CS 200 - Programming I: Programming Process

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TopHat Sec 4 (3:30 PM) Join Code: 296444

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Computational Thinking

Problem Solving

Art of Programming

Abstraction

- Can you see the essential parts of the problem?
- What are the outputs? inputs? their relationship?
- Can you summerize the problem at a high level?
- What are the different components of the solution?

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Computational Thinking

- Think like a computer.
- What is the sequence of actions need to accomplish the task?
- Start with *pseudocode*.

Thinking Like a Computer

Programming is like Designing a Recipe

Chocolate Chip Cookies

Ingredients:

- 227g (1 cup) butter, softened
- 200g (1 cup) sugar
- 105g (½ cup) brown sugar
- 2 eggs
- 2 tsp vanilla
- 250g (2 cups) all-purpose flour
- 1 tsp soda
- 1 pinch salt
- 1 ½ cups of chocolate chips

Instructions:

1. Beat butter, sugars, eggs and vanilla until light and fluffy.
2. Add flour, soda, and salt; blend well.
3. Add chips.
4. Drop from a teaspoon 2 inches apart.
5. Bake 190°C for 9 min.

Original: 375°F for 10 min.
Convection: 325°F for 9 – 10 min.

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Human Thinking

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Computer Thinking

Exercise

Calculating the area and circumference of a circle.

1. What are the inputs? outputs? their relationship?
2. Pseudocode it!
3. Code it!

Explaining and Tracing

Explaining vs Tracing

Explaining

Summerize and provide a high-level explanation of what the code does in plain English.

TopHat Q1

Explain the `Circle.java` code:

a. Calculates the area and the circumference of a circle.

b. Reads a radius as input from the user and outputs the the area and the circumference of the corresponding circle.

c. Creates a double variable called rad. Initializes it as 0. Prompts the user for a radius and stores it in rad. Outputs "Area:"; calculates the area of a circle of radius rad and outputs it. Outputs "Circumference:"; calculates the circumference of a circle of radius rad and outputs it.

Explaining vs Tracing

Explaining

Summerize and provide a high-level explanation of what the code does in plain English.

Tracing

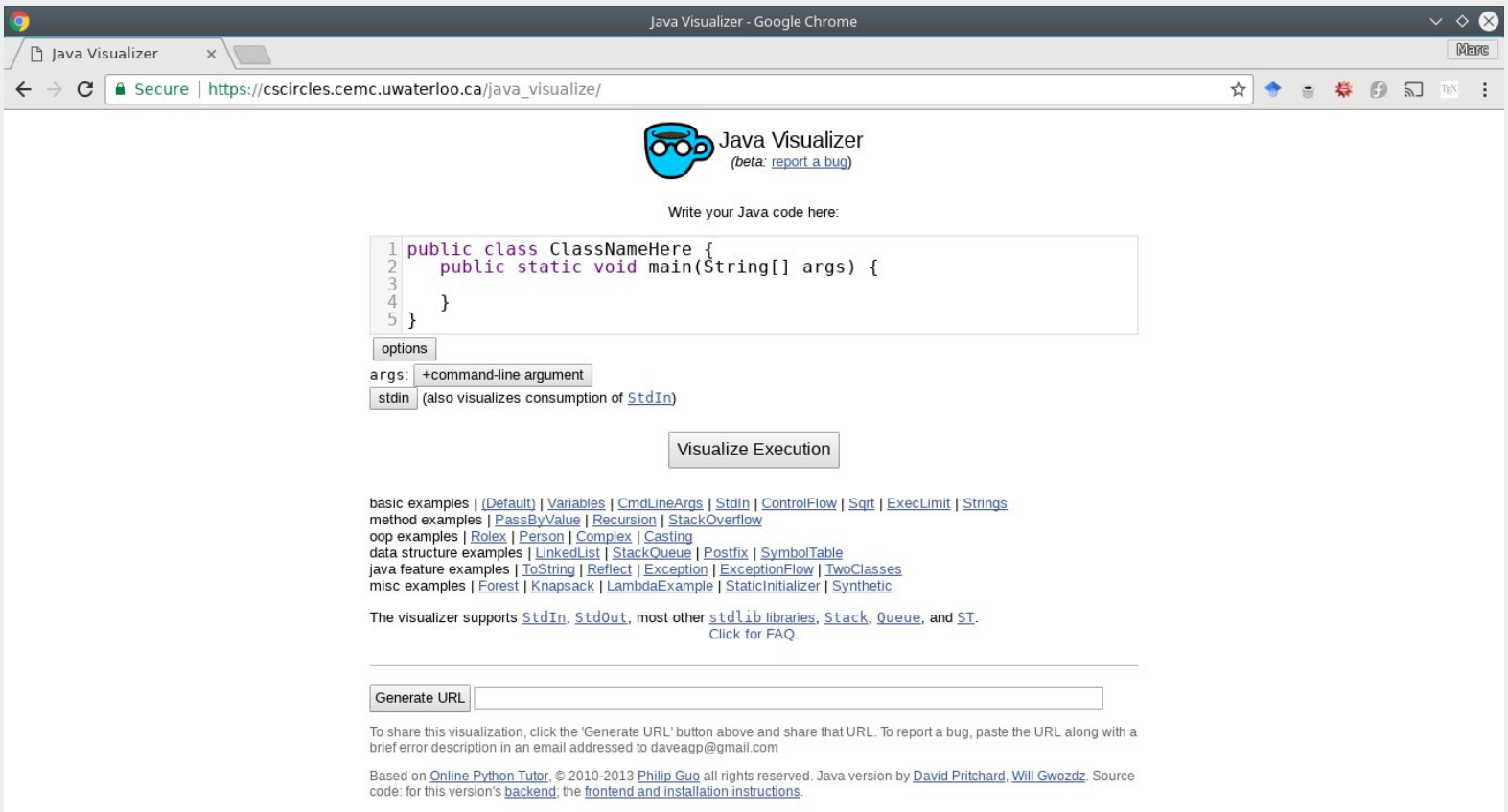
Run the code as computer does.

- Put pen to paper.
- Write down the active variables and their values.
- Update them as they change as you mentally walk through the statements sequentially.

Tool for Tracing

Java Visualizer

- `https://cscircles.cemc.uwaterloo.ca/java_visualize/`



Edit-Compile-Run Cycle

Edit

Writing some source code (set of instructions) in plain text.

Editors

- Text Editors:

vi

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- Integrated Development Environment (IDE):

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Build your code so that it can be run on a computer.
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`javac` – The *Java* compiler

- `javac` produces a *bytecode* file that needs to be run in a *virtual machine*.

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- *javac* produces a bytecode file with a `.class` file extension.

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- *javac* produces a bytecode file with a `.class` file extension.
- Example:

  ```
  javac Circle.java
  ```

  produces a `Circle.class` *bytecode* file.

Run

Run or execute your code.

java

- The `.class` bytecode file produced by `javac` needs to be run in the Java virtual machine.

Run

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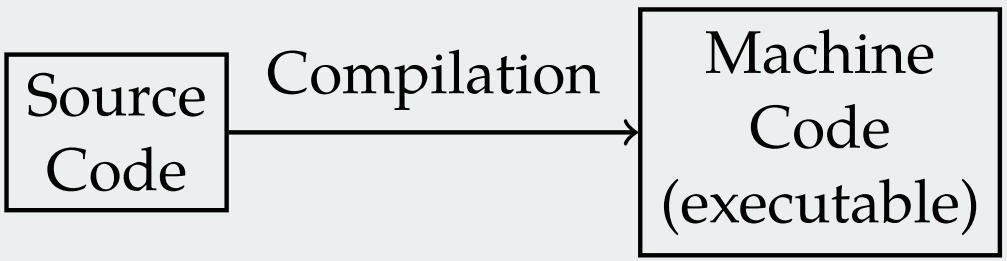
- Example:

  ```
  java Circle
  ```

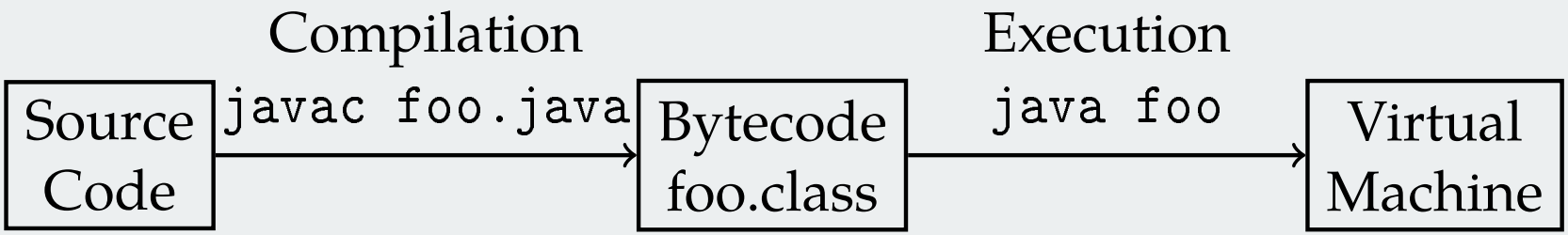
  runs the Circle file.

Virtual Machine

The Classic Model: Native executable



The Java Model: Virtual Machine



TopHat Q2

I have just written some Java code in a file SomeCode.java. How do I compile and run it?

a. java SomeCode
b. javac SomeCode.class
c. javac SomeCode.java
d. java SomeCode.java
e. javac SomeCode
f. java SomeCode.class

Java Initiation

Basic Output

String Literals

- Double quotes ("):

```
"I am a string literal"
```

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  `int a = 10; System.out.println("A " + a);`

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Printing to the Console

- Print a string:
  `System.out.print("Does not append a new line");`
- Print a string with a newline:
  `System.out.println("Appends a new line");`

TopHat Q3

What is the output of:

```
System.out.println("5 and 5 = " + 5 + 5);
```

Type the output.

Basic Input

Using the `Scanner`

- Include the library at the top of the file:
  ```
  import java.util.Scanner;
  ```
- Create an *instance* of a `Scanner` *object*:
  ```
  Scanner sc = new Scanner(System.in);
  ```
- Reading an integer:
  ```
  int anInt = sc.nextInt();
  ```

Comments and Whitespace

Comments

- Ignored by the compiler.
- Written by the programmer to explain the code.
- Single-line (//)

```
// Single line comment
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- Multi-line (/* */)

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/**
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Whitespace

- Mostly ignored by the compiler.
- Good use of white space makes code easier read!

Compiler Errors and Warnings

Compilation Errors

- Prevents compilation
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- Good practice to write programs that compile without warnings.

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Warnings

- Warnings don't stop the compilation process.
- Good practice to write programs that compile without warnings.
- For even stricter compilation, use `-Xlint`:

```
javac -Xlint Foo.java
```

Computer

Basic Machine Architecture

"This is a computer."

von Neumann Architecture

- von Neumann proposed this architecture in 1945.
- Consists of:
  - a processing unit,
  - memory,
  - input devices, and
  - output devices.

Basic Machine Architecture

John von Neumann

von Neumann Architecture

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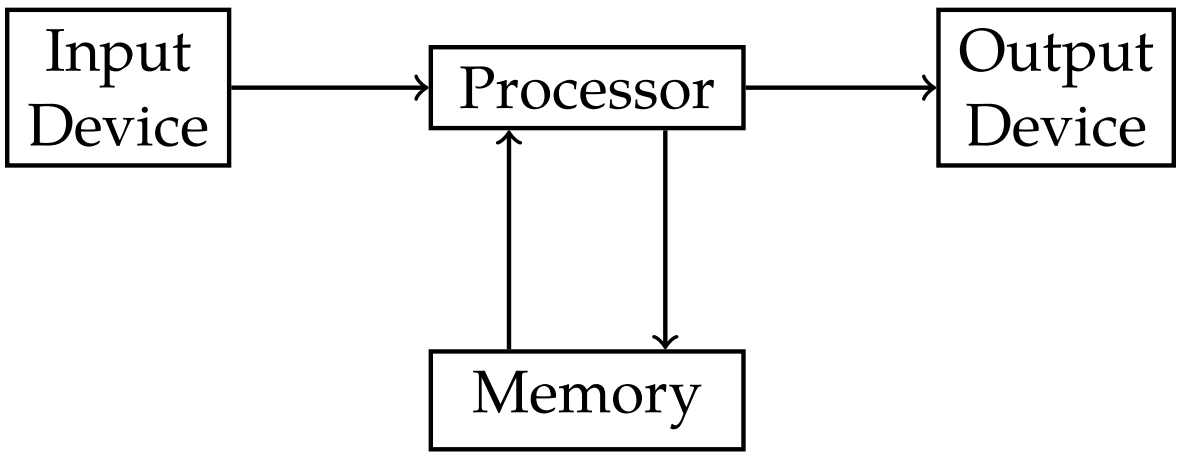
Basic View of a Computer



Further Reading

COMP SCI 200: Programming I
zyBooks.com, 2015.
zyBook code:
WISCCOMPSCI200Fall2019

- Chapter 1. Programming Process

Appendix

References

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