

## COMP 141: Compilers and Interpreters, Trends in PLs

**Instructions:** In this lab, we are going to learn how to use prevalent compilers and interpreters for C and Java in Unix-based systems<sup>1</sup>. You may need to search online! Next, you will explore trends in PLs.

### 1 GCC

GCC (GNU Compiler Collection) provides a set of compilers for various PLs in Unix-based systems. The collection include C, C++, Objective-C, Fortran, Ada, and Go. Originally, it was only handling C language (the original name was GNU C Compiler). In this exercise, we are going to investigate how we can compile C programs using this tool.

Assume that we have a C program named `hello.c`. For each of the following, give at proper command using GCC.

1. GCC can be used to compile a C program to object files and link them into an executable, in a single step. (input: `hello.c`, output: executable binary)
2. GCC can directly compile the source code to object files. (input: `hello.c`, output: `hello.o`)
3. GCC includes the capability to invoke the linker that collects a bunch of object files into an executable. (input: `hello.o` output: executable binary)
4. GCC can compile the source code to Assembly language. (input: `hello.c`, output: the Assembly code `hello.s`)
5. GCC includes the capability to invoke the assembler that translates the Assembly code into object files. (input: the Assembly code `hello.s`, output: `hello.o`)

### 2 Java

Java is a PL that is first compiled into Java bytecode. Then, the Java interpreter that resides in Java Virtual Machine executes the bytecode in a single step.

1. What is the name of Java compiler program in Unix-based systems (used in commandline interface)?
2. How it can be invoked to produce the bytecode?

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<sup>1</sup>Unix-based systems is a huge family of operating systems including different distributions of Linux, MacOS, Solaris, iOS, Android, Chrome OS, BSD, etc.

3. What is the Java bytecode file's extension?
4. What is the name of Java interpreter program in Unix-based systems (used in commandline interface)?
5. How it can be invoked to execute the bytecode?

### **3 Trends in PLs and Beyond**

Check the most recent Stack Overflow annual survey at <https://survey.stackoverflow.co/2022/> and answer the following questions.

1. Considering experience in coding (in years) among all the respondents, which group has the biggest share?
2. Considering the developer type among all the respondents, which group has the largest share?
3. What are the top three countries from which respondents come from?
4. What percentage of respondents are men vs. women?
5. For how many consecutive years, Javascript has become the most popular PL?
6. What are the top five most popular database technologies?
7. What are the top five most popular web frameworks and technologies? Specify which PL aligns with each of these frameworks and technologies.
8. What are the top five most popular IDEs?
9. What are the top five most loved PLs?
10. What are the top five most dreaded PLs?
11. What are the top five highest paying PLs? Specify the major programming paradigm that each of these PLs support.

### **4 TIOBE Index**

While PYPL is created by analyzing how often language tutorials are searched on Google, TIOBE index counts the number of web pages with the language name. What are the top five most popular PLs according to TIOBE index?