CIT-260
Week One

Objectives for this week

At the end of this week, students should be able to

- Explain the contents of the syllabus
- Explain what a high level programming language is
- Describe the steps to build and execute a Java program
- Install and configure IntelliJ IDEA
- Describe the structure of a Java program
- Write, compile, and execute a simple Java program

What You Will Learn This Week

- What this course is all about
- What is in the Course Syllabus
- A little about computer programs
- What a simple Java program looks like
- Who your classmates are and something about them

What You Will Do This Week

- Study this set of slides
- Review the course syllabus
- Get to know your class-mates
- Sign up for a Zoom account
- Install IntelliJ IDEA
- Write a short Java program and submit it

This is an **introduction** to object-oriented programming. At the end of this course you should have a solid grasp of the basic principles of object-oriented programming. These include

* Reading and writing data to the Console
* Using primitive data types and operators
* Thinking algorithmically
* Changing the flow of control in a program
  - with selection statements
  - with loops
* Using object-oriented design principles
  - abstraction, encapsulation, inheritance, polymorphism
* Using methods to break problems into smaller pieces
* Handling exceptions
* Reading and writing data to a file

At the end of this course you should be able to design, construct, test, debug and document simple object-oriented programs using the Java programming language.

No matter what anyone else tells you, programming is an art. It is an extremely creative process that requires both passion and dedication.

"The computer programmer is a creator of universes for which he alone is the lawgiver. No playwright, no stage director, no emperor, however powerful, has ever exercised such absolute authority to arrange a stage or field of battle and to command such unswervingly dutiful actors or troops."

--Joseph Weizenbaum

A computer is just a dumb machine. On its own, a computer is not capable of doing anything. We have to tell a computer what to do by giving it a set of instructions called a *program*. Computers do not understand human languages, so we have special computer languages that we have to learn to write our programs. These languages are called *programming languages*.

Machine Language

The most primitive form of programming language is machine language. Every computer has a built in set primitive instructions, which are entered in binary. Entering binary instructions into the computer is a tedious process. The picture here shows a Digital Equipment PDP-8 computer, a popular computer in the early 1970s. Programs could be entered on the front panel by flipping switches. When the switch was up it represented a zero. When it was down it represented a one.

Assembly Language

Assembly languages were developed to make programming easier. A program called the assembler is used to convert assembly language programs into machine code. This conversion is very fast, since there is usually a one-to-one relationship between assembly language code and machine code. Here is an example of a PDP-8 assembly language program that adds the contents of two memory addresses and leaves the sum in the accumulator

```
00200 CLA          / Clear the accumulator
00201 TAD A       / Add contents of memory location A to the accumulator
00202 TAD B       / Add the contents of memory location B to the accumulator
00203 HLT         / Stop the CPU
00204 JMP I, 7600    / return control to the operating system
00205 A, 0003    / define memory location A and store the value of 3 there
00206 B, 004    / define memory location B and store the value of 4 there
```

High Level Languages

High-level programming languages are English-like and are much easier to learn and to use than assembly language. For example, the following is a high-level language statement that adds the values of a and b, and stores the sum in c.

```
c = a + b
```

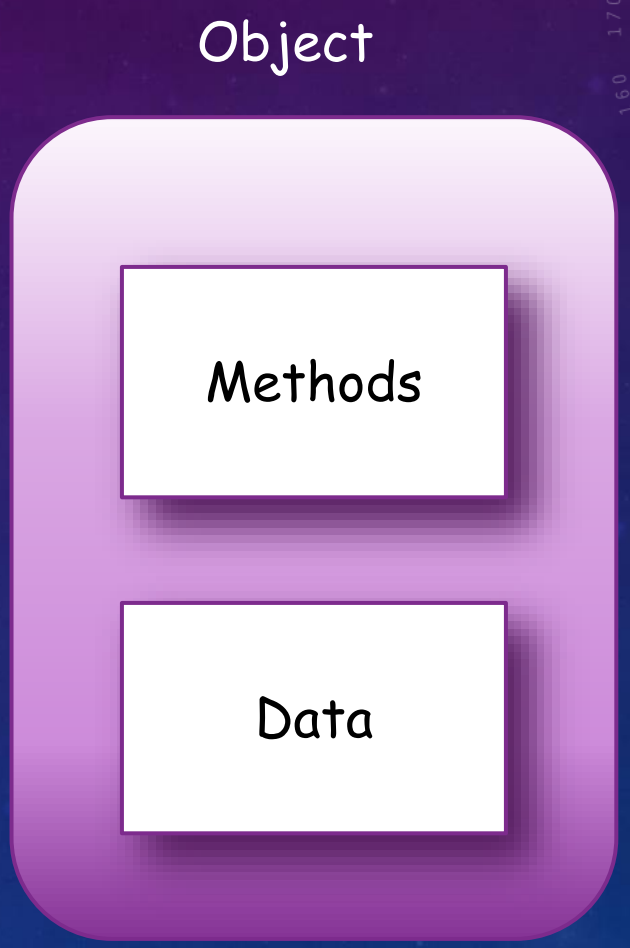
Procedural Programming

In procedural programming languages, like C, statements such as

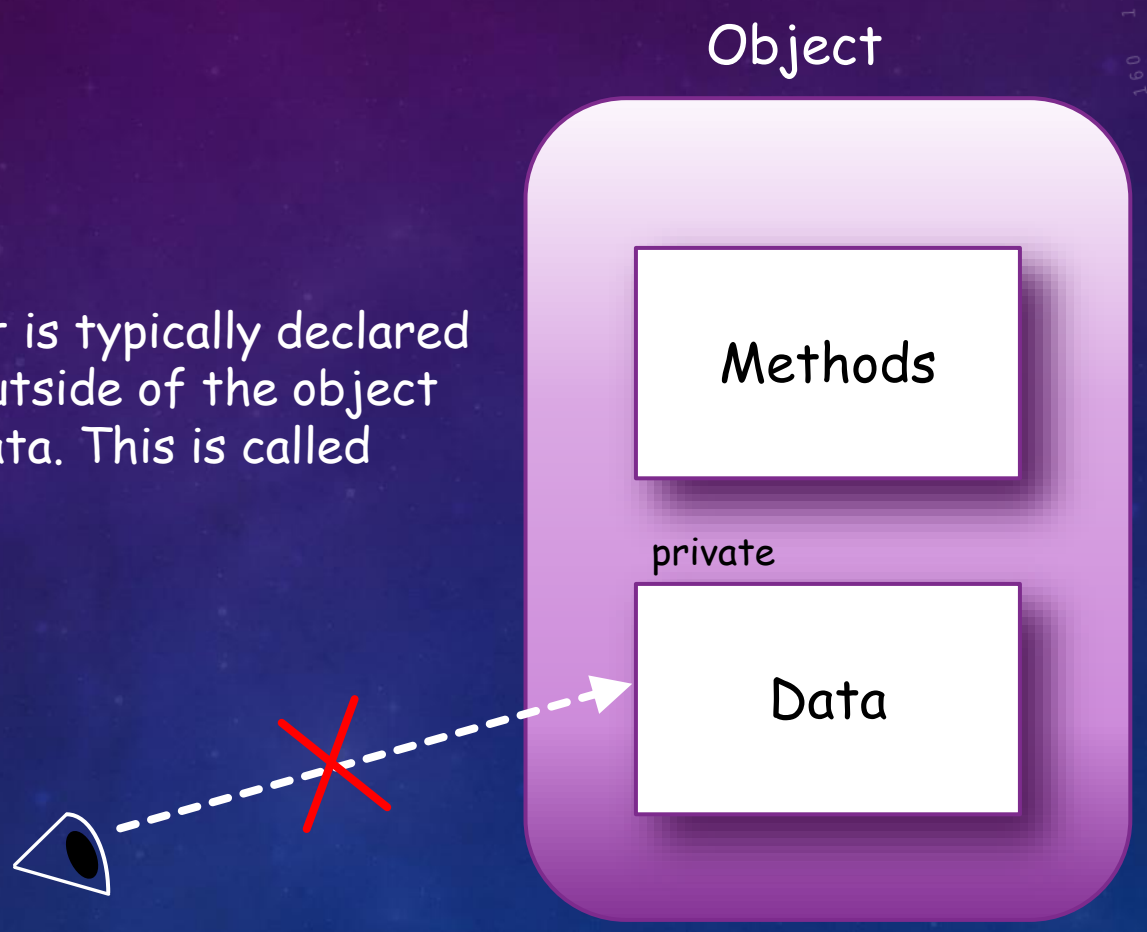
```
c = a + b
```

are combined together into units known as procedures, functions, or subroutines. Procedures can be called from anywhere in a program and they operate on the data values (like a, b, and c) in the program. Much of the data in a procedural program is defined in a way that it can be seen and operated on by any procedure in the program. This separation of data from the procedures that work it makes programs that are difficult to maintain, and there is limited re-use of procedures.

In an object-oriented programming language data and the procedures that operate on that data are put into a software package called an *object*. In Java, we refer to the procedures that are associated with an object as *methods*.

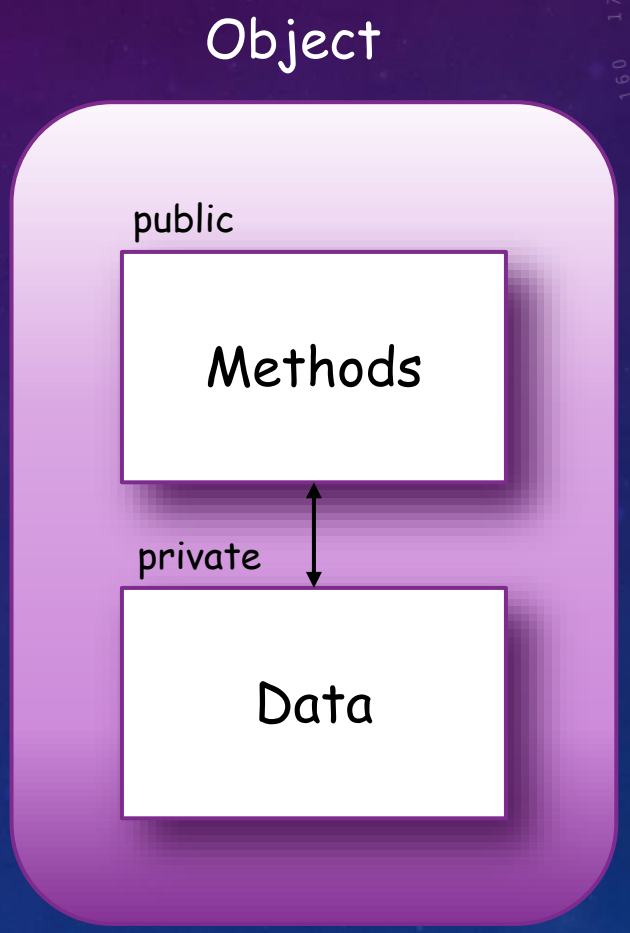


The data inside of the object is typically declared as private, so that entities outside of the object cannot directly access the data. This is called *data hiding*.



The methods inside of the object are typically declared as public, so that entities outside of the object can use them to access and manipulate the data in the object.

Packaging the data and methods together this way is called *encapsulation*.



Programming Languages that primarily deal with objects are called object-oriented programming languages.

One of the most popular object-oriented programming languages is Java.

In this course we will use Java to illustrate the important principles of object-oriented programming. Java is a very rich language. We will only discuss the parts of Java necessary to explain the programming concepts presented in this course.

Java was developed by James Gosling at Sun Microsystems. It was introduced in 1995 as part of Sun's Java platform.

Java derives much of its syntax from C and C++, but unlike C and C++, Java is compiled into bytecodes that allow it to run on any computer that supports the Java Virtual Machine. With Java you only need to write a program once and then you can run it on any machine that has a Java Virtual Machine.

Creating, Compiling and Executing Java Programs

In this class, you will use a software package called IntelliJ IDEA to create, compile, and execute your programs. INTELLIJ IDEA is what is known as an integrated development Environment, or IDE.

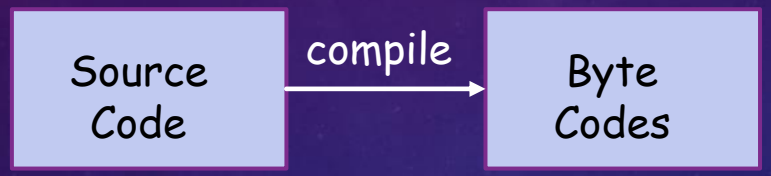
IntelliJ IDEA contains a complete set of tools to create, compile, test, debug, and execute Java programs.

Creating, Compiling and Executing the Program

Source Code

Using the code editor in IntelliJ IDEA, we create the source code. The source code is written in Java.

Creating, Compiling and Executing the Program



The compiler converts Java source code into an intermediate language called bytecodes.

Creating, Compiling and Executing the Program

Java bytecodes are executed on a Java Virtual Machine.

The Java Virtual Machine (JVM) is a software program that runs on your computer. It *interprets* the byte codes by converting them into machine language code that is executed as it is converted.

A Simple Java Program

```
// This program displays the message
// Welcome to Java
public class Welcome {
   public static void main(String[] args) {
      System.out.println("Welcome to Java");
   }
}
```

Every java program must have at least one class. Each class has a name. By convention class names are capitalized. We will talk more about classes later in the course.

```
// This program displays the message
// Welcome to Java
public class Welcome {
  public static void main(String[] args) {
    System.out.println("Welcome to Java");
  }
}
```

Everything that belongs to the class is enclosed in these curly braces.

The keyword **public** is an access modifier. It tells us that this class can be seen by parts of the program code that are outside of this class.

```
// This program displays the message
// Welcome to Java
public class Welcome {
   public static void main(String[] args) {
      System.out.println("Welcome to Java");
   }
}
```

Every java program must also have exactly one method named *main*. Method names are not capitalized.
The main method defines the entry point for the program,
This is where the program will begin executing.

```
// This program displays the message
// Welcome to Java
public class Welcome {
  public static void main(String[] args) {
    System.out.println("Welcome to Java");
  }
}
```

These are the *arguments* that are being passed to the main( ) method. We are not going to concern ourselves with these arguments, because the programs we write will never use them.

```
// This program displays the message
// Welcome to Java
public class Welcome {
  public static void main(String[] args) {
    System.out.println("Welcome to Java");
  }
}
```

Methods are made up of statements. A statement is an instruction that tells the computer to do something. A statement ends with a semi-colon.

```
// This program displays the message
// Welcome to Java
public class Welcome {
  public static void main(String[] args) {
    System.out.println("Welcome to Java");
  }
}
```

All of the statements that belong to a method are enclosed in curly braces. This is called the body of the method.

```
// This program displays the message
// Welcome to Java
public class Welcome {
  public static void main(String[] args) {
    System.out.println("Welcome to Java");
  }
}
```

This statement tells the computer to display the string of characters inside the quotation marks. **System.out** is an object that represents the display screen on your computer. The display screen and the keyboard are often referred to as the computer's console.

```
// This program displays the message
// Welcome to Java
public class Welcome {
  public static void main(String[] args) {
    System.out.println("Welcome to Java");
  }
}
```

println is the name of a method that outputs the string in the parenthesis to the display.

The text in between the quotation marks is known as a **string literal**.

Comments at the beginning of a program tell others what the program does. The characters // mark this as a single line comment.

```
// This program displays the message
// Welcome to Java
public class Welcome {
  public static void main(String[] args) {
     System.out.println("Welcome to Java");
  }
}
```

Programming Style

Programming style deals with what a program looks like. It is possible to write a program that works, but because of bad programming style it is hard to read, and therefore hard to maintain. Most software development organizations will require their programmers to follow a set of style guidelines when writing their source code.

Naming Conventions

Choose meaningful and descriptive names.

Class names: Capitalize the first letter of each word in the name, for example,

WelcomeToJava.

This is called title case.

Method names: The first letter is not capitalized. For example,

computeArea()

This is called camel case.

Indentation and Spacing

Indentation:

everything inside of a block should be indented.

Normally Eclipse takes care of indentation for you.

Spacing:

use a blank line to separate segments of the code.

Programming Errors

- Syntax Errors
  - Detected by the compiler –the language has been used incorrectly.
- Runtime Errors
  - Cause the program to abort – the computer cannot do something you told it to do.
- Logic Errors
  - Produces incorrect results – the program works but there is something wrong in your logic

Learning to program requires

- Time
- Patience
- Good language skills
- The ability to think abstractly
- Good math skills
- The ability to solve problems
- Practice – Program, program, program
- A sense of curiosity

Learning to Program Takes Time

Researchers have shown that learning to do anything well (playing the piano, painting, playing tennis, etc) takes about 10 years. Learning to be a good programmer is no different.

To become proficient at programming

- Practice
  - Practice
    - Practice …

Preparing For This Week's Assignment

The following slides illustrate how to download and install the Java JDK and IntelliJ IDEA. These slides show the install on a Windows computer, but installing on a Mac computer will be similar.

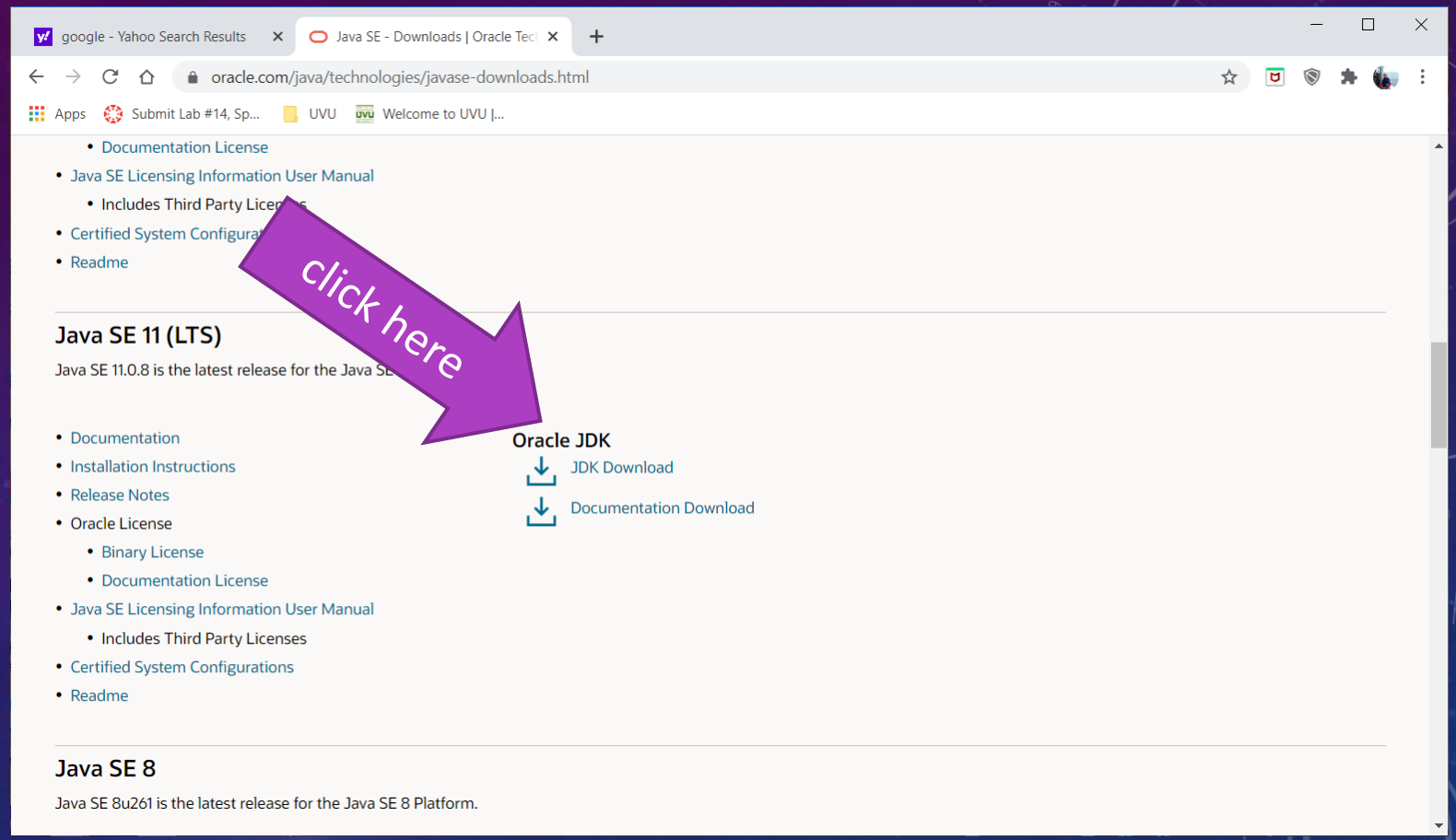
The Java Development Kit (JDK)

The JDK contains a package of tools that are required for developing Java programs. You may already have the JDK installed on your computer, but you will want to download and install the most recent Long Time Support (LTS) edition. This is currently JAVA SE 11.

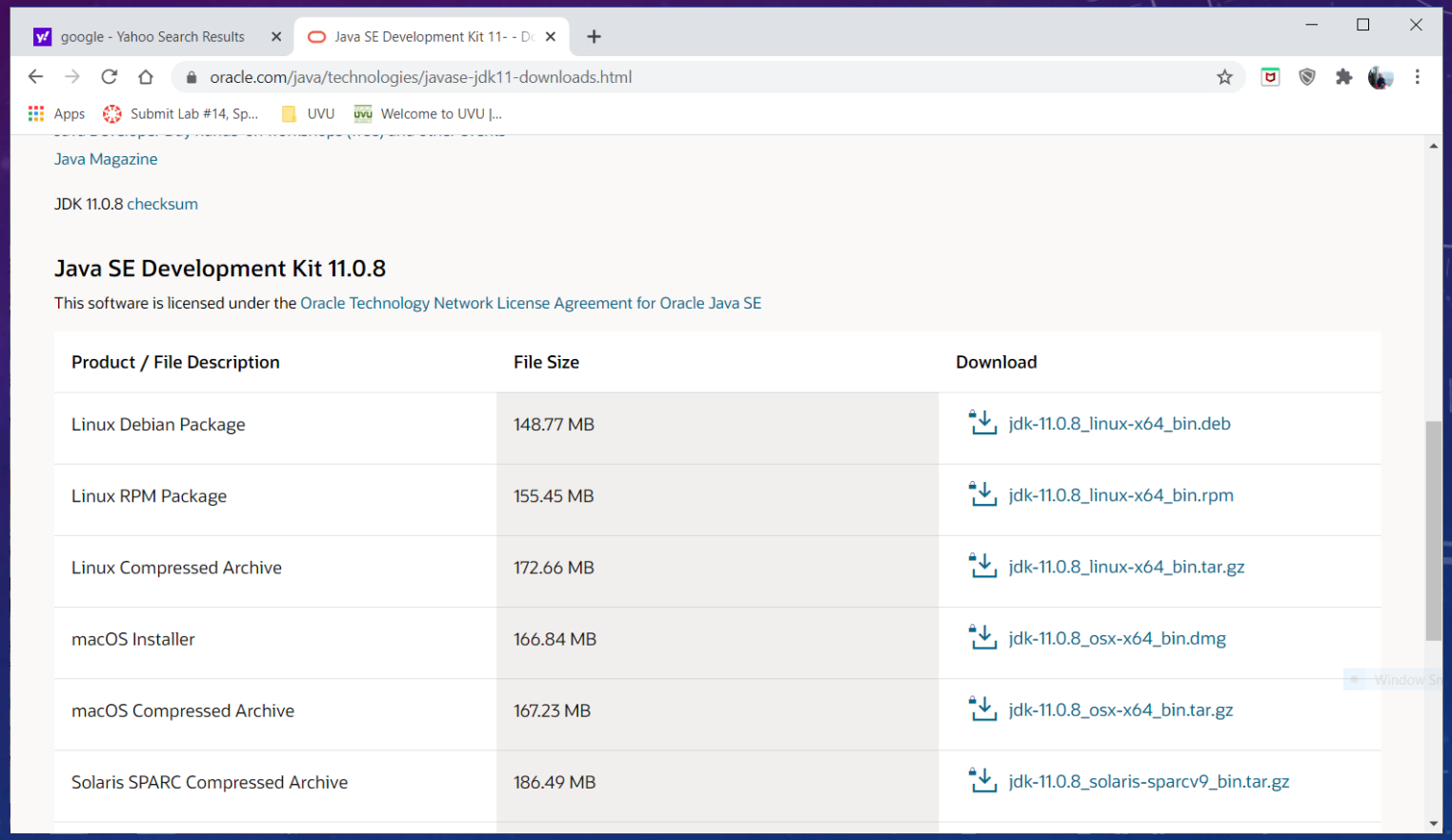
Downloading and Installing The JDK

Downloads for the JDK are located at
https://www.oracle.com/technetwork/java/javase/downloads/index.html

When you arrive at the landing page for the JDK downloads, scroll down until you find the information for Java SE 11 (LTS). This is the current long term support version of the JDK that you should download and use for this class. This is the current industry standard version.

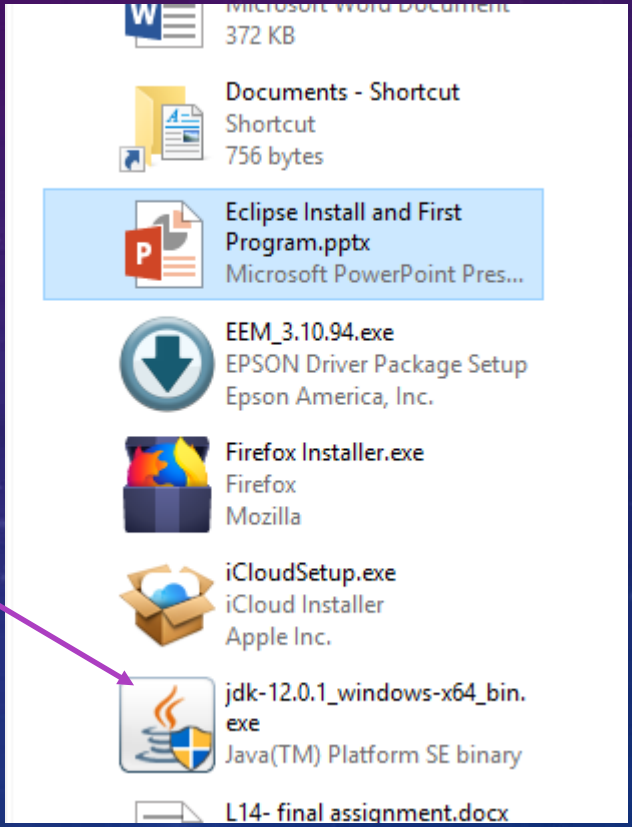


On this page, click on the download for your operating system.



Find the downloaded file in your download folder and double-click on it to start the install process.

Follow the prompts.

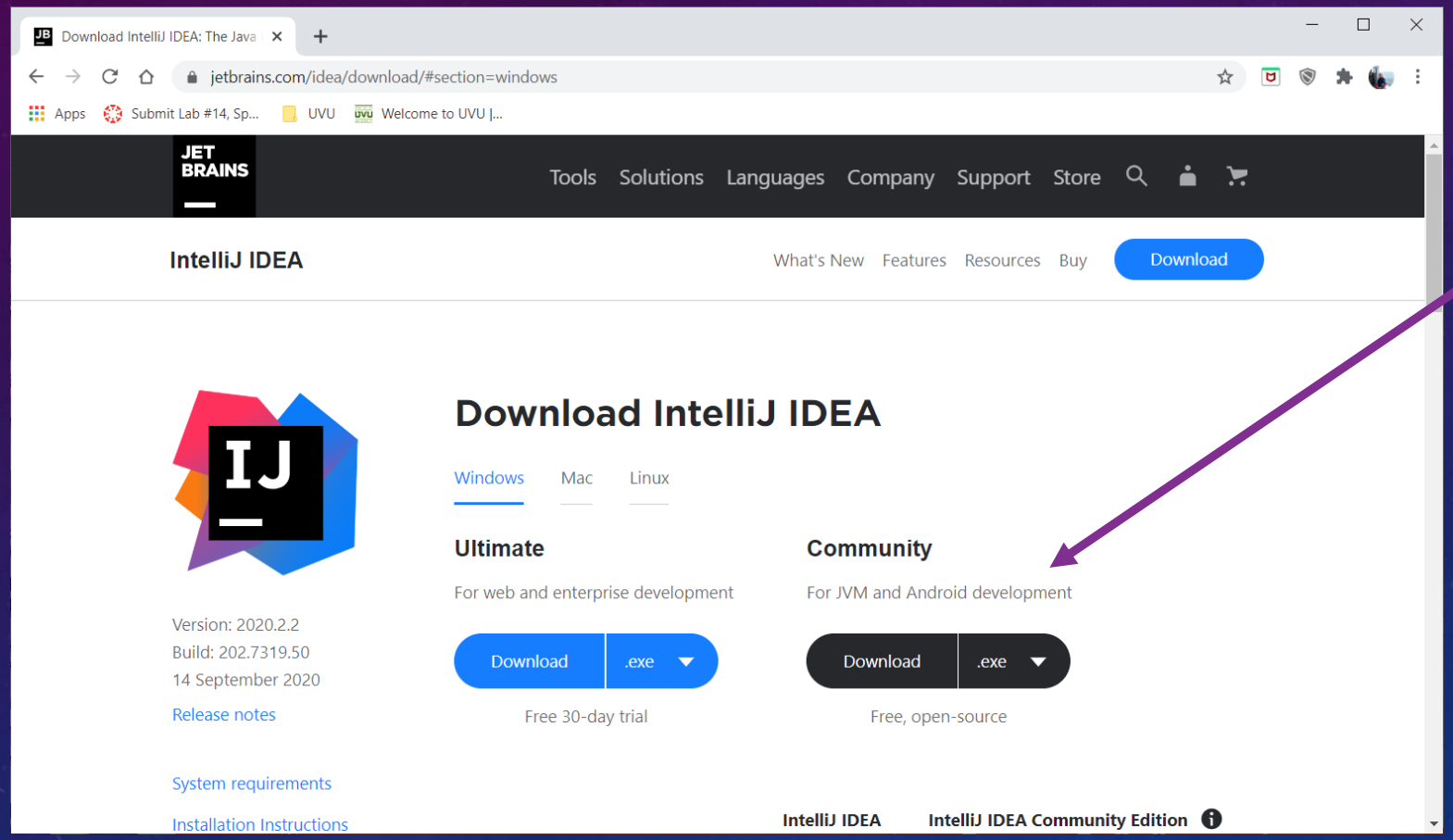


Where did the install put the JDK?

Windows: C:/Program Files/Java/
MacOS: Macintosh HD/Library/Java/JavaVirtualMachines/

Download and install IntelliJ IDEA

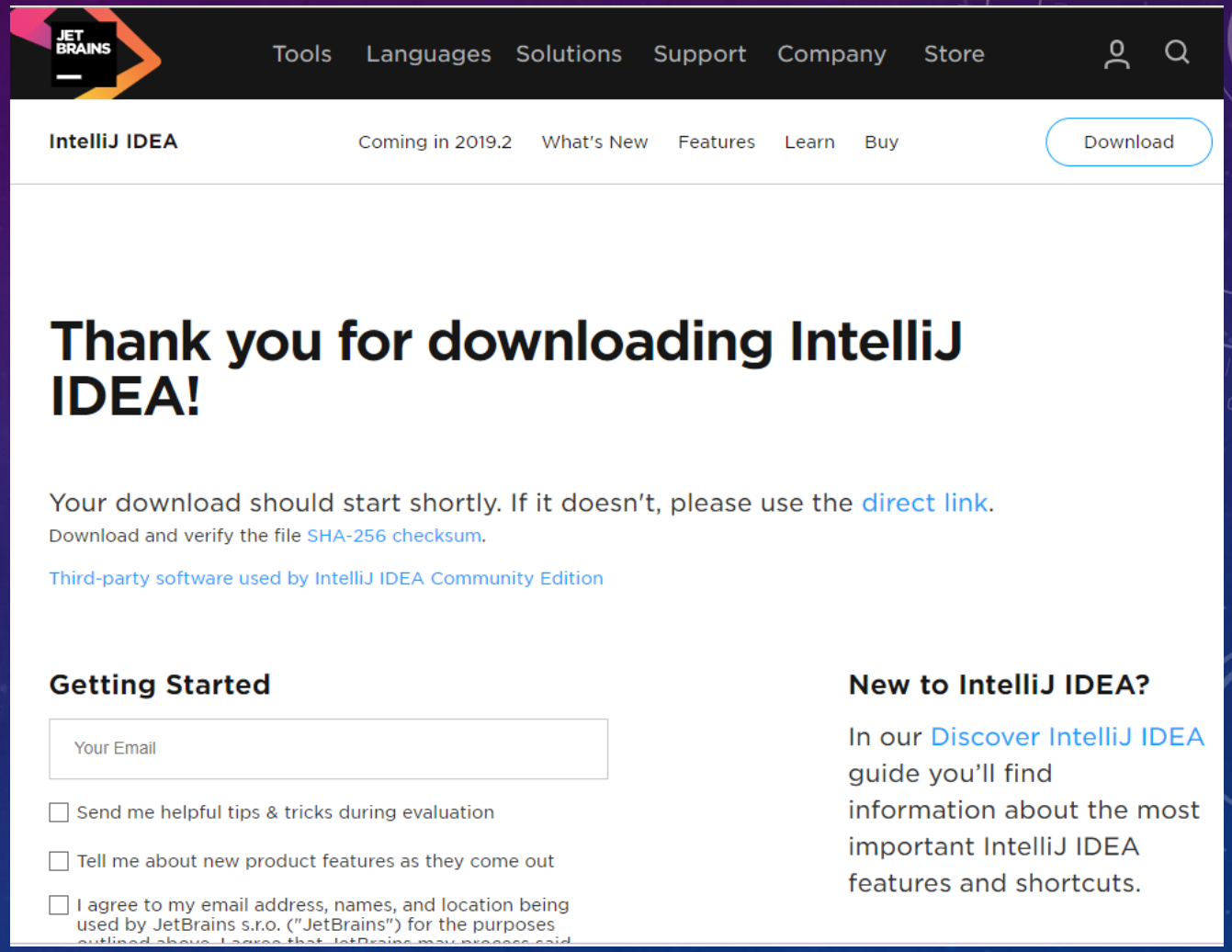
Go to https://www.jetbrains.com/idea



Download the free Community edition here.

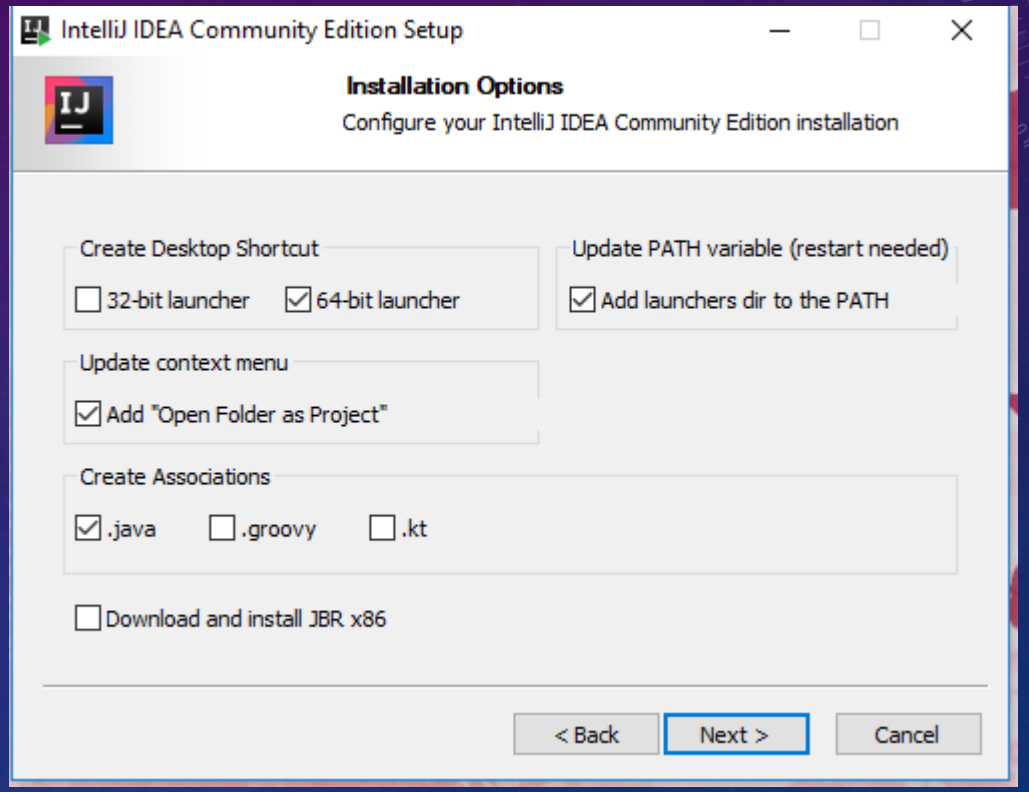
Click on the Community download.

The download should start automatically. You do not need to provide an email unless you want to get emails from JetBrains.



Double click on the downloaded file to start the install process. Follow the prompts.

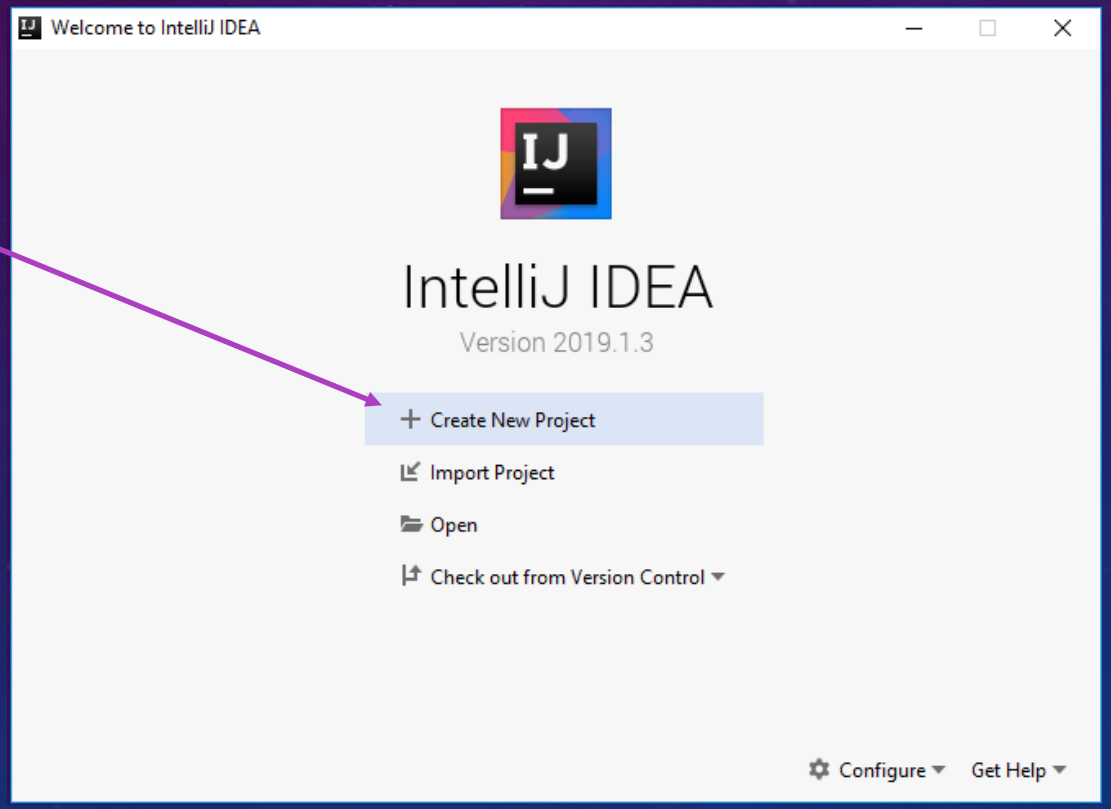
Select these options. (Windows only):



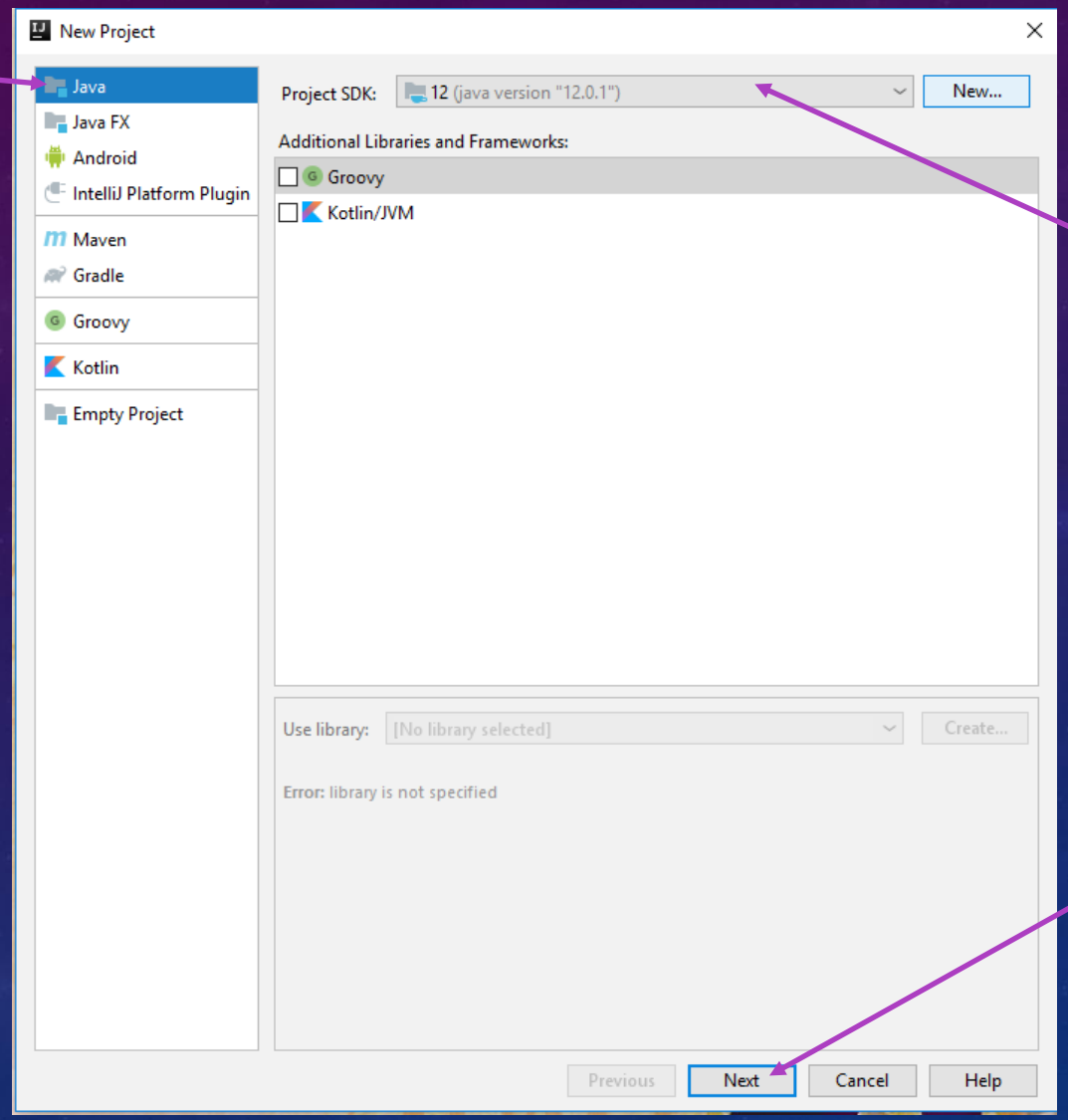
Click on the IntelliJ icon to launch IntelliJ IDEA. When you first start IntelliJ IDEA, there are some configuration options you can choose. You can ignore these.

Writing Your First Java Program

Click on Create New Project



Select Java

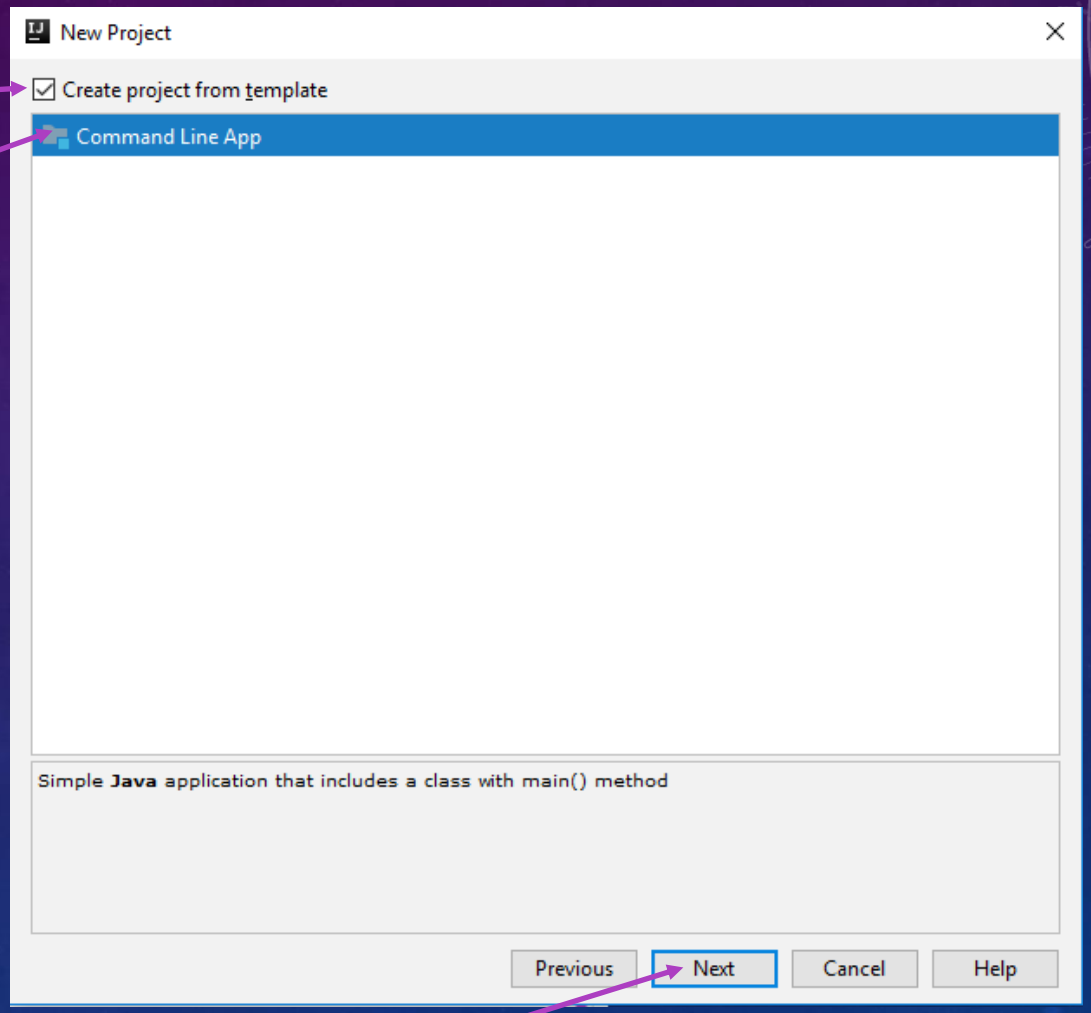


If the JDK you installed does not show up here, click on the **New** button and find the installed JDK

Click on Next.

Click on the Create project from template box

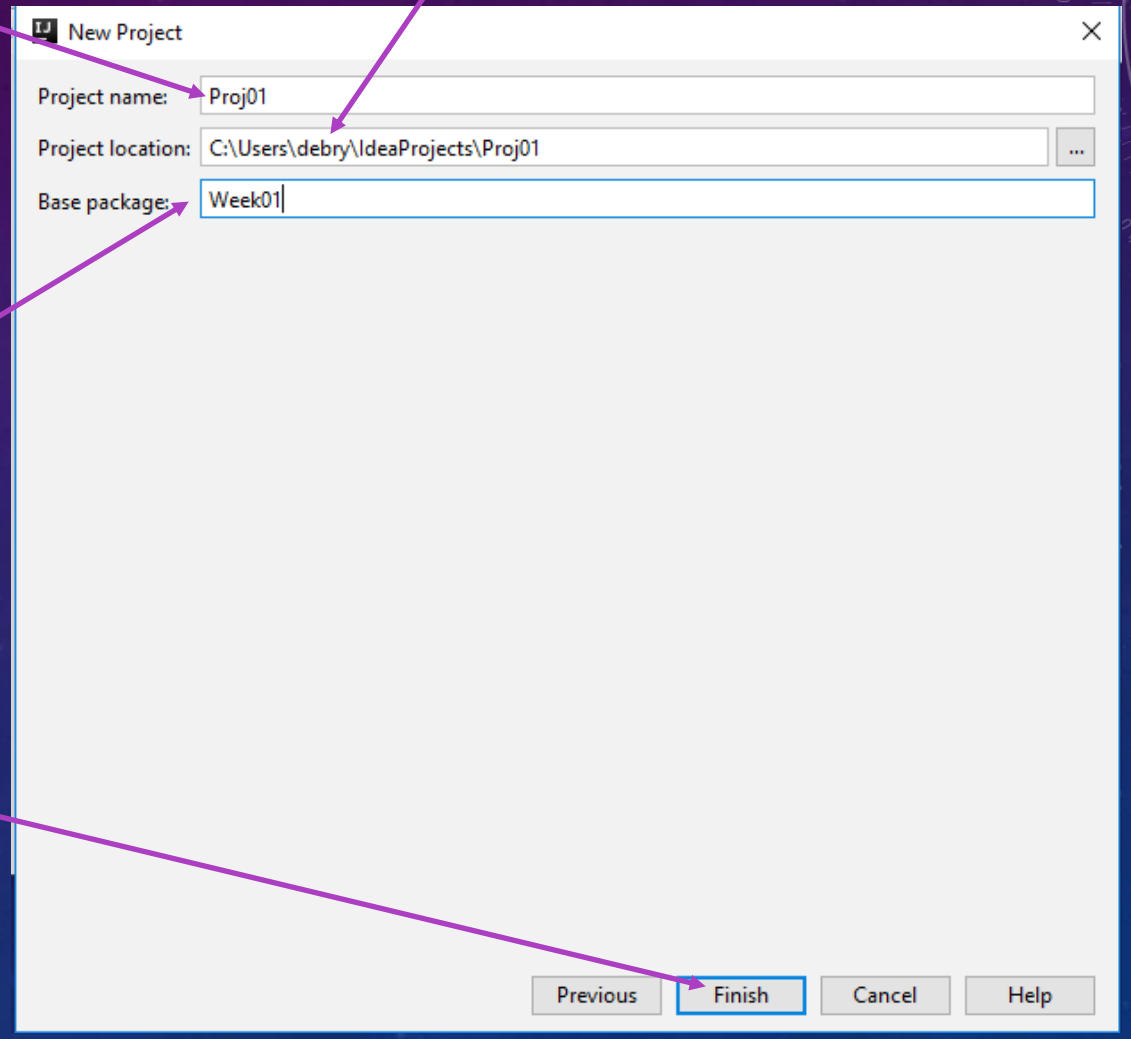
Pick Command Line App



Click on Next

Use the default location
or type a different location.

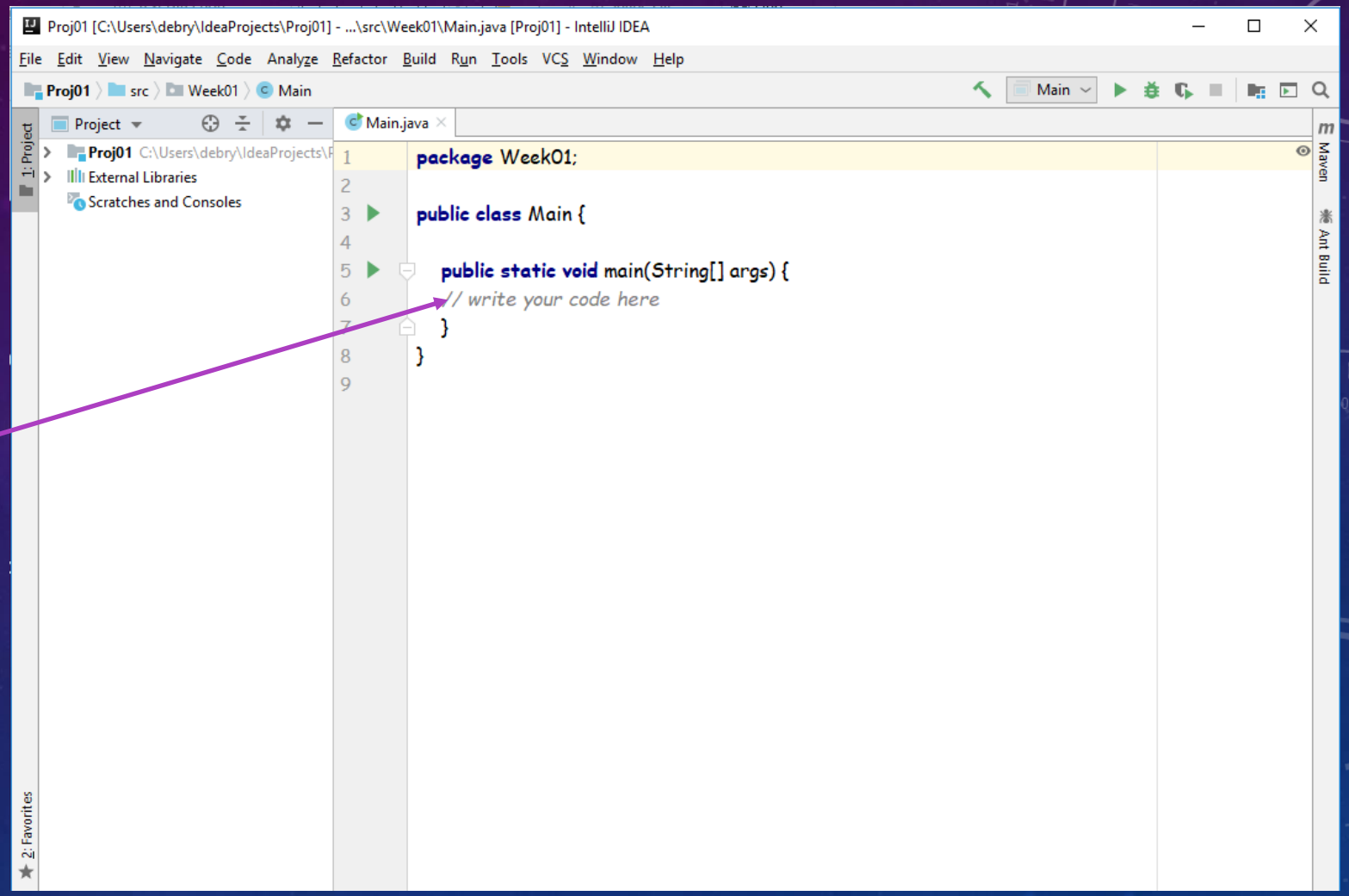
Type in a project name



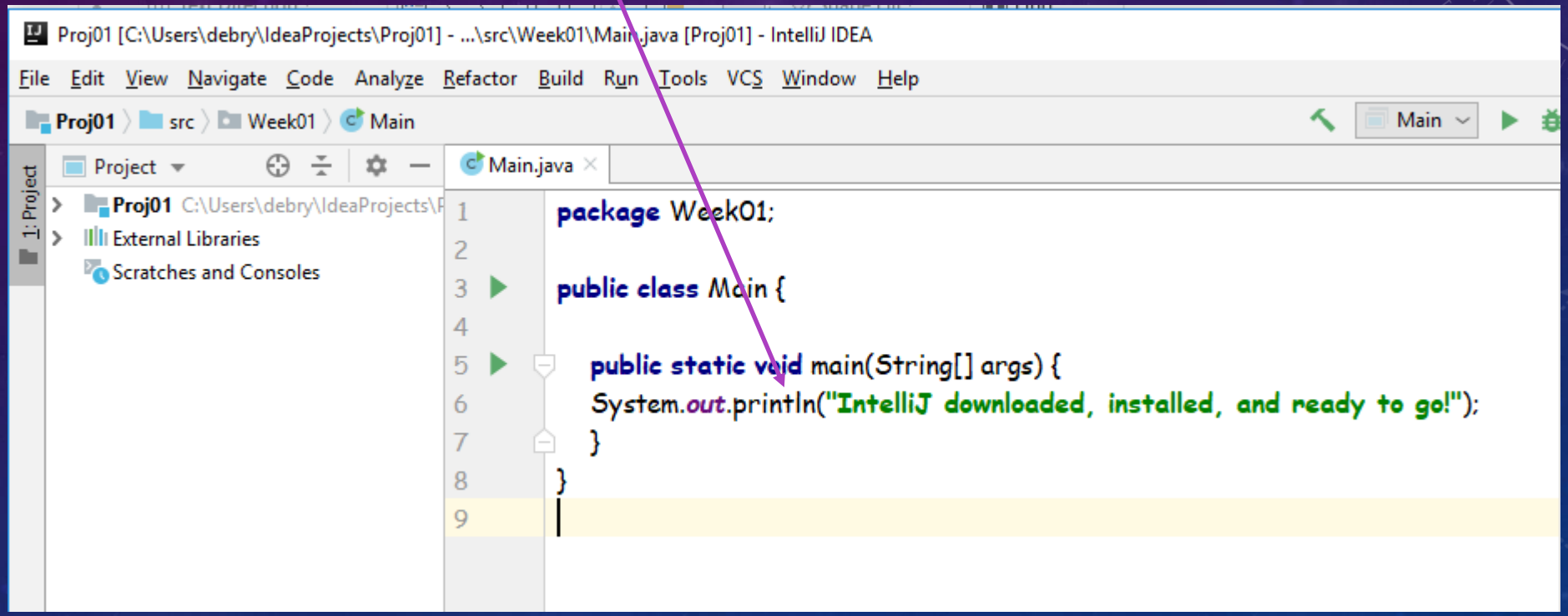
Type a package name

Click on
Finish

Add your code here



Add this line of code



Click on Run->Run Main on the menu bar or click on this green triangle to run your program.

The output of your program appears here

Proj01 [C:\Users\debry\IdeaProjects\Proj01] - ...\src\Week01\Main.java [Proj01] - IntelliJ IDEA

File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window Help

Proj01 > src > Week01 > Main

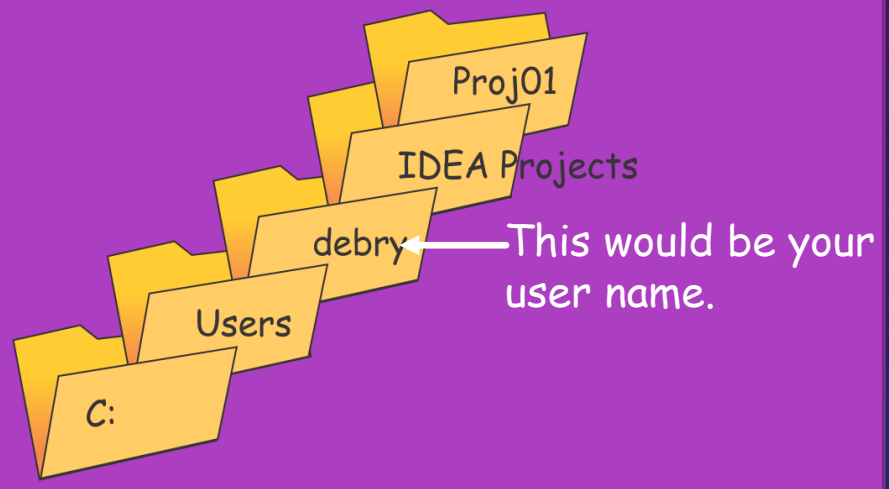
Main.java

```
package Week01;

public class Main {

    public static void main(String[] args) {
    System.out.println("IntelliJ downloaded, installed, and ready to go!");
    }
}
```

Run: Main

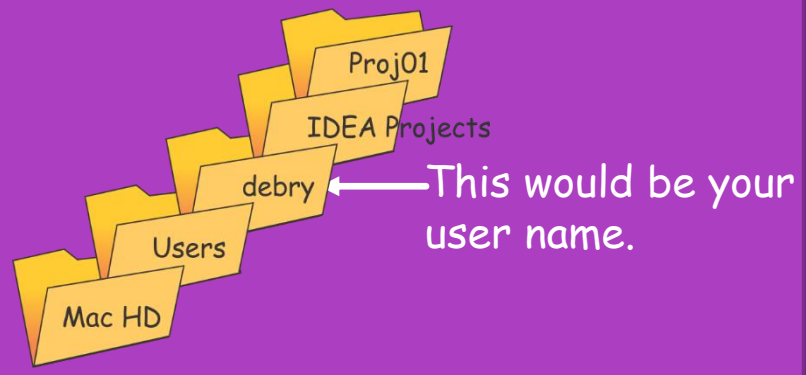
```
"C:\Program Files\Java\jdk-12.0.1\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Editi
IntelliJ downloaded, installed, and ready to go!

Process finished with exit code 0
```

Where are my files (Windows)?



If you use the default location for your files, your program will be in a folder with the project name, in a directory tree like this:

Where are my files (Mac)?



This would be your user name.

If you use the default location for your files, your program will be in a folder with the project name, in a directory tree like this:

Video presentation on running Intellij IDEA for the first time

https://youtu.be/c0efB_CKOYo

To Submit Your Program

(1) Create a zip folder
(2) Drag the entire project folder and drop it into the zip folder
    - If the assignment has two programs, you will have two project folders
(1) Submit the zip folder

Don’t wait until late in the week to download and install IntelliJ IDEA. You will need it to complete this week’s assignment. If you have problems downloading and installing IntelliJ IDEA, post a message on the discussion board for help.