Lecture 1

Commmand Line Interface
Java Compiler

Introduction to Computer Programming - CST8110

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The Command Line Interface (CLI)

In the first half of this course (i.e. until the midterm), we will be using the Command Line Interface (CLI) to compile and run our Java programs. It is an interface to browse your file system and launch programs.

https://en.wikipedia.org/wiki/Command-line_interface

- ... often preferred by more advanced computer users.
- (Rarely used) by casual computer users, who favor graphical user interfaces or menu-driven interaction.
- Programs with command-line interfaces are generally easier to automate via scripting.

The Command Line Interface is also knowns as:

- The Console.
- A Terminal Window.
- A Shell.

Windows Command Line

The default program to open the CLI on Windows is called **cmd**.
Start -> Run -> type "cmd".
or hold the Ctrl and WindowsKey, then type "cmd".

Demo

- Start Firefox using the command line versus a shortcut.
- Start Firefox with a command line arguments in cmd versus a shortcut.

Note

- Linux and macOS (and everybody else) have what is known as a POSIX shell.
- Windows recently added support for a POSIX shell with their Windows Subsystem for Linux (WSL) offering, but it doesn't come by default.
- Before that, a POSIX shell was available through Cygwin.

Windows Command Line - Basics

Some basic commands:

Demo

- exit
- cd - change directory (i.e. folder)
- dir - list the files in the current folder
- C: - change partition
- cls - clear the screen
- copy
- del - delete a file

Links

- Online Tutorial
- Microsoft Reference

Windows Command Line - Things to Know

Some useful concepts:

Demo

- Filenames with spaces
- Tab Completion
- Dimension of your terminal window and scroll buffer size.
- The concept of the path.

The path can be modified at "My Computer" > "Properties" > "Advanced" > "Environment Variables" > "Path".

Warning

- You must restart the **cmd** process after modifying the path, for the change to apply.

Raw Text Editors

Let's try a few Windows text editor:

Demo

- Notepad
- Notepad++

Warning

- Microsoft Word or LibreOffice, or any other rich text editors are not suitable for writting source code.
- Source code does not contain bold, italic, text alignment, tables, graphics, fonts, etc... just text.

Advanced Demo

- XVI32, a binary editor.
- Text files encodings (e.g. utf-8).

Other Text Editors

If you are using a non-Windows Operating System:

- Linux users can try gedit.
- macOS users can try BBEdit (formerly TextWrangler).

After the midterm, we will start using the Integrated Development Environment (IDE) called Eclipse, but for now I want you to have a good try at using the SDK by itself. My goal is that you will appreciate more fully the pros and cons of using an IDE, and not be overwhelmed.

Bare Bones Java Program

BareBonesProgram.java

```
public class BareBonesProgram {

   public static void main(String [] args) {
   }

}
```

Warning

- The filename must match the class name.
- The source code and filename are case-sensitive.
- **javac** must be in your PATH.

Demo

- Compile without respecting the warnings above.

Executables

On Windows, a file is considered executable if its extension is:

- .exe
- .bat
- .com (discontinued)

Note

- On Linux, the file permission defines if a file is executable (not the extension).

In any case, executable files are a bit misleading. They are simply files containing data which the OS can bootstrap into execution.

The file iself may be a simple command line script (e.g. .bat), a plain text program written in a programming language like python (e.g. .py), or machine code (i.e. compiled assembly) (e.g. .exe).

Binaries

Binary files are files that contain bytes that are not plain text. For example, the following file formats are binary files:

- .png (image)
- .jpg (image)
- .docx (Microsoft Word)
- .pdf
- .exe

Not all executable files are binaries, and not all binaries are executable.

Note

- When a programmer says: "Give me the binaries", they mean "give me the compiled code".

Java Binaries

In Java, the output binaries are .class files. They contain what is called Java byte-code. Byte code is not human readable, it is encoded in binary.

Note

- Java Byte-code is a language in itself, like assembly. This is beyond the scope of this class (and degree), but there are tools that can allow you to compile plain text byte-code.

Sadly, .class files are not normally recognized by an operating system as being executable. This is annoying when you want to share your program with your family and friends.

```
Compile: javac BareBonesProgram.java
Run:      java BareBonesProgram
Note the lack of extension when using 'java' to
    run the program.
```

Java Binaries

Java is a high-level language that does not compile to machine code for a specific architecture (e.g. x86, arm). It is instead compiled into byte-code, a type of platform-independant machine code.

A virtual machine (VM) that understands byte-code is necessary to run a Java program. The **java** program launches a Java VM that can understand your program. The Virtual Machine itself is normally written in C/C++ and compiled into native machine code.

Java is therefore semi-compiled (to byte-code), and semi-interpreted (by a VM).

Other Languages

There are many programming languages out there. Some compile to native machine code executables, some are plain-text scripts, and some like Java are compiled in an intermediary binary format and require an interpreter (like scripts do).

- C/C++ (native assembly)
- Java (intermediate assembly)
- Python (plain text, intermediate assembly)
- javascript (plain text)
- C# (intermediate assembly)
- Perl (plain text)
- PHP (plain text, intermediate assembly)

It is as difficult to share a Python script with your friends as it is to share a Java program.

Java

The reason Java is popular are not easily understood by newcomer, but here is a non-exhaustive list of reasons anyway:

- Platform independent.
- The Standard Library includes GUI.
- The Standard Library includes a lot.
- Centralized Standard Library documentation.
- It has a C-like syntax.
- The language is improved regularly. See enhancements.html.
- It is impossible to corrupt the main memory.
- It has a Garbage collector.
- It is the main language of Android applications.
- The virtual machine is securable.
- It scales, performs and is reliable.

For these reason, it is the ideal blue collar language. The average programmer can write a powerful yet bug free program with Java. In C, you need extreme discipline and knowledge.

Java SDK

Acronyms

SDK	Software Development Kit
JDK	Java Development Kit
JRE	Java Runtime Environment

Note

- The program **javac** (compiler) is part of the JDK.
- The program **java** (interpreter / VM) is part of the JRE.