Java

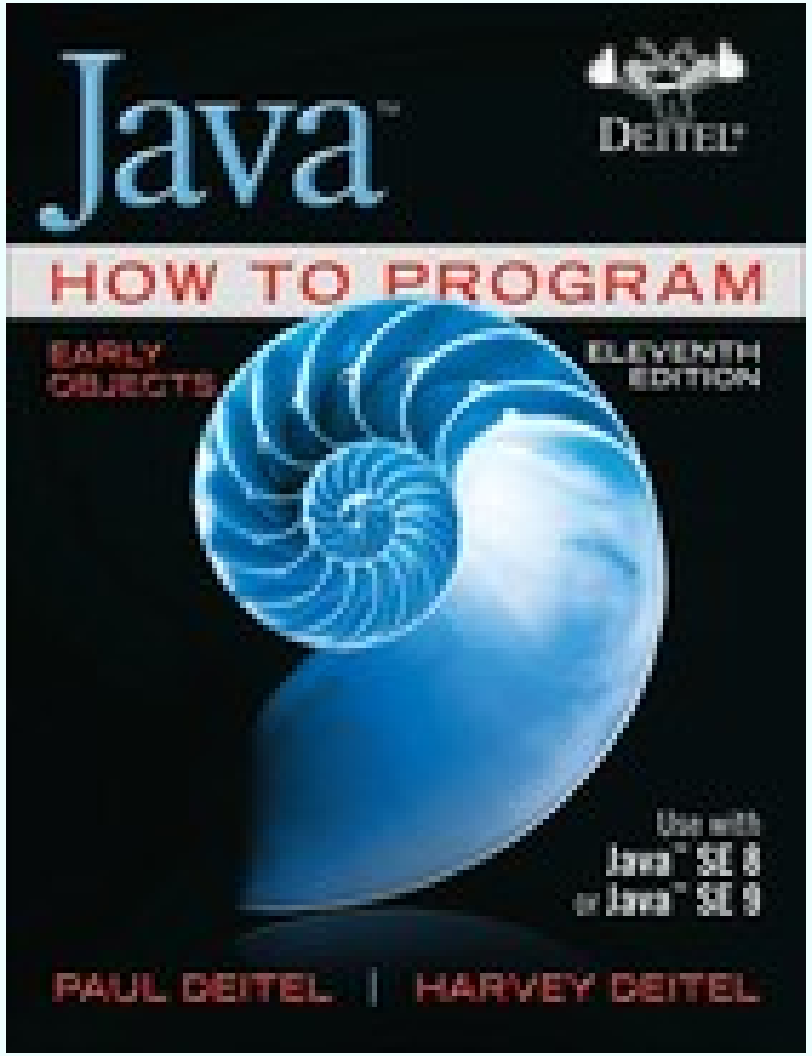
Course Introduction

Course Material

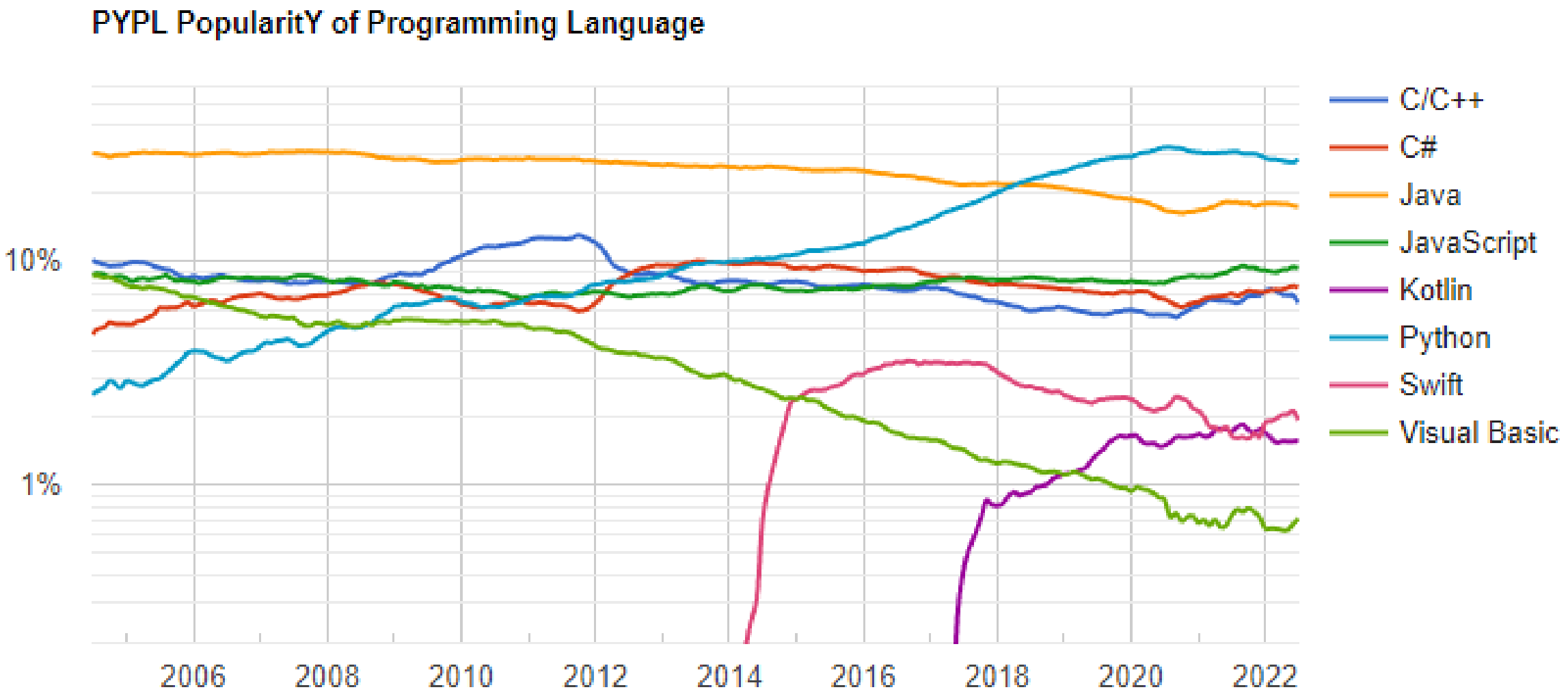
- All materials are posted on GitHub
- Flipped lecture
  - Self studied notes
  - Explained with Youtube Video
- Trinket.io

Reference Books

Java How To Program (Early Objects)
by **Paul J. Deitel and Harvey Deitel**



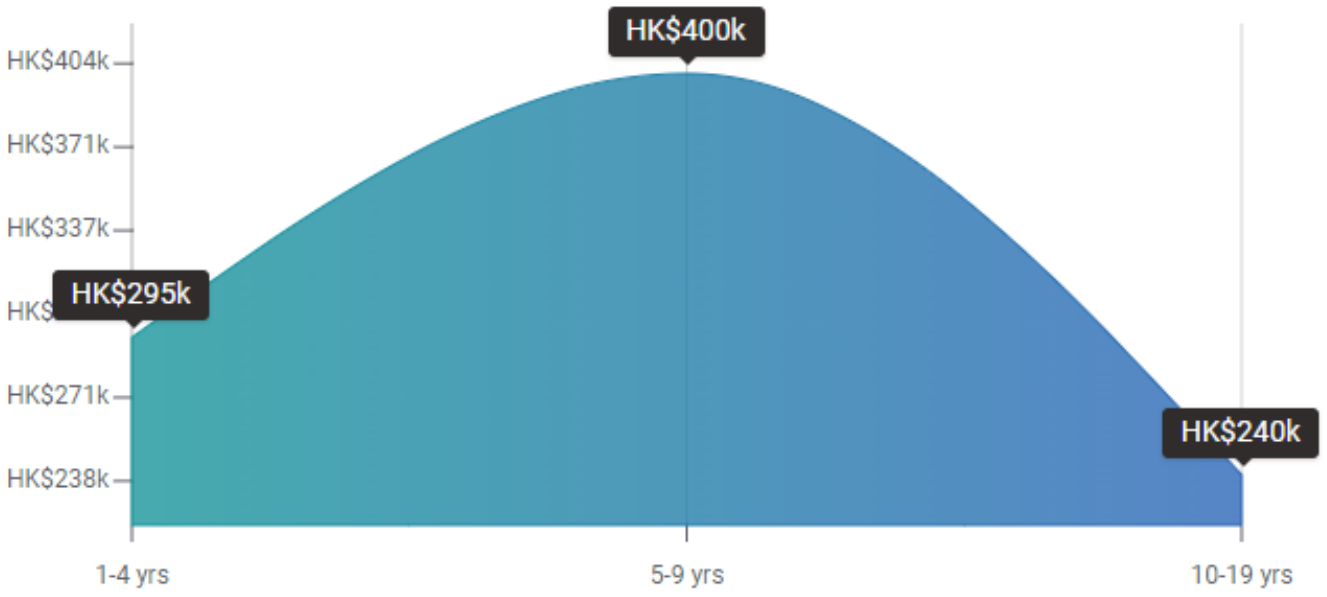
Java is still very hot



ref: PYPL

Java is still very hot

What is the Pay by Experience Level for Java Developers?



Early Career	▲ 7%
Mid Career	▲ 45%
Late Career	▼ 13%

An early career Java Developer with 1-4 years of experience earns an average total compensation (includes tips, bonus, and overtime pay) of HK$294,791 based on 9 salaries. A mid-career Java Developer with 5-9 years of experience earns an average total compensation of HK$400,000 based on 5 salaries. An experienced Java Developer ...Read more

ref: payscale.com

Mother tongue spoken in different CS dept

C++

- HKUST
- CityU

Java

- HKBU
- CUHK
- PolyU
- HKU

not in a particular order, non-exhaustive list

Topics to Cover (Tentative)

1. Bridging from Python and Processing
2. Problem Solving with Java
3. Array
4. Methods
5. Exception Handling and File IO
6. Class

Intro to Java

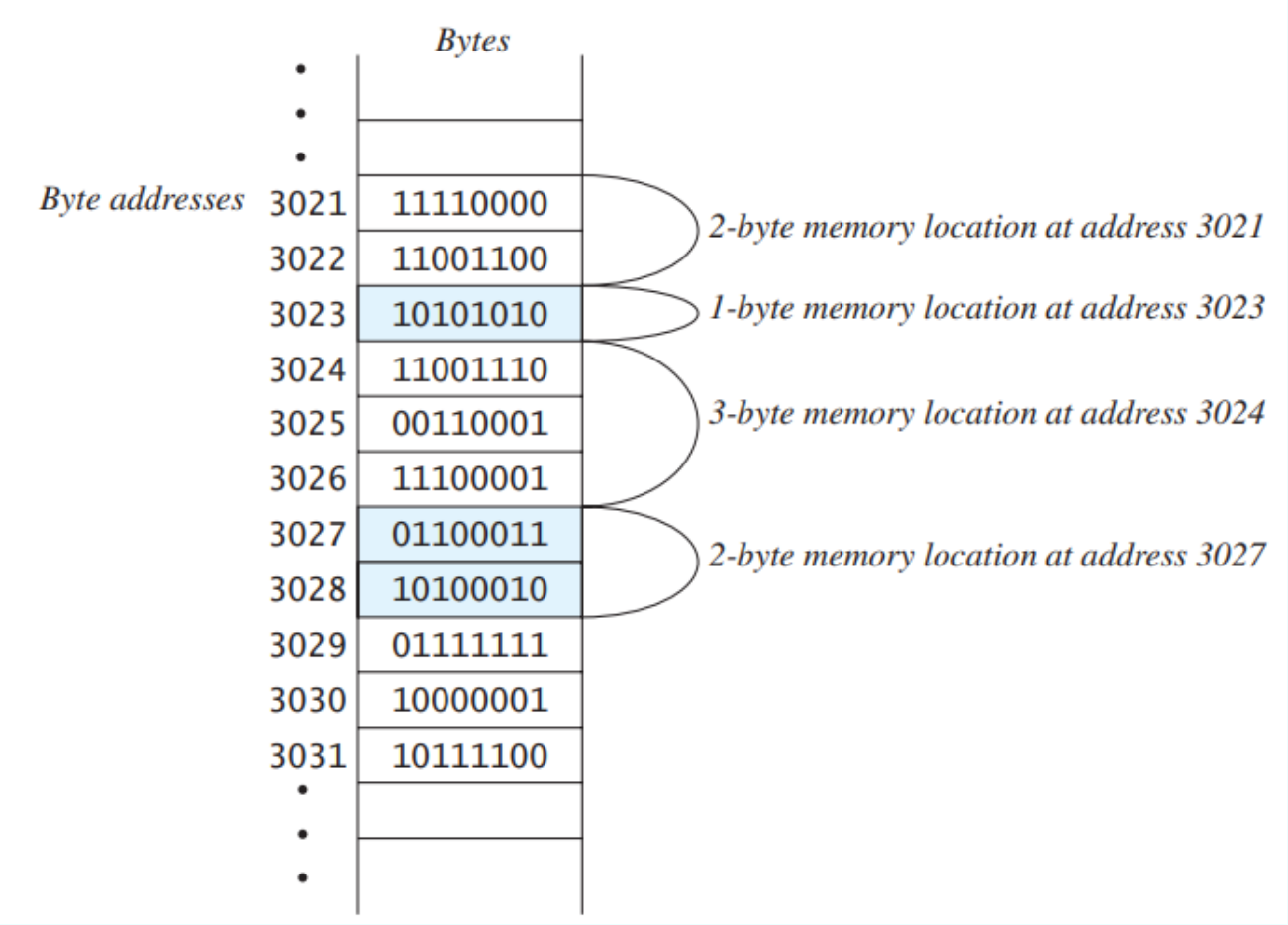
By Kevin 2022/2023

Computer Basics

- Computer systems consist of hardware and software
- Hardware:
  - CPU, the master mind that gives instruction
  - Volatile memory, RAM, that holds data for the current program
  - Persistent memory, HD, that holds more data, more reliable, yet slower

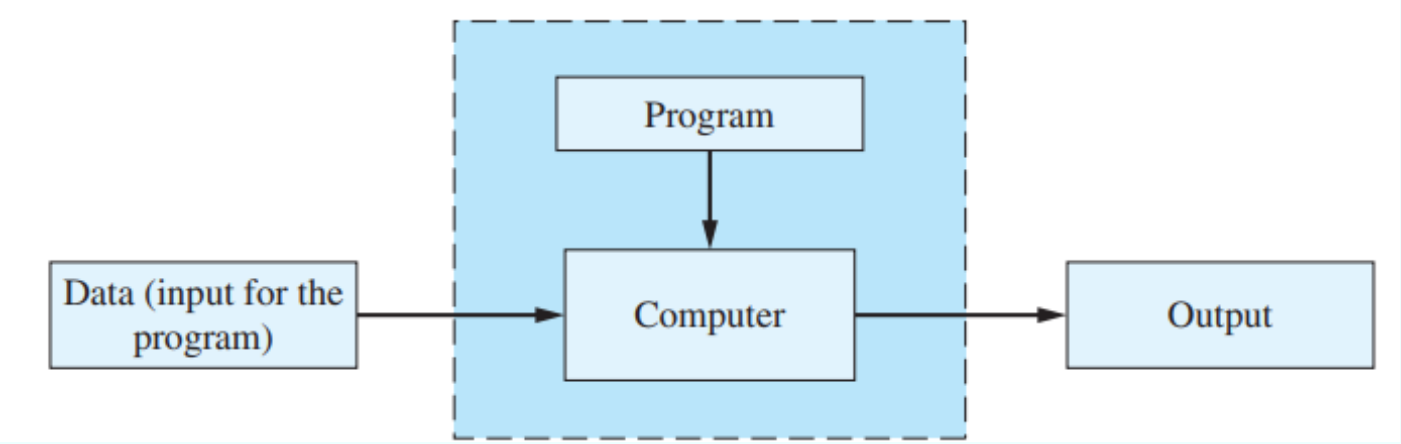
Main Memory

- Data stored in main memory is represented as binary, grouped into a byte (8-bits).
- One byte of integer can only represent the possible value of 0 to 255.
- A larger number uses a few adjacent bytes.
- Each memory slot has an address.
- A 32-bits system means we use 32-bits to store an address.



Programs

- Normally an **Operating System** is responsible to launch a program.
- A runnable program is **compiled** into some code (e.g. `.exe`) that can be executed on a computer platform.



👩‍🏫💬 Why can't we double-click-run an Android APK on Windows?

Compiler vs Interpreter

Compiler

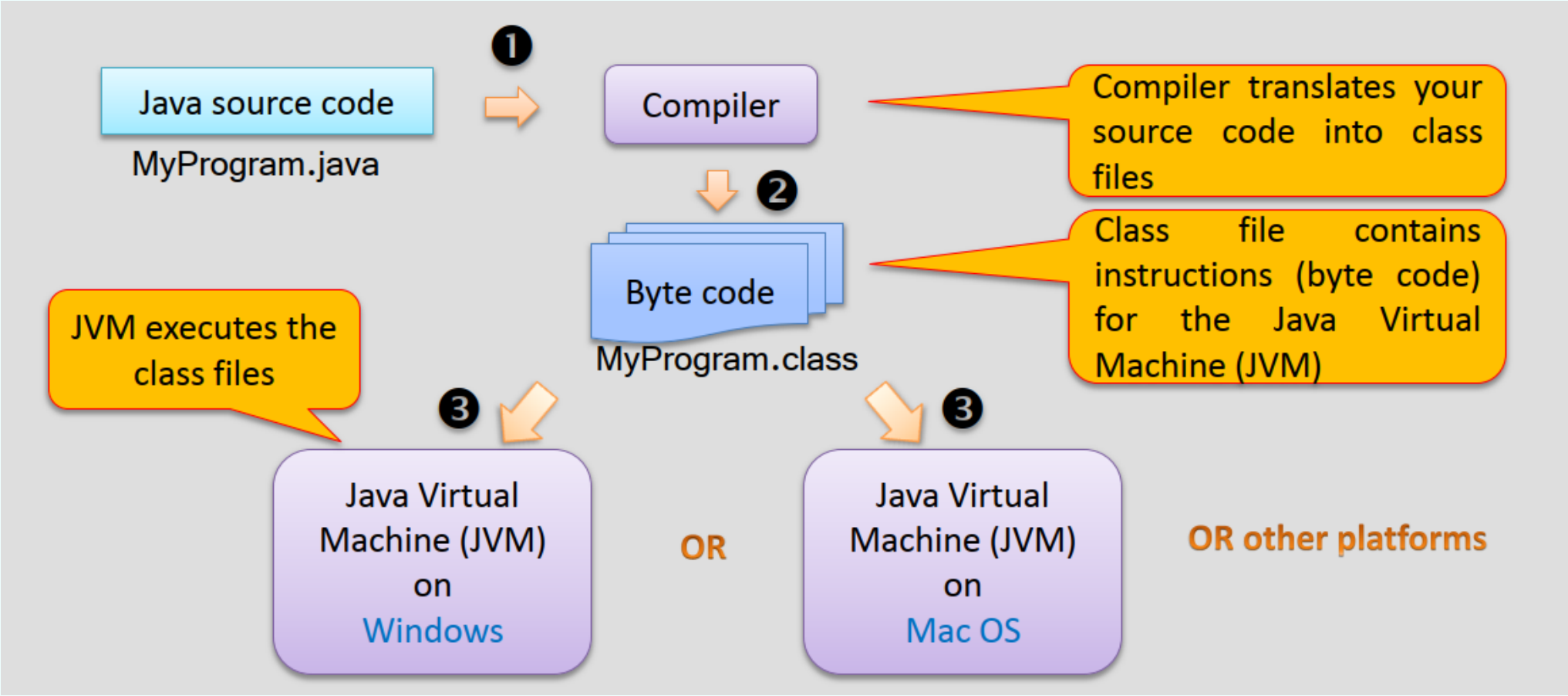
- Compiler is a special type of computer program
- Translates human writing programming code to runnable code
- A program needs to be compiled for once only
- Compiled code can be executed directly
- More efficient
- e.g. C/C++

Interpreter

- Interpreter does not compile code.
- Translates source code line-by-line while it is running
- More portable
- e.g. Python/VBA/bash script

Java Bytecode

- Java compiler *compiles* source code into **bytecode**.
- A **Java Virtual Machine (JVM)** *interprets* the bytecode.



W. Savitch and F Carrano, "Java An Introduction to Problem Solving & Programming," Pearson, 6th Ed.

Compile Our First Java Program

```java
public class HelloWorld {
    public static void main(String argv[]) {
        new HelloWorld().runApp();
    }
    public void runApp() {
        System.out.println("Hello World!");
    }
}
```

Name this file `HelloWorld.java`

> 👩‍🏫💬 In Windows system filename is not case sensitive. As a good habit you should strictly follow the case of your class name.

Compile Our First Java Program

Linux

```
$ ls
HelloWorld.java
$ javac HelloWorld.java

$ ls
HelloWorld.class HelloWorld.java

$ java HelloWorld
Hello World!
```

- `ls` - a Linux command for listing the file under the current directory
- `javac HelloWorld.java` - compiles the source program `HelloWorld.java` into a class file `HelloWorld.class`
- `java HelloWorld` - it execute the compile java program `HelloWorld`.

Compile Our First Java Program

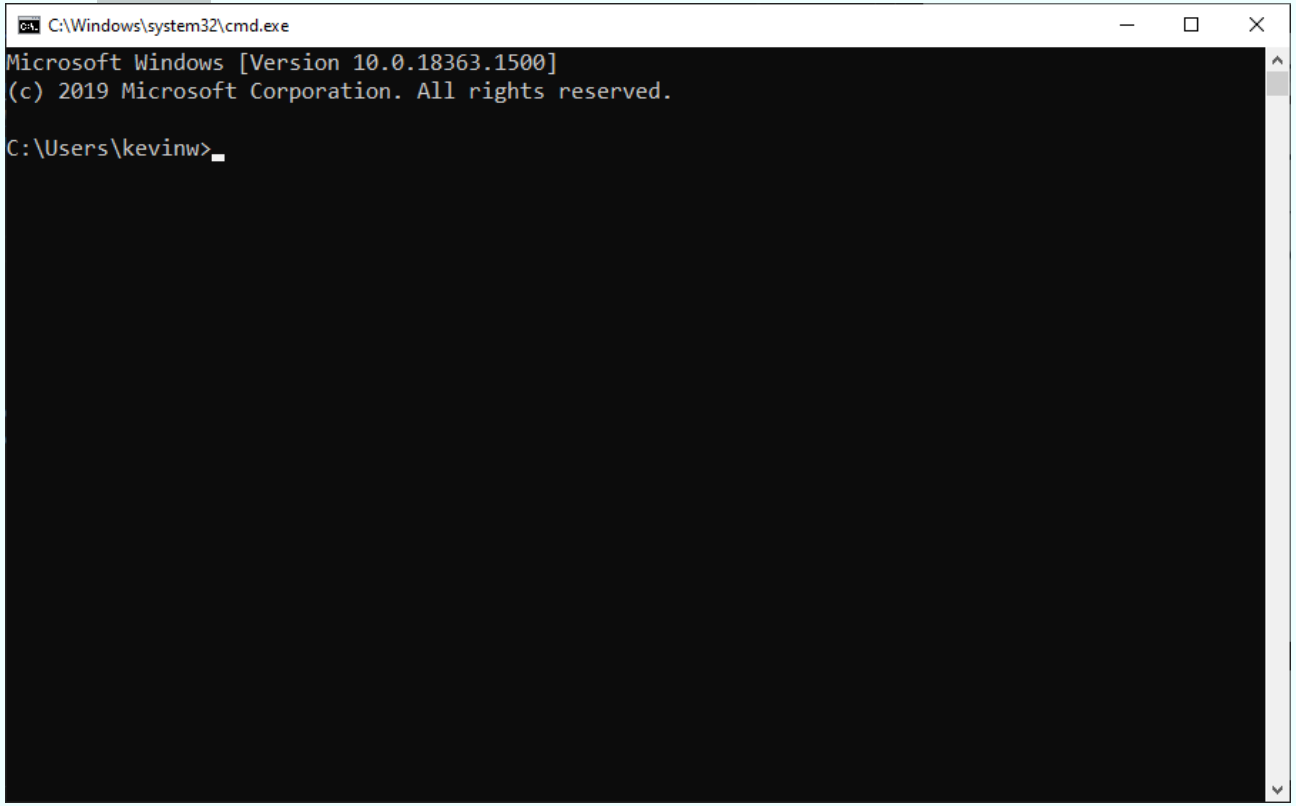
Windows' Command Prompt

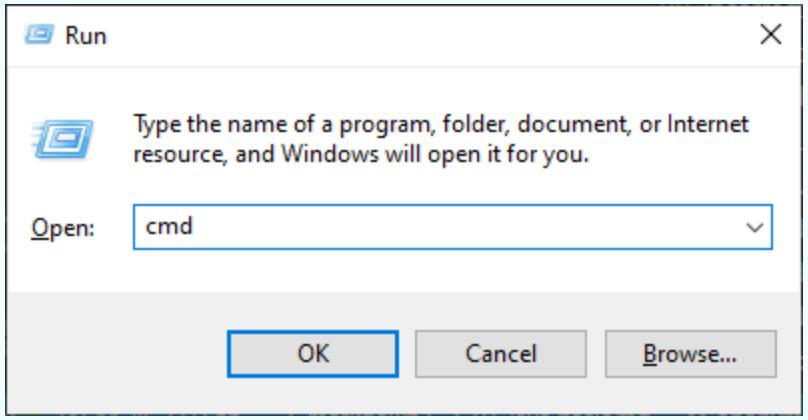
1. Start a Command Prompt
2. Create your Java source file (`HelloWorld.java`)
3. Compile the source file
4. Run the program

Compile Our First Java Program

Start a Command Prompt

1. Press `Windows Key` + `R` to launch `Run`
2. Type `cmd` in the box and click OK.





Compile Our First Java Program

```
C:\Users\kevinw>cd Desktop

C:\Users\kevinw\Desktop>mkdir MyFirstJava

C:\Users\kevinw\Desktop>cd MyFirstJava

C:\Users\kevinw\Desktop\MyFirstJava>Dir

 Volume in drive C has no label.
 Volume Serial Number is 91D0-BC80

 Directory of C:\Users\kevinw\Desktop\MyFirstJava

05/11/2021  04:12 PM    <DIR>          .
05/11/2021  04:12 PM    <DIR>          ..
               0 File(s)              0 bytes
               2 Dir(s)  604,250,165,248 bytes free

C:\Users\kevinw\Desktop\MyFirstJava>notepad HelloWorld.java
```

Compile Our First Java Program

- Use the program **Notepad** to edit `HelloWorld.java`.
- Save after you have done.
- Make sure the **Save as type** is All Files.
- Do not use **Wordpad** or **Word**.

> 👩‍🏫💬 Files saved in Wordpad or Word has their own format and its own file extension. Moreover, Word processors will convert the symbol quotation "" to “” which cannot be recognized by the compiler.

Compile Our First Java Program

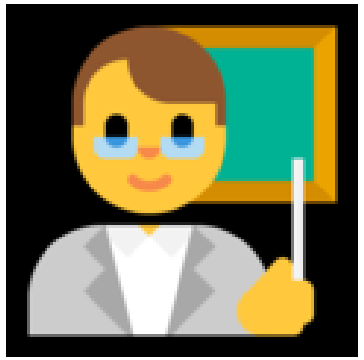
```
C:\Users\kevinw\Desktop\MyFirstJava>dir
 Volume in drive C has no label.
 Volume Serial Number is 91D0-BC80

 Directory of C:\Users\kevinw\Desktop\MyFirstJava

05/11/2021  04:41 PM    <DIR>          .
05/11/2021  04:41 PM    <DIR>          ..
05/11/2021  04:41 PM               199 HelloWorld.java
               1 File(s)            199 bytes
               2 Dir(s)  604,243,447,808 bytes free

C:\Users\kevinw\Desktop\MyFirstJava>javac HelloWorld.java

C:\Users\kevinw\Desktop\MyFirstJava>java HelloWorld
Hello World!

C:\Users\kevinw\Desktop\MyFirstJava>
```

Java IDE

- Integrated Development Environment (IDE) - Software application that helps us:
  - Editing our programs
  - Compiling our programs
  - Executing our programs; and
  - Debugging our programs
- Popular IDEs for Java:
  - NetBeans
  - Eclipse
  - **IntelliJ**
  - Visual Studio Code

Compiling a Java Program with IntelliJ

Compile First
Java Program
with IntelliJ



Comment in Java

- We want to leave some remarks/comments inside our program to enhance the readability.
- Comments in Java are not read by the compiler^.
- Comments can be taken in either form

Line comment: texts after the symbol `//` are comments

```
// line comment
// another line comment
```

Block comment: texts between the symbol `/*` and `*/` are comments

```
/* First lines of comments
   Another lines of comments */
```


^with the exception of java doc. Don't worry about that now.

Bridging from Python to Java

By Kevin 2022/2023

Python vs Java

- Quite different from Java
- Python allows you to quickly come up with little programs for testing ideas
- Java allows you to build a larger software in a more structured way

> 👨‍🏫💬 Assume you still remember Python a bit, this notes serves as a quick cheatsheet to migrate from Python to Java.

Python vs Java

Comment in Python

```python
# This is a comment in Python

'''
This is a multiple line comment
in Python.
'''
```

Comment in Java

```java
// This is a comment in Java

/* This is a multiple lines
   in Java. */
```

👨‍🏫💬 Tips: in most IDE pressing 'CTRL' + '/' (or CMD + / in mac) is a comment toggle.

Python vs Java

Arithmetic in Python

```python
a = 1 + 2 - 5
b = 4 / 2
c = 3 * 9
d = 3 ** 4   # power
e = 42 % 5   # remainder
f = 84 // 5 # floor division
```

Arithmetic in Java

```java
a = 1 + 2 - 5;
b = 4 / 2;
c = 3 * 9;
e = 42 % 5;  // remainder
```

floor division and power needs to be done via the APIs `Math.floorDiv()` and `Math.pow()`

Python vs Java

Assignment in Python

```python
a = 4
```

Assignment in Java

```java
a = 4;
a++;    // same as a = a + 1
++b;    // same as b = b + 1
c--;    // same as c = c - 1
--d;    // same as d = d - 1
```

On top of that both language support assignment operators like `+=`, `-=` etc.

Python vs Java

If-then-Else in Python

```python
if a == 1:
    print("one command")
    print("Another command")
else:
    print("else")
```

multiple statements are grouped by indentation

If-then-Else in Java

```java
if (a == 1) {
    System.out.println("one command");
    System.out.println("another line");
} else
    System.out.println("else");
```

multiple statements are grouped by `{ }`

Python vs Java

If-then-Else in Python

```python
if a == 1:
    print("one command")
    print("another line")
elif b > 3:
    print("alternatively")
else:
    print("else")
```

Use the keyword `elif` to handle multiple cases.

If-then-Else in Java

```java
if (a == 1) {
    System.out.println("one command");
    System.out.println("another line");
} else if (b > 3) {
    System.out.println("alternatively");
} else
    System.out.println("else");
```

`else if` are two separated words

Python vs Java

Comparison in Python

Name	Operator	Example
Equal	`==`	`if 2 == 1:`
Not Equal	`!=`	`if x != 4:`
Greater than	`>`, `>=`	`if 2 > 3:`
Less than	`<`, `<=`	`if 2 < 3:`

Condition must be followed by semicolon `:`

Comparison in Java

Name	Operator	Example
Equal	`==`	`if (2 == 1)`
Not Equal	`!=`	`if (x != 4)`
Greater than	`>`, `>=`	`if (2 > 3)`
Less than	`<`, `<=`	`if (2 < 3)`

Condition must be enclosed by parenthesis `()`

Python vs Java

Logical Operator in Python

Name	Operator	Example
and	`and`	`if fat and tall:`
or	`or`	`if fat or tall:`
not	`not`	`if not tall:`

Logical Operator in Java

Name	Operator	Example
and	`&&`	`if (fat && tall)`
or	`||`	`if (fat || tall)`
not	`!`	`if (!tall)`

Python vs Java

Loops in Python

```python
while x < 10:
    x = x + 1
    print(x)
```

```python
for x in range(1,10):
    do_something()
```

Loops in Java

```java
while (x < 10) {
    x = x + 1;
    System.out.println(x);
}
```

```java
for (int x = 0; x < 10; x++)
    do_something();
```

Python vs Java

List in Python

```python
array = []
array.append(1)
array.append(10)
i = 0
j = 1
array.append(array[i] + array[j])
```

Array in Java

```java
int[] array = new int[3];
array[0] = 1;
array[1] = 10;
int i = 0; int j = 1;
array[2] = array[i] + array[j];
```

Python vs Java

Function in Python

```python
def function(param1, param2):
    if (param1 > param2):
        return 1
    else:
        return 2
```

A function always starts with `def`.

Return values are **weak type** and nullable.

Method in Java

```java
public int method(int param1,
                  int param2) {
    if (param1 > param2)
        return 1;
    else
        return 2;
}
```

The **return type** of a Java method must be defined. A non-void method must have a return statement on every possible path.

Python vs Java

Simple Program in Python

```python
i = 9527

while i > 1:
    for j in range(2, i + 1):
        if i % j == 0:
            print(j)
            i = i / j
            break
```

Simple Program in Java

```java
int i = 9527;

while (i > 1) {
    for (int j = 2; j <= i; j++) {
        if (i % j == 0) {
            System.out.println(j);
            i = i / j;
            break;
        }
    }
}
```

More about Java

1. Java must have a class

- A complete Java program must include at least one class.
- Code are placed inside **methods** of a class.

```
System.out.println("Hello"); //does not work alone
```

```
public class Main {
    public static void main(String[] arg) {
        System.out.println("Hello"); //code placed inside method
    }
}
```

More about Java

2. Java starts from public static void main

- All Java executable program must include a method called `public static void main`. All code starts there.

```
public class Main {
    public static void main(String[] arg) {
        System.out.println("Hello"); //Programme entry point
    }
    public static void hi(String[] arg) {
        System.out.println("hi"); //would not go here
    }
}
```

More about Java

3. Java needs to be compiled before runs

- The compilation procedure is transparent to you for most of the time.
- **Compile**: the process to convert source code (.java) to byte code (.class)

4. Running Java Byte code needs a JRE/JDK

- **JRE**: Java Run-time Environment (most PC installed that)
- **JDK**: Java Development Kits. Include JRE as well.

More about Java

5. Java variable needs to be declared

- All variable needs to be declared before it can be used.
- Java is a **strong type** language. Each variable has a fixed type.