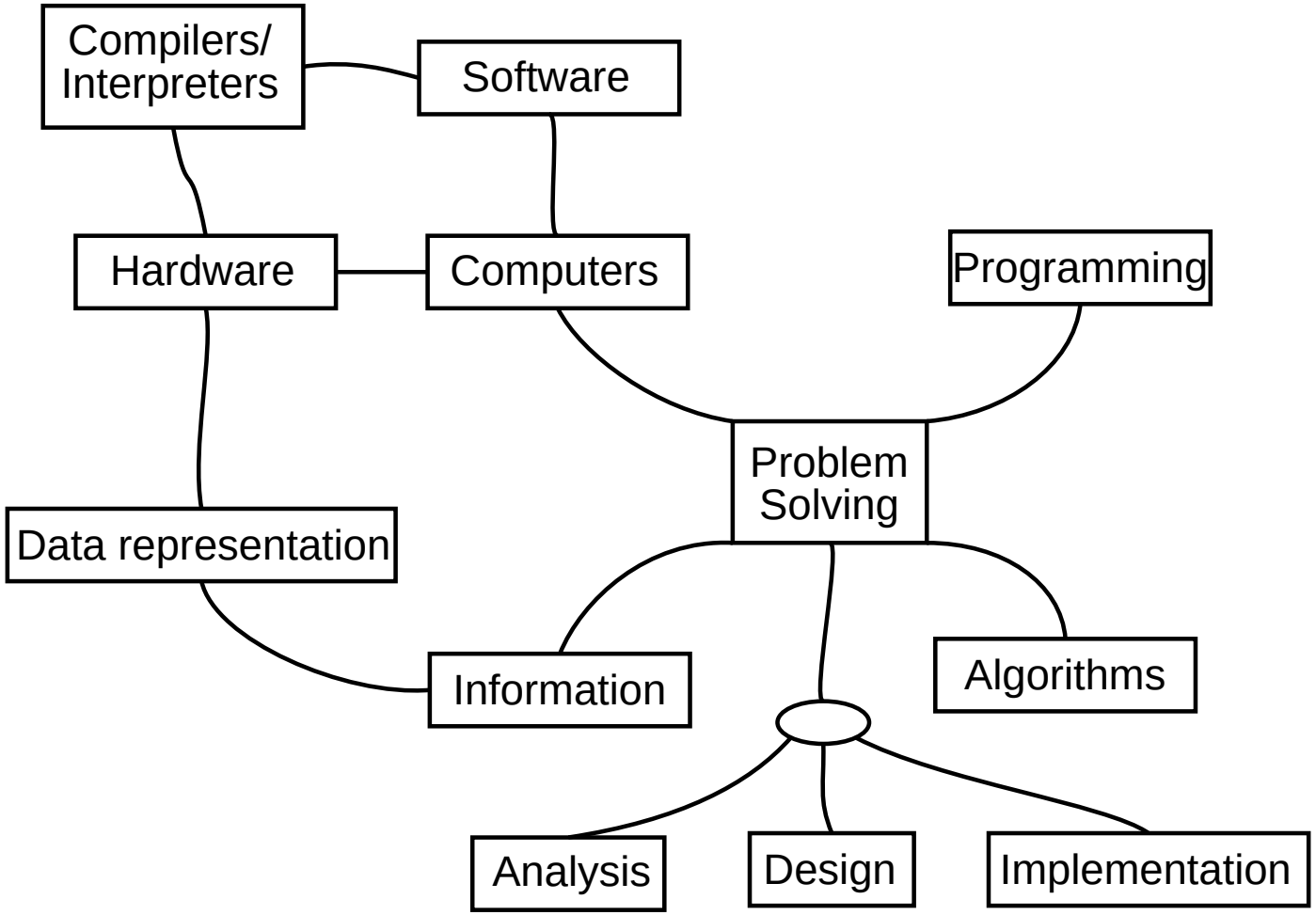
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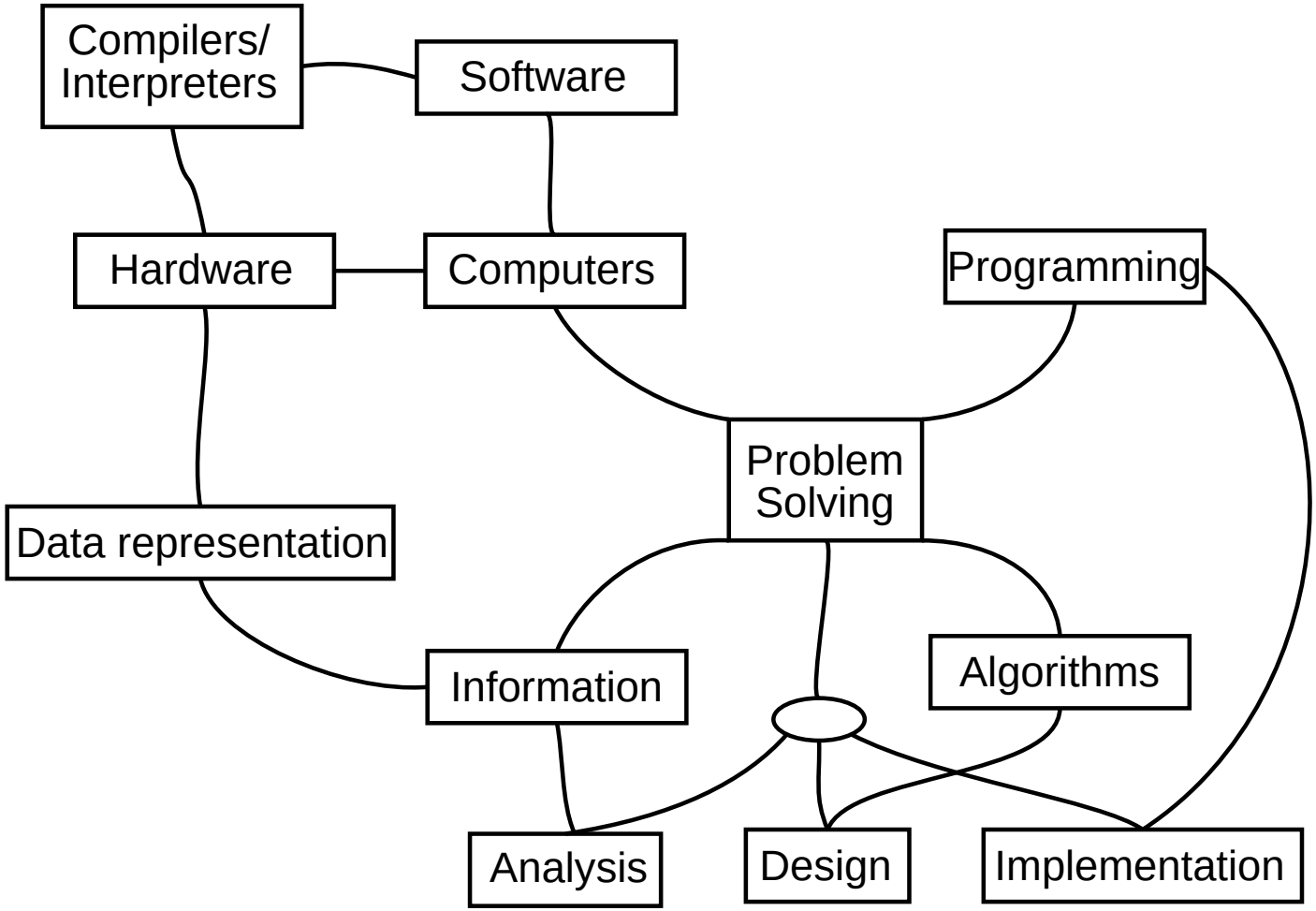
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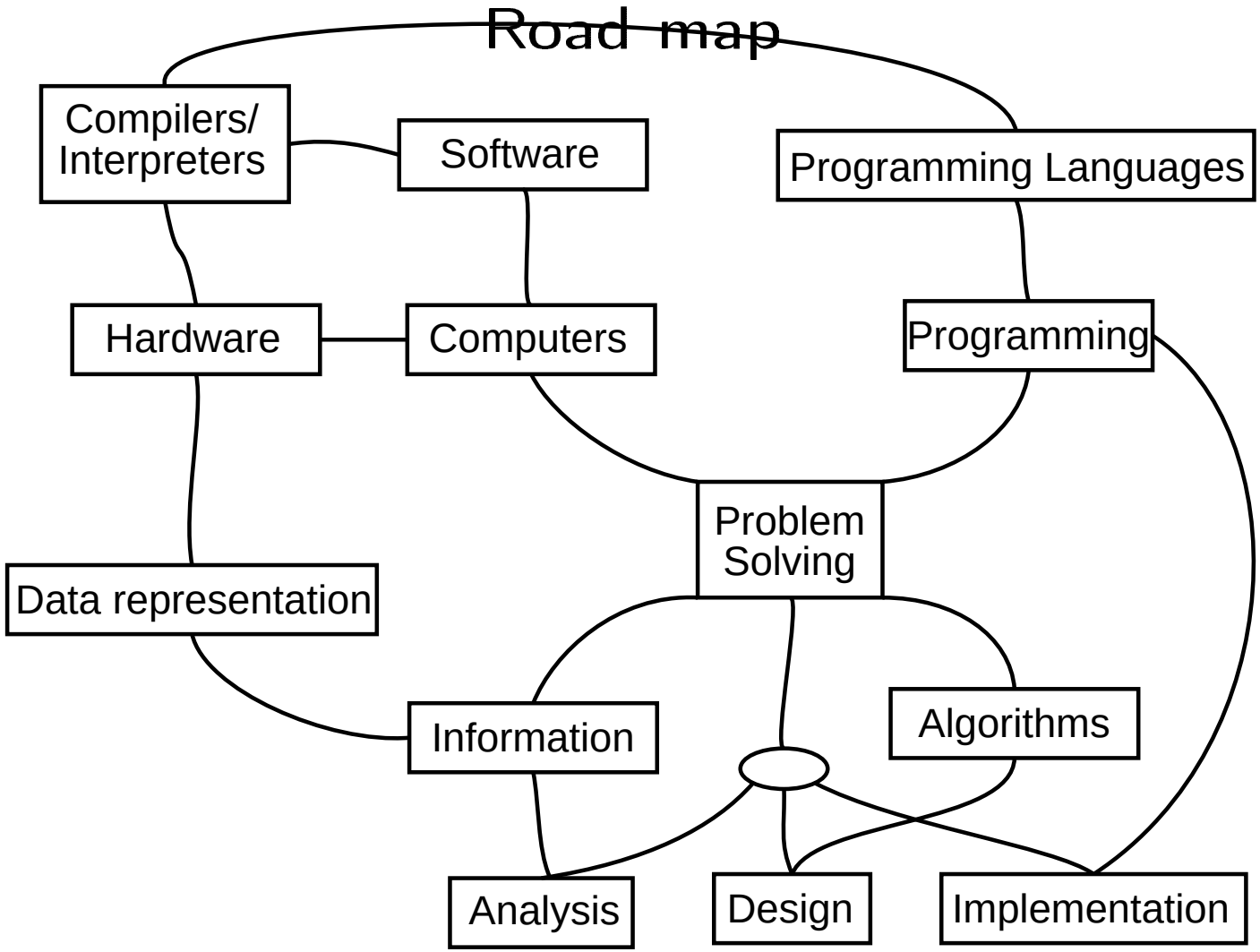
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Programming Languages

- Machine language (binary, processor dependent)
- Assembly language (textual, low-level, processor dependent)
- High-level languages (textual, abstract, processor independent)
  - There are many high-level languages: Java, C, C++, C#, ML, Haskell, Scheme, Prolog, Python, Perl, etc.
  - Different types of languages:
    - Imperative
      - Procedural
      - Object Oriented
      - Concurrent
    - Declarative:
      - Functional
      - Logic
    - Mixed

Executing programs

- Editing
- Compilation/Interpretation
  - (Native) Compilation: Translation to machine language + Execution
    - Advantages: Fast, processor specific code is generated
    - Disadvantage: Needs a compiler for each type of processor; generates a different target file for each type of processor
  - Interpretation: Direct execution
    - Advantages: Execution is processor independent. Does not generate a different target file for each possible processor (portability)
    - Disadvantage: Slow execution due to overhead of interpretation.
  - Combined: Translation to bytecode + interpretation of bytecode
    - Best of both worlds: Only one file is generated (portable) and it is faster to execute than direct interpretation (but slower than native compilation.)

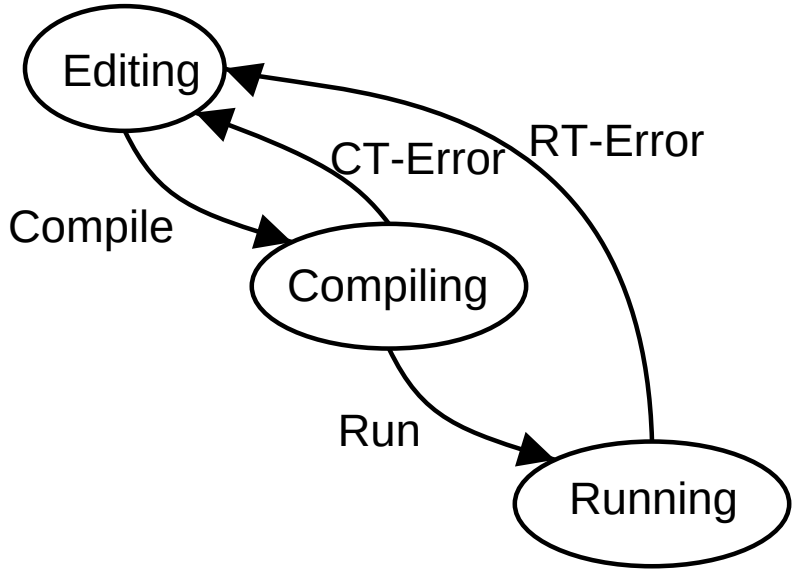
Languages

- Elements of a language
  - Alphabet
  - Syntax (grammar)
  - Semantics (meaning)
- Elements of Java:
  - Alphabet of Java: ASCII
  - Syntax: 'constructs'
    - Class definitions
    - Method definitions
    - Statements
    - others
  - Semantics: computation

Errors

- Errors:
  - Compile-time errors
  - Run-time errors
    - Exceptions
    - Logical

Errors



Basic Java Syntax

- A Java program is made up of one or more *class definitions*
- A class definition is made up of zero or more *method definitions*
- A method definition is made up of zero or more *statements* and *variable declarations*
- Roles:
  - Classes: Modules and Types of objects
  - Methods: procedures, functions, algorithms
  - Statements: instructions

Basic Java Syntax

```
public class ClassName
{
    // Body of ClassName
    // ...
    // List of method definitions
}
```

Basic Java Syntax

```
public class HelloWorld
{
   // Body of ClassName
   // ...
   // List of method definitions
}
```

Basic Java Syntax

```
public class Classname
{
    // method header
    {
        // method body: list of statements
    }
}
```

Basic Java Syntax

```
public class HelloWorld
{
    public static void main(String[] args)
    {
        System.out.println("Hello");
        System.out.println("Good bye");
    }
}
```

Basic Java Syntax

```
public class HelloWorld
{
    public static void main(String[] args)
    {
        System.out.println(“Hello”);
        System.out.println(“Good bye”);
    }
}
```

Bad Java Syntax

```
public class HelloWorld
{
    System.out.println(“Hello”);
    System.out.println(“Good bye”);
}
```

Bad Java Syntax

```
public static void main(String[] args)
{
    System.out.println(“Hello”);
    System.out.println(“Good bye”);
}
```

Bad Java Syntax

```
public static void main(String[] args)
{
    public class HelloWorld
    {
        System.out.println(“Hello”);
        System.out.println(“Good bye”);
    }
}
```

Indentation

```
public class HelloWorld
{
    public static void main(String[] args)
    {
        System.out.println(“Hello”);
        System.out.println(“Good bye”);
    }
}
```

Indentation

```
public class HelloWorld
{
public static void main(String[] args)
{
System.out.println(“Hello”);
System.out.println(“Good bye”);
}
}
```

Indentation

```
                public class HelloWorld
{
 public static void main(String[] args)
                                    {
        System.out.println(“Hello”);
System.out.println(“Good bye”);
    }
                   }
```

Indentation

```
public class HelloWorld{public static void main(St
ring[] args){System.out.println(“Hello”);System.ou
t.println(“Good bye”);}}
```

User Interface

- The user interface of a program is the way it interacts with the user: keyboard/mouse/windows/text

- Graphical User Interface:
  - Windows: buttons, text boxes, slidebars, graphics, etc.
  - Input with mouse and keyboard.

- Textual User Interface:
  - Console window: plain text
  - Input: keyboard only
  - Output:

```
System.out.println("text");
```

Introduction to statements

- The print statement

```
System.out.println(string_literal);
System.out.print(string_literal);
```

- String literals:

```
"(almost)any characters"
"This is a string literal"
"String literals can contain almost any character,
"a"
""
"24"
```

Introduction to statements

- String concatenation:

  string_literal + *string_literal*
  string_literal + *number_literal*

  “This is a ”+“message”
  “This is a message”
  “There are ”+70+“ students in this class”

- String literals with numbers are not numbers: “17” is not the same as 17

  “17” + “29”

is

  “1729”

while

  17 + 29

is

  46

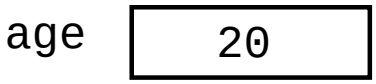
Simple programs

```
// File: PrintingStuff.java
public class PrintingStuff
{
    public static void main(String[] args)
    {
        System.out.println("This trivial program j
        System.out.println("prints this text to a
        System.out.println("Window.");
    }
}
```

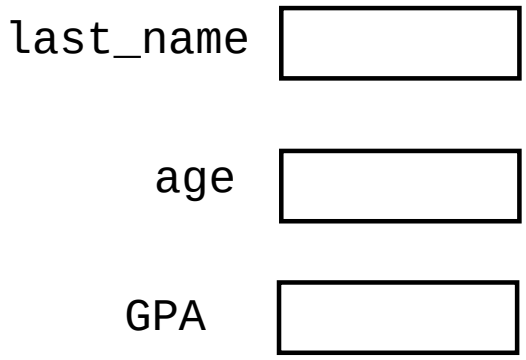
Variables

- A variable is a memory location
- A variable can contain information
- A variable has a symbolic name

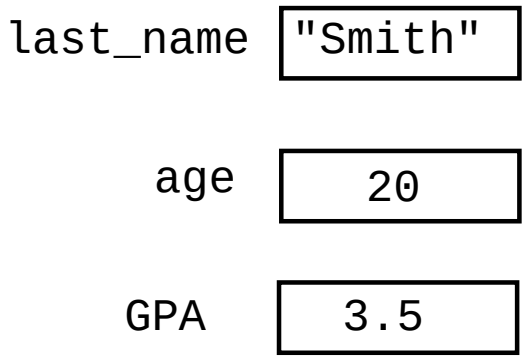
Variables



Variables



Variables



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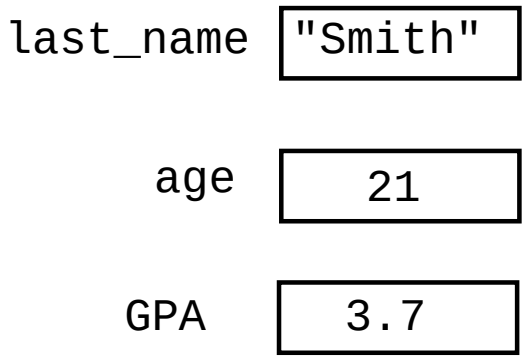
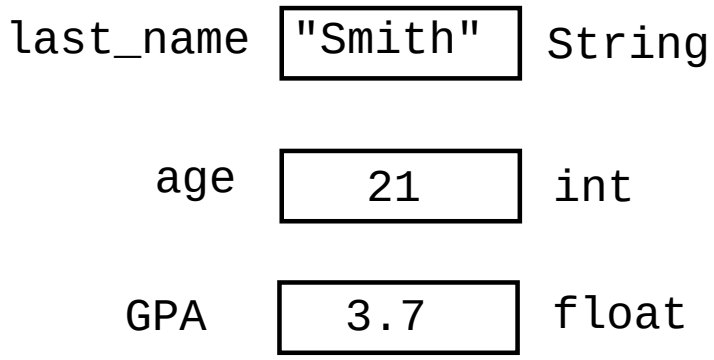


Variables



Variable declaration

- A *variable declaration* is a statement that declares tha a variable is going to be used.
- A variable declaration goes inside some method
- A variable declaration has the form:

  type identifier ;

- Examples:

```
String last_name;
int age;
float GPA;
```

Assignment

- An *assignment* is a statement that gives a value to a variable
- An assignment goes inside some method
- An assignment has the form:

  variable = *value*;

- Its meaning it to put the value into the memory location of the variable
- Examples:

```
last_name = "Smith";
age = 20;
```

- Note that the following are *incorrect*:

```
20 = age;
"Smith" = last_name;
```

Assignment

- The variable must be declared before being assigned a value

```
String last_name;
last_name = “Smith”;
```

- But the following is wrong:

```
age = 20;
int age;
```

- The type of the value must be the same as the type of the variable

```
last_name = 20; // Incorrect
age = “Smith”; // Incorrect
```

Variables and String expressions

- Variables can be used with concatenation in String expressions

  `“your age is ”+age`

- is equivalent to

  `“your age is 19”`

- if the variable age contains the value 19

A simple program

```
public class PrintData
{
  public static void main(String[] args)
  {
    String last_name;
    int age;
    last_name = “Smith”;
    age = 20;
    System.out.println(“Your last name is ” + last_name);
    System.out.println(“You are ” + age + “ years old”);
  }
}
```