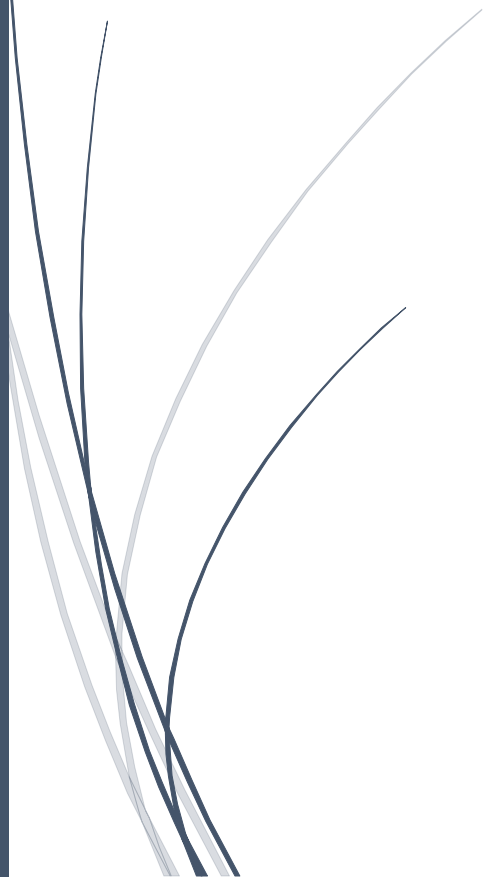
User's Manual

Boolean Expression Minimizer

Machine Problem 1



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BS COMPUTER SCIENCE

Introduction

What is Tabulation Method?

The ***Tabulation method***, also known as the ***Quine-McCluskey method***, is one way to minimize Boolean expressions, other than the Karnaugh map method. The method is particularly useful for minimizing functions with large number of variables, as doing the K-map method with more inputs make the grouping quite tedious, sometimes impossible. The Tabulation method and K-map method is functionally similar, but the Tabulation method is more efficient for use in computer algorithms. The method will be discussed further in the Technical Manual.

What is Boolean Expression Minimizer?

Boolean Expression Minimizer (BooM) is a console application that simplifies Boolean expressions using the algorithm of Tabulation Method. It is written in Java programming language.

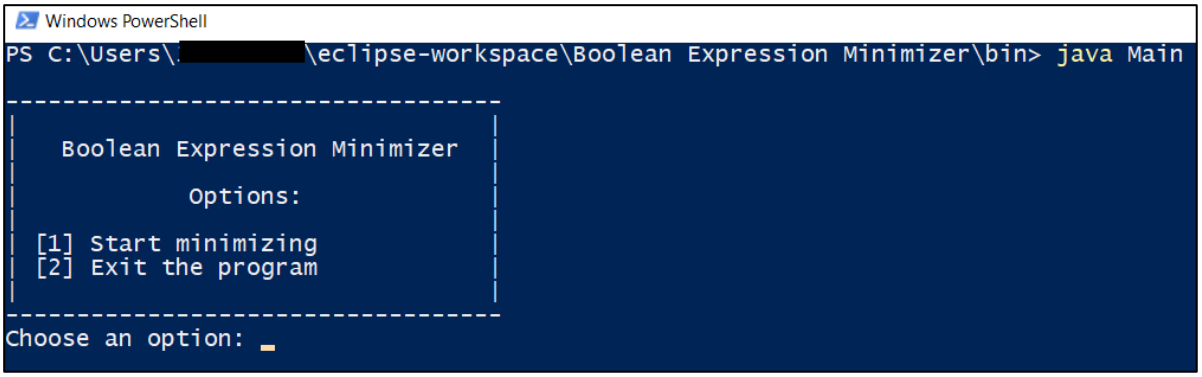


Figure 1 Boolean Expression Minimizer (BooM) being run in Windows PowerShell

Features:

Here are some of the features of the application.

1. Can support up to 26 variables.
2. Users can customize the variable assignment *(Note: Only Alphabetic Characters are allowed)*.
3. Users can add don't care conditions.

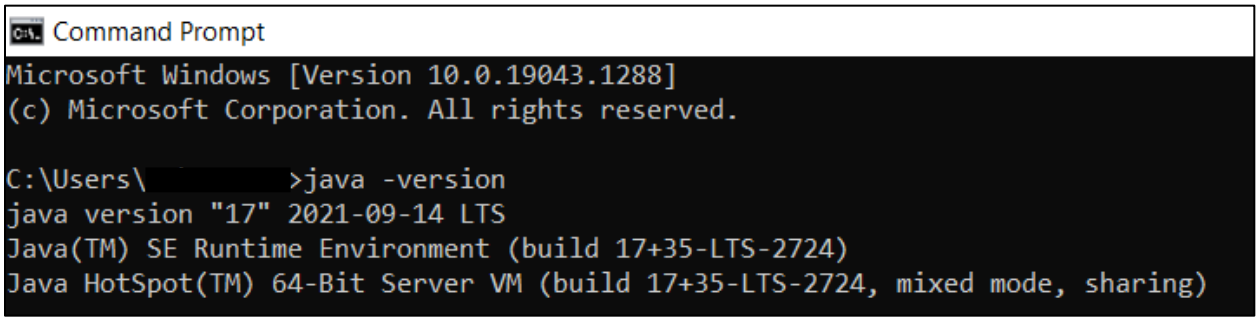
Getting Started

Requirements:

1. Java

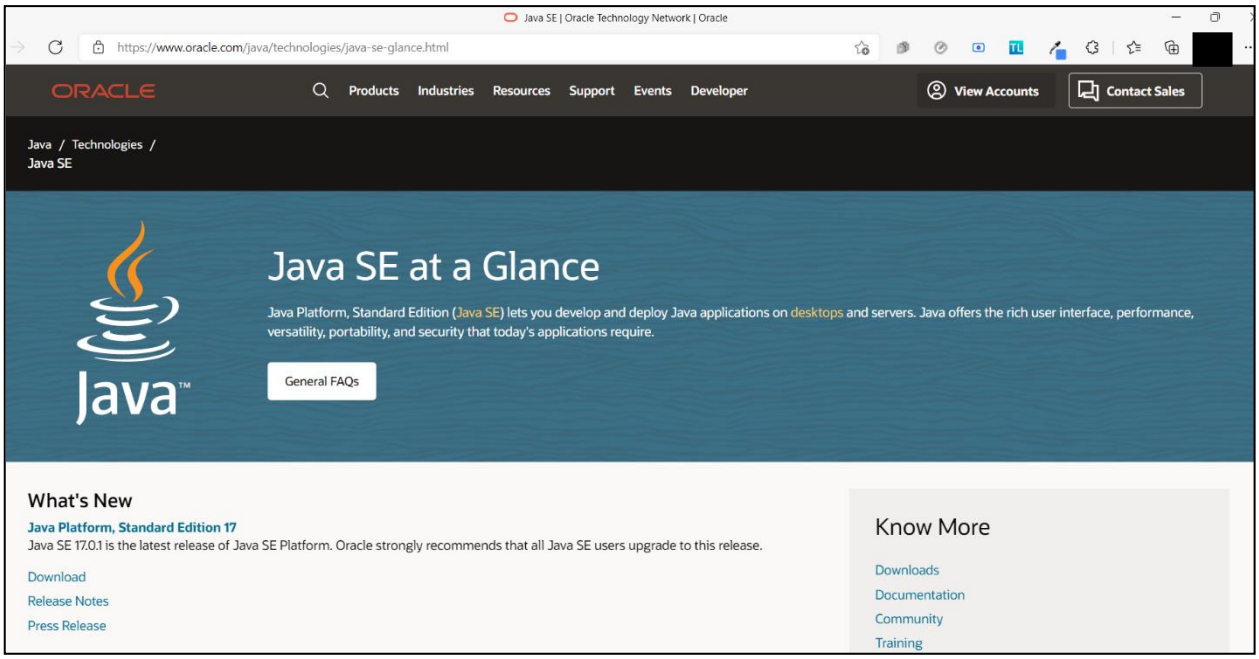
To run BooM, you need to have ***Java*** installed at your computer.

To check if it is installed, type 'java -version' in Command Prompt (for Windows).

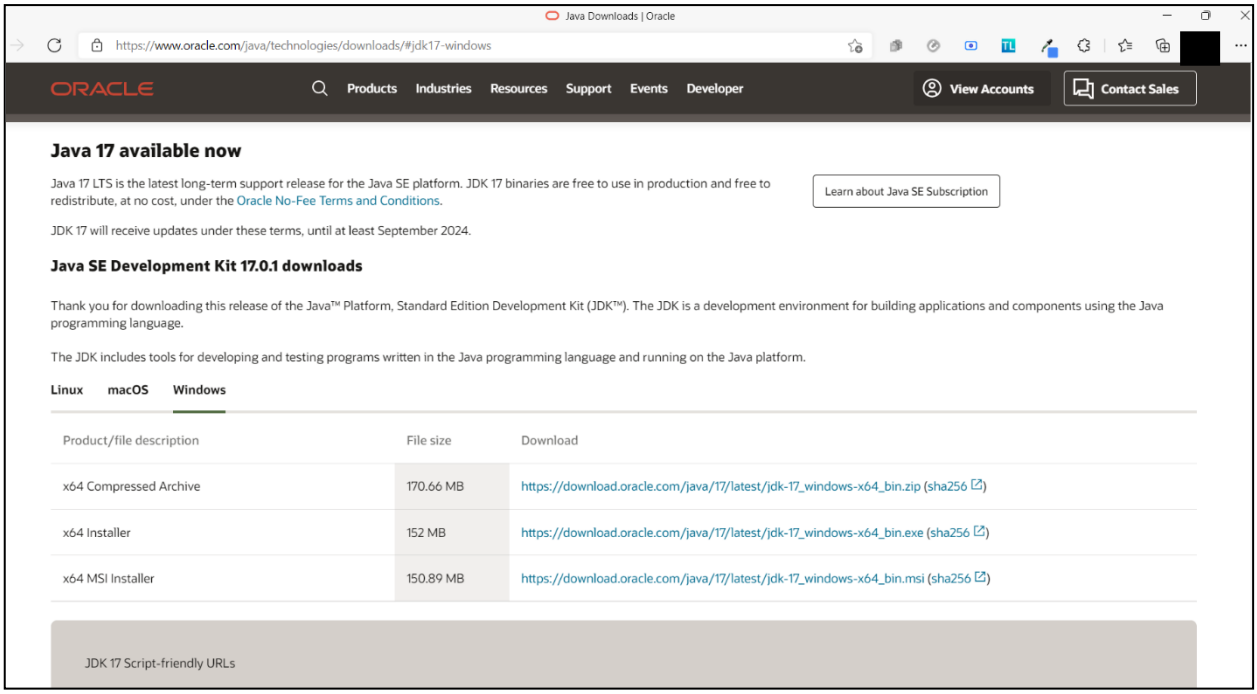


If it is already installed, you can skip to 'Optional'. If not, follow the steps below:

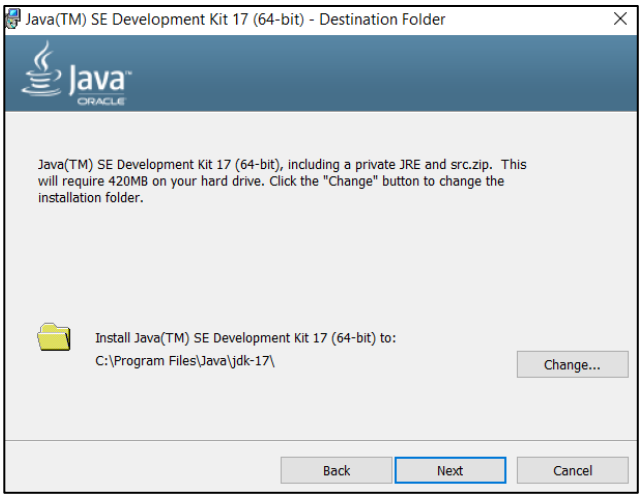
1. Go to https://www.oracle.com/java/technologies/java-se-glance.html



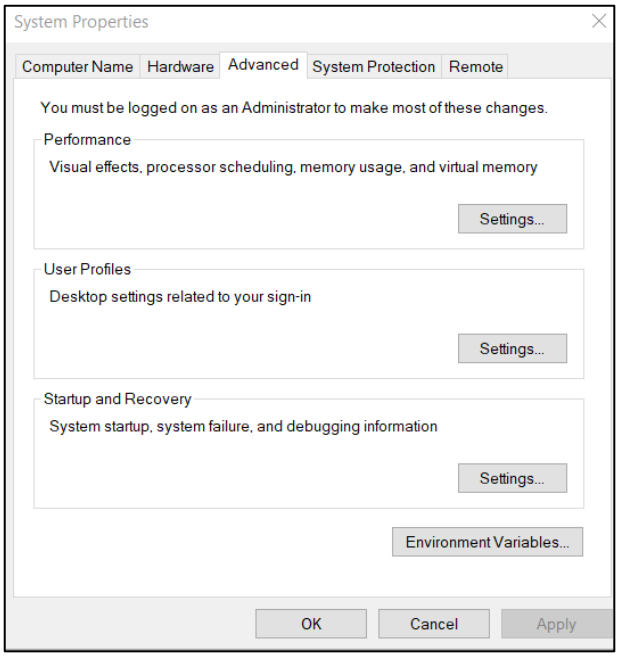
2. Click ‘Download’. You should be redirected to the download page.



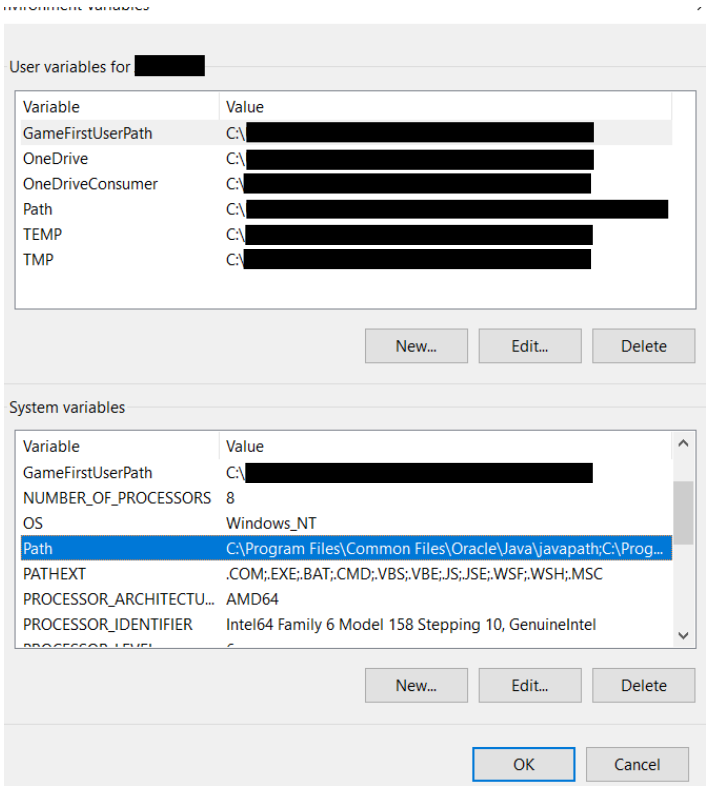
3. Select the OS and download the ‘x64 Installer’ (in Windows) by clicking the link.
4. After downloading the installer, install the ‘jdk-17_windows-x64_bin’.
5. Follow the instructions in the installer.



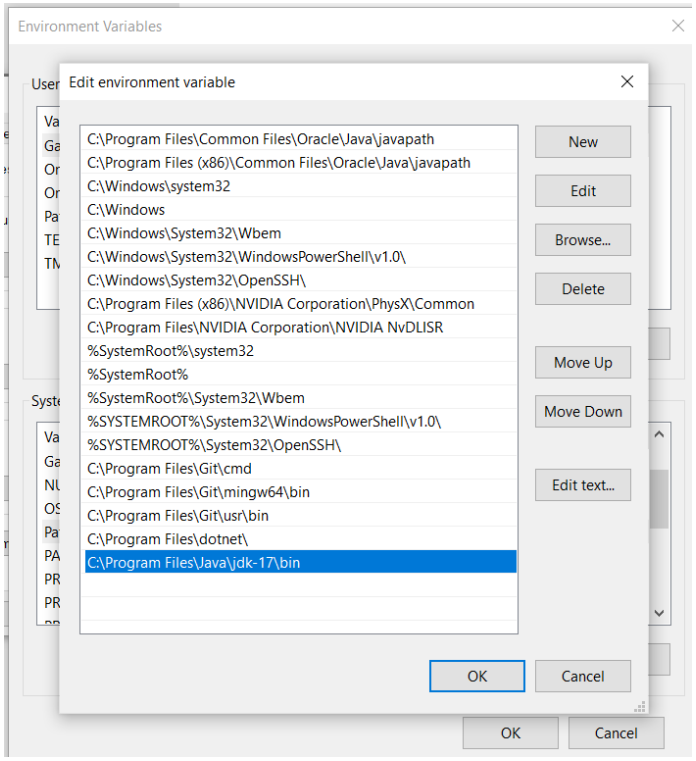
6. After installing, go to 'System Properties' (Can be found on Control Panel > System and Security > System > Advanced System Settings).



7. Click ‘Environment Variables’.



8. Click ‘Path’ under ‘System Variables’ (the highlighted one). Then, click ‘Edit’.



9. Click ‘New’. Then enter ‘C:\Program Files\Java\jdk-17\bin’ (the directory of the installation of Java with ‘\bin’).
10. Press ‘OK’.

Note: To check if the installation is successful, go to Command Prompt and enter ‘java -version’ to check if it is installed. Refer to the first picture in ‘Getting Started’.

Optional: Java IDE

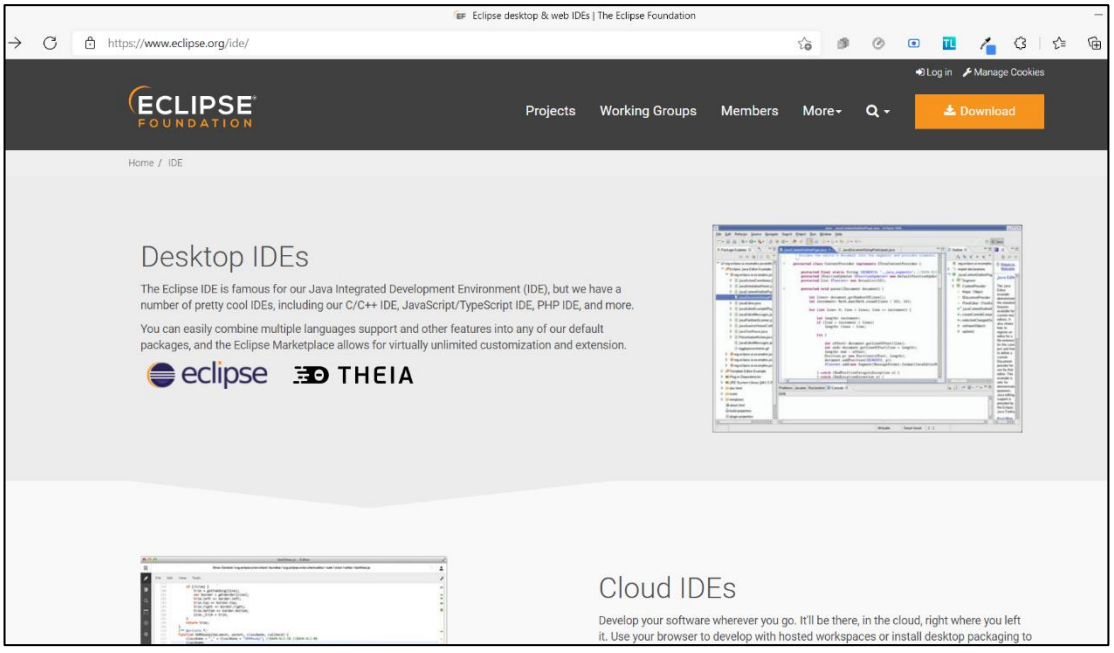
It is not really required to install an IDE to run the program. You can run the program using Command Prompt or Windows PowerShell and edit the code using Notepad. But this is not advisable, especially the latter, because it is easy to miss errors in editing when using Notepad. Because of this, it is advisable to download an IDE.

For suggested Java IDE to use, **Eclipse** is recommended, as it is also the IDE that is used to program the application.

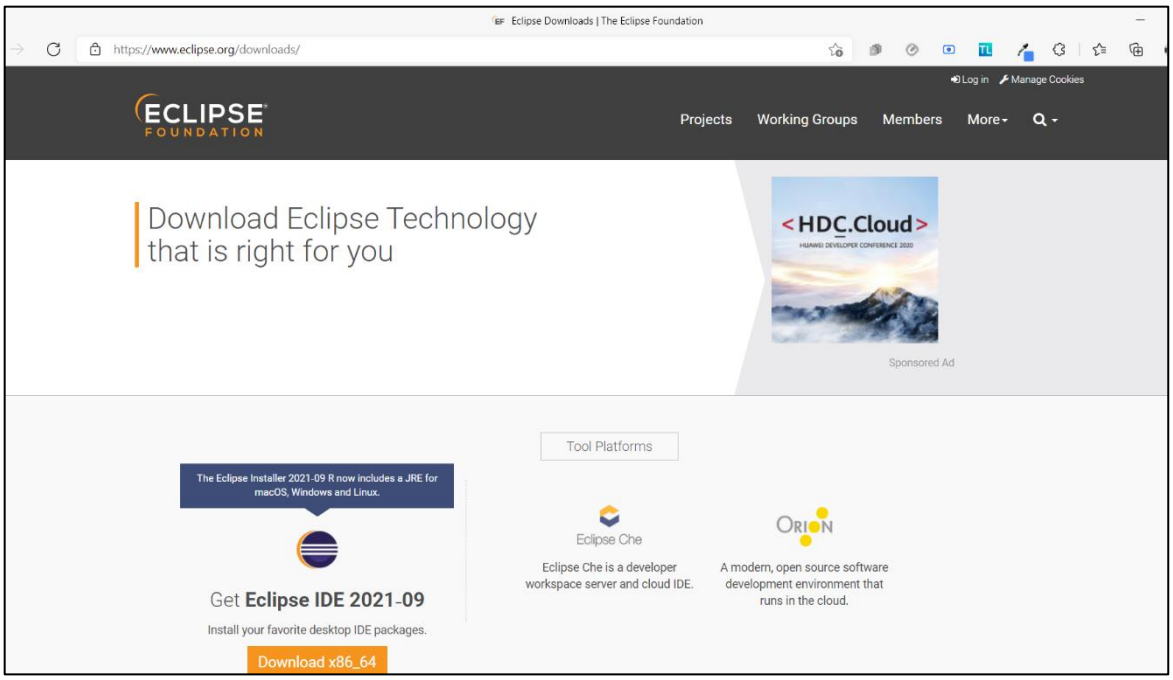
If you want to install Eclipse, follow the steps below. Else, proceed on the ‘Running the Program’ part of this guide.

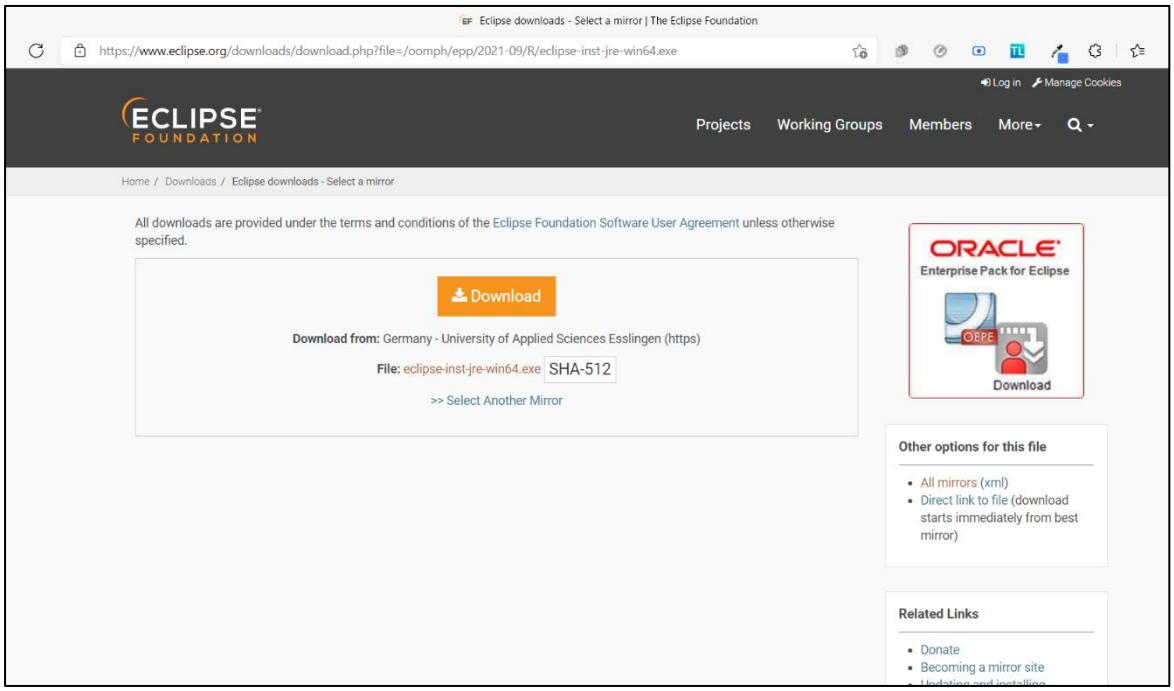
Installing Eclipse IDE

1. Go to https://www.eclipse.org/ide/

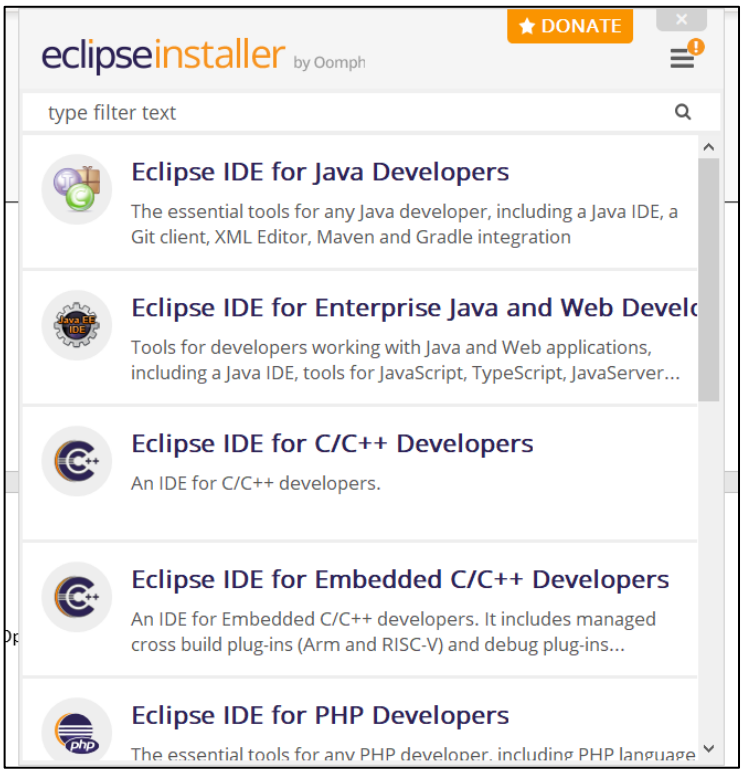


2. Click ‘Download’. This will redirect you to another site. Then, click ‘Download x86_64’. After that, click ‘Download’.





3. Open ‘eclipse-inst-jre-win64.exe’



4. Click ‘Eclipse IDE for Java Developers’. Then, click ‘Install’. After that, you are done.

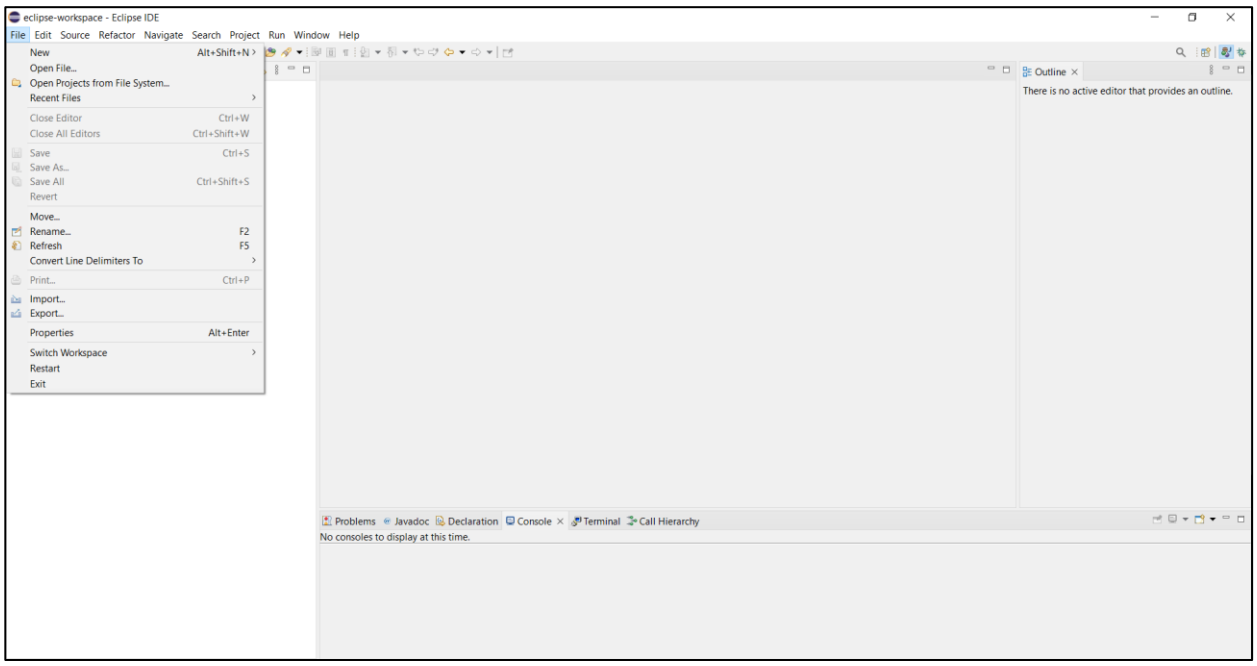
Running the Program

There are three ways to run BooM (assuming that the user is using Windows as OS): by running it in the IDE (Eclipse), by using the Windows PowerShell, or by using the Command Prompt. This section of the guide will discuss these three ways.

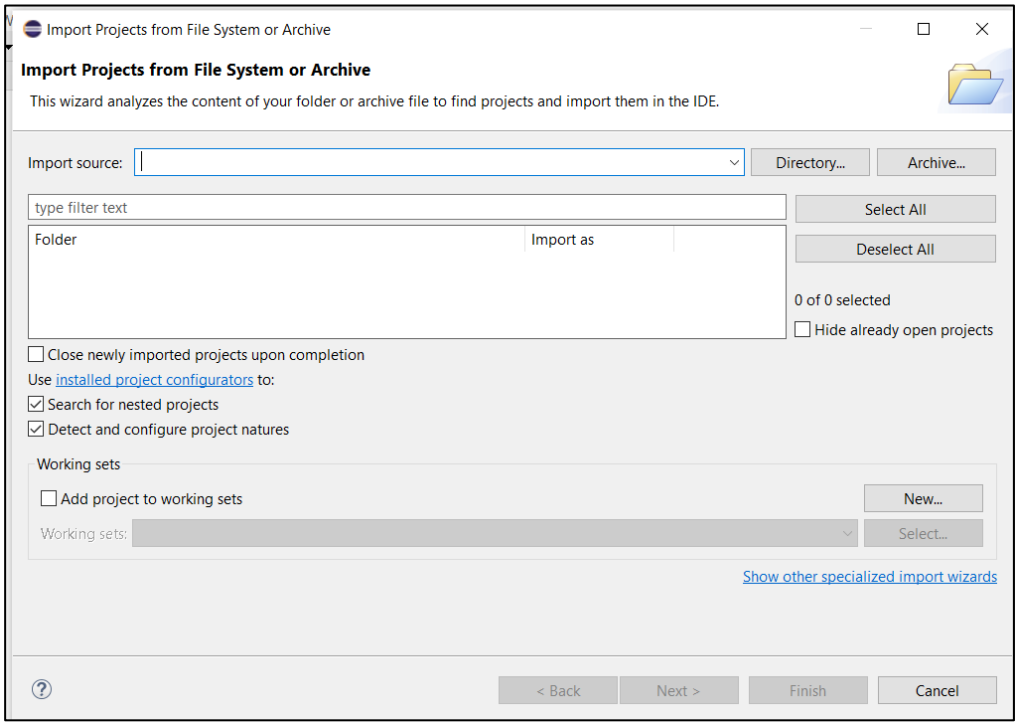
Running BooM in the IDE (Eclipse)

You can run the program in the IDE by following these steps:

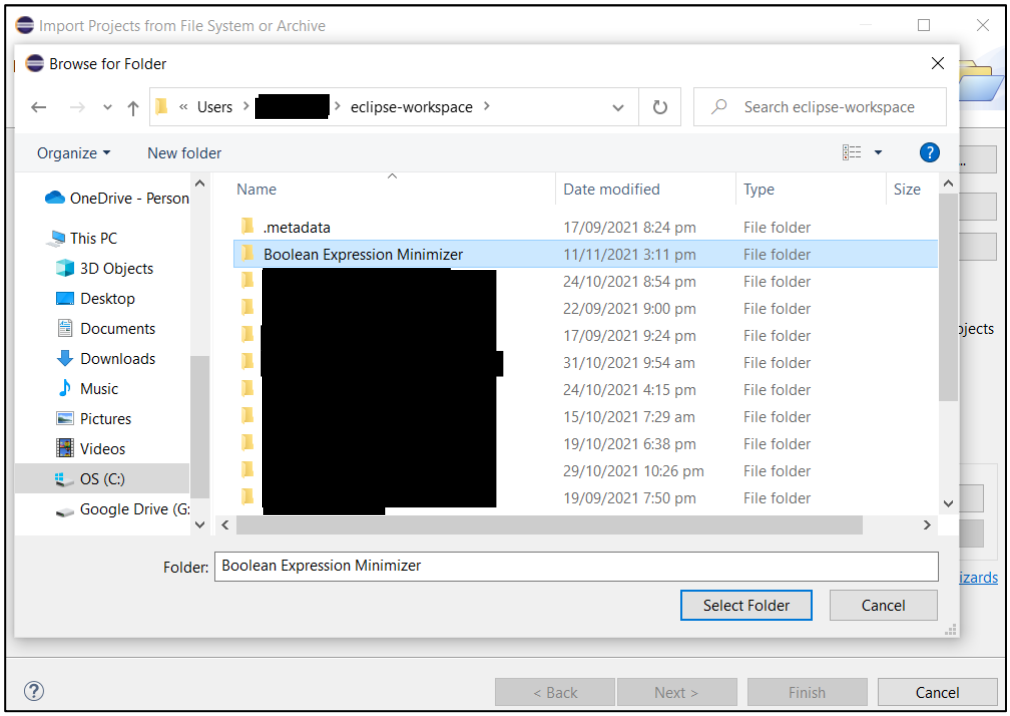
1. Open Eclipse IDE.
2. Click ‘File’



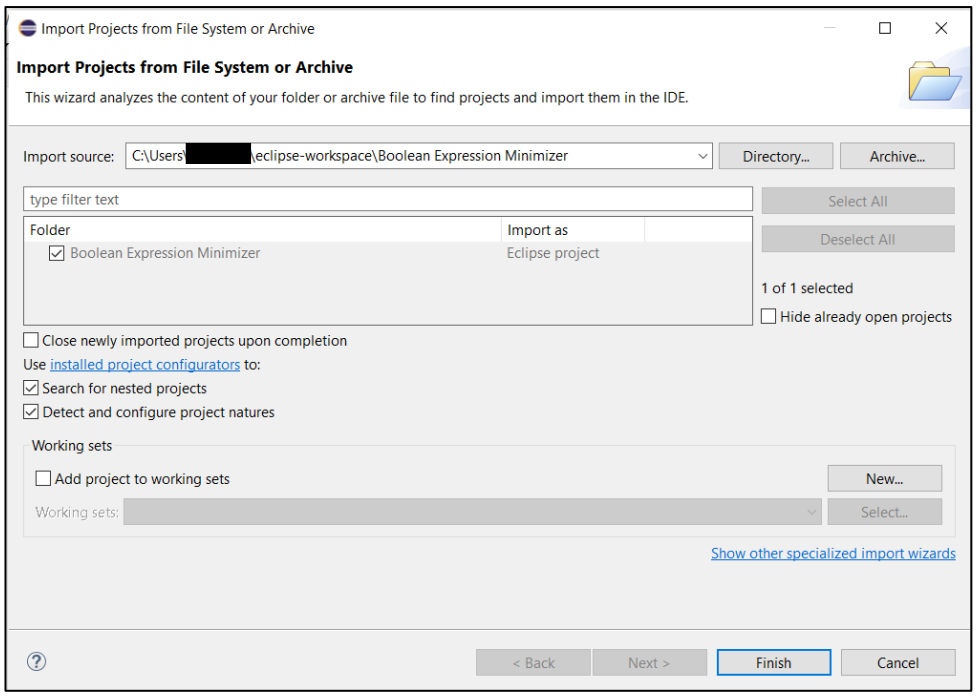
3. Click ‘Open Projects from File System’.



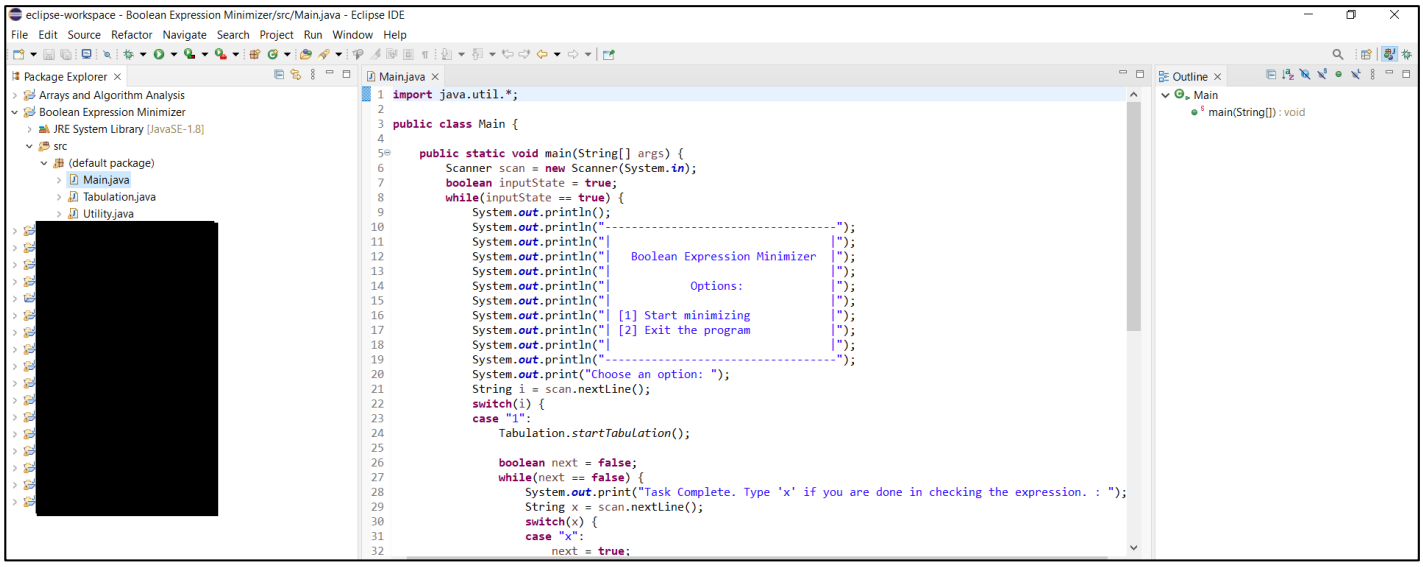
4. Click ‘Directory’ and find the folder ‘Boolean Expression Minimizer’ and select that folder.



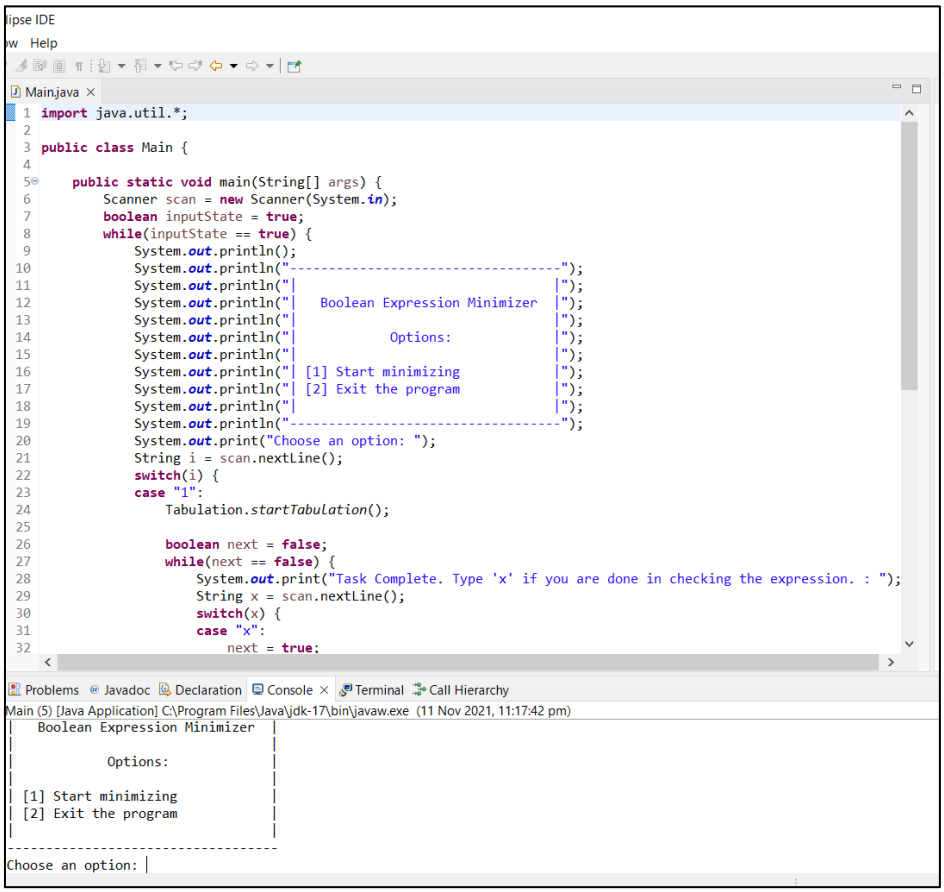
5. Click ‘Finish’



6. The folder should be visible now on the ‘Package Explorer’. Now, click the following: Boolean Expression Minimizer > src > (default package) > Main.java.



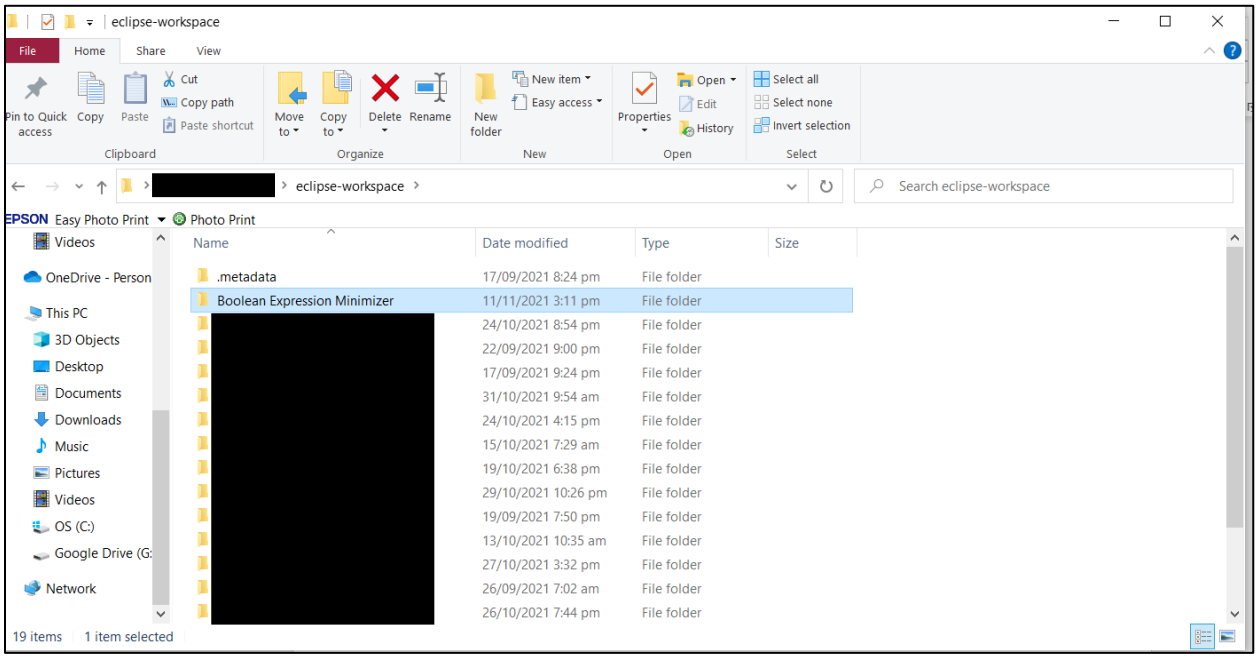
7. Click ‘Run’ > ‘Run’. Alternatively, you can click ‘CTRL + F11’ to run the program. The program will be accessible through the console below.



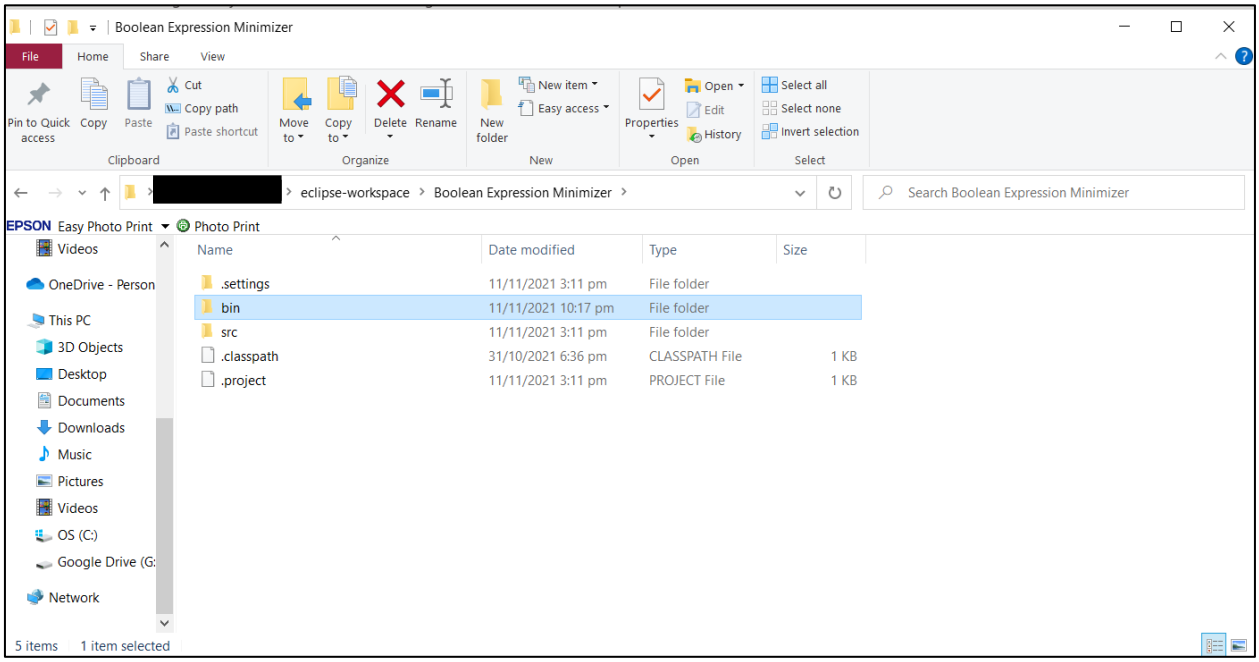
Alternative: Running BooM on Windows PowerShell

In case that you did not install Eclipse (or any other IDE), you can still run BooM using Windows PowerShell. Follow these steps to run BooM on Windows PowerShell:

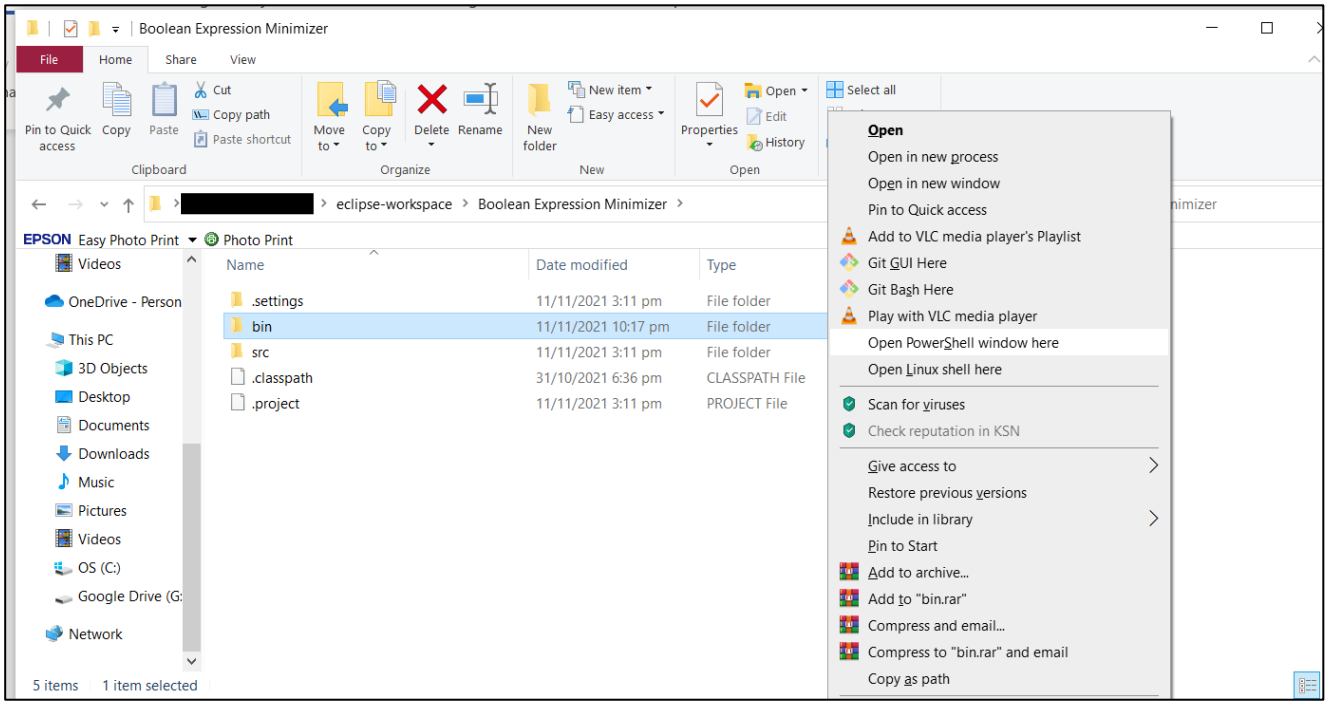
1. Open ‘Boolean Expression Minimizer’ folder.



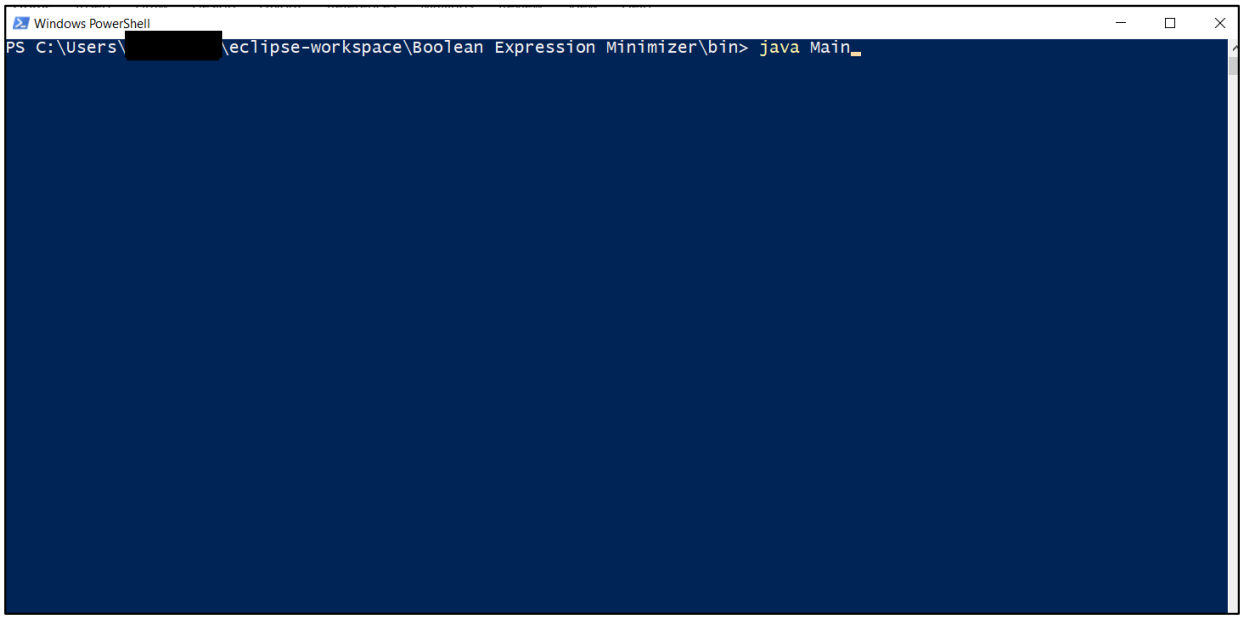
2. After opening the said folder, press ‘SHIFT + RIGHT MOUSE CLICK’ on ‘bin’ folder.



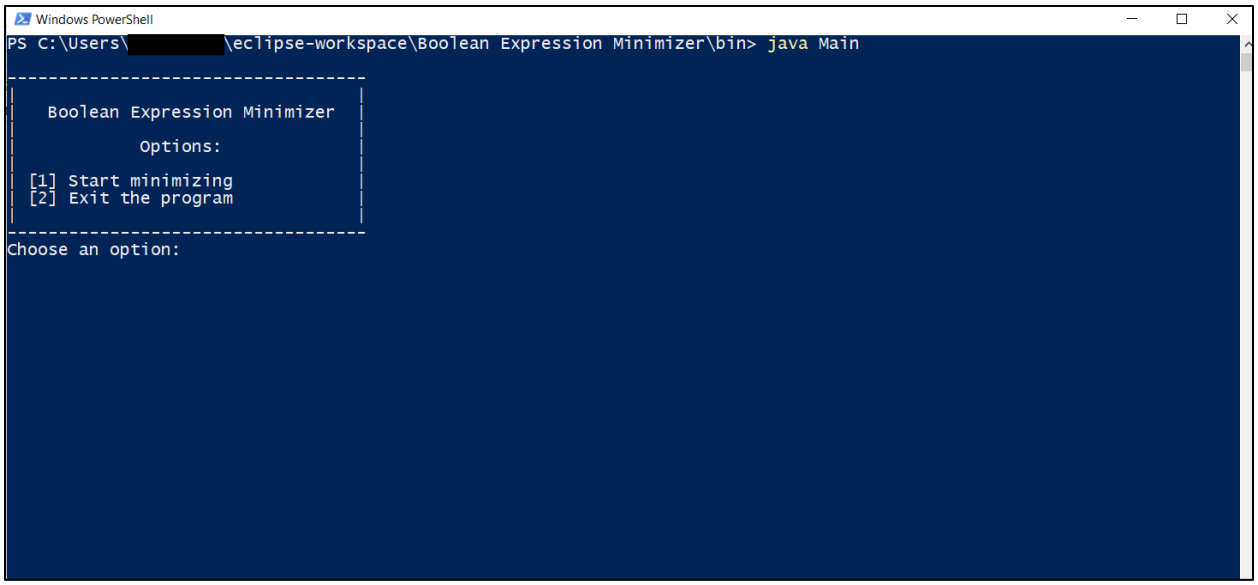
3. Click ‘Open PowerShell window here.



4. Once PowerShell is open, enter ‘java Main’, then press enter.



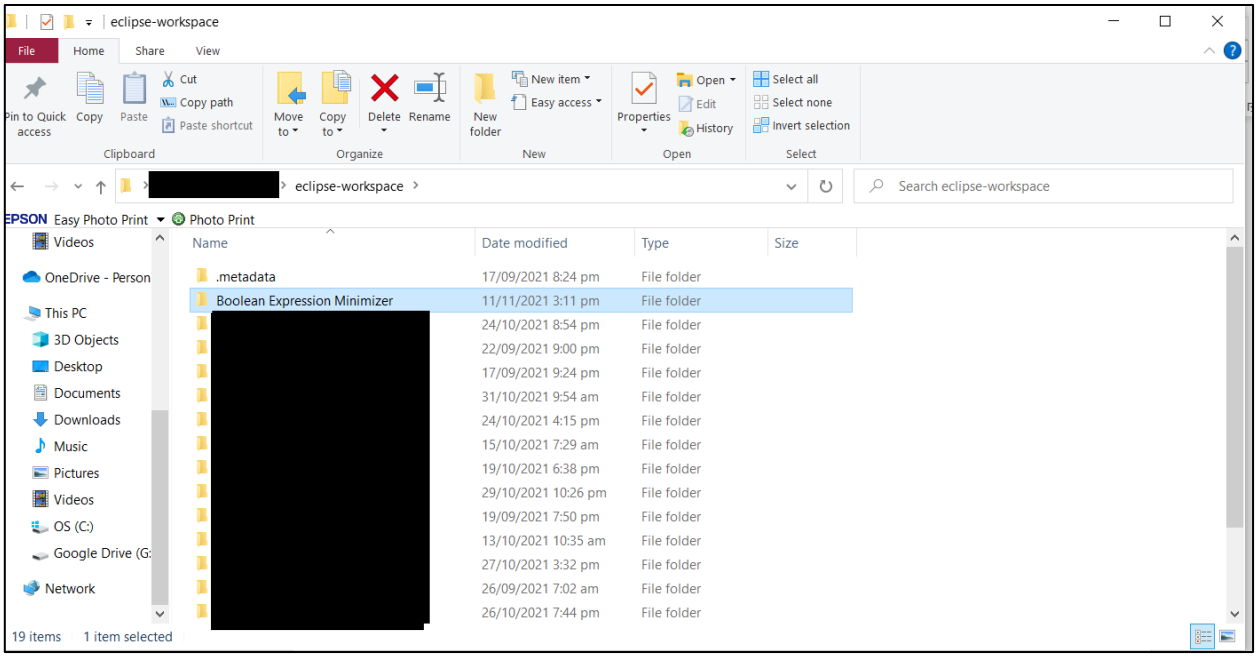
5. You should be able to use the program now.



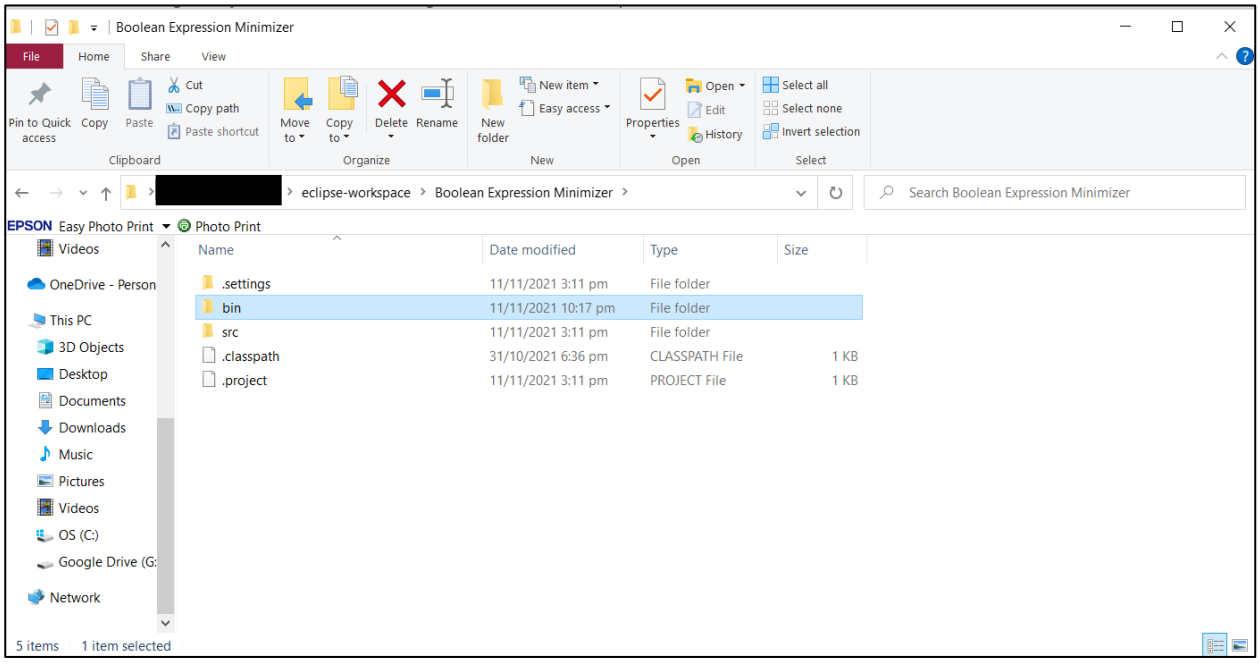
Alternative: Running BooM in Command Prompt

As an alternative, if you do not have Eclipse IDE or Windows PowerShell, you can use Command Prompt to run the program. Follow these steps for you to run BooM using Command Prompt:

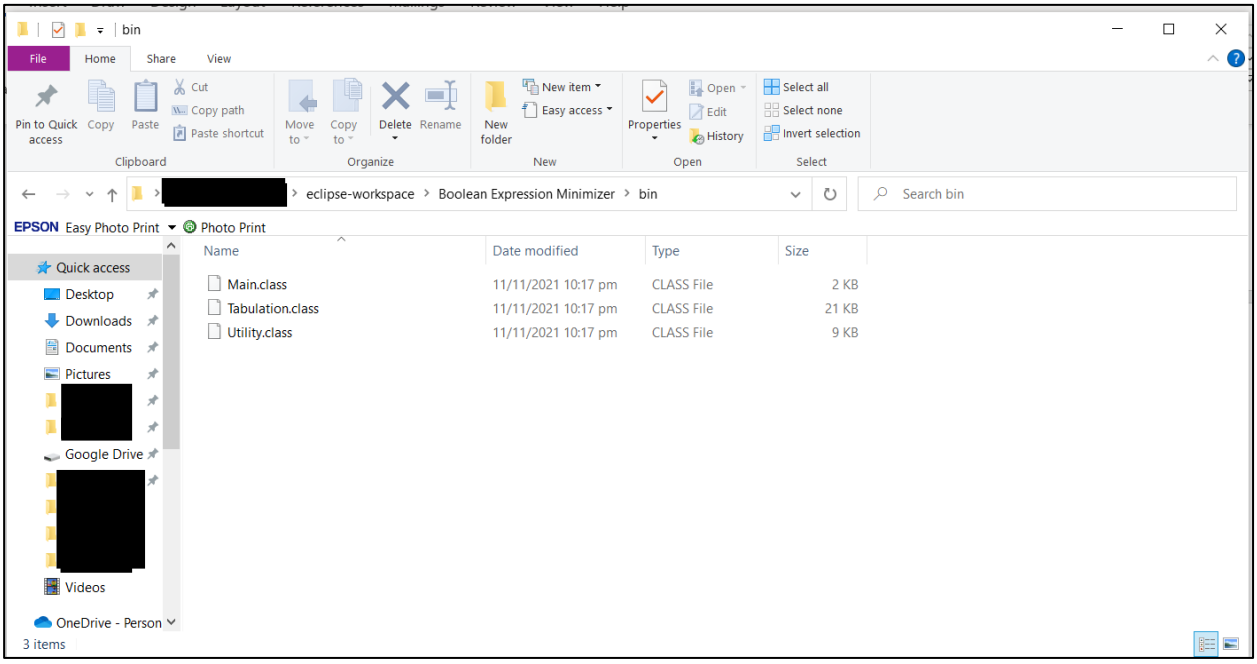
1. Open ‘Boolean Expression Minimizer’ folder.

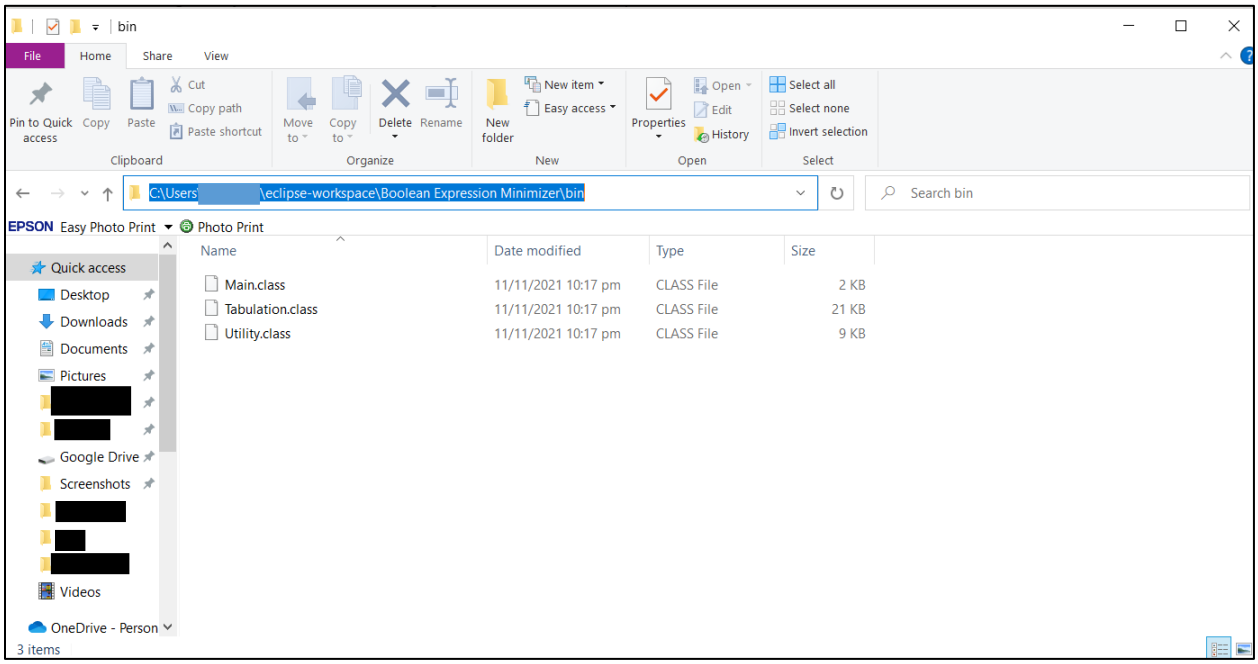


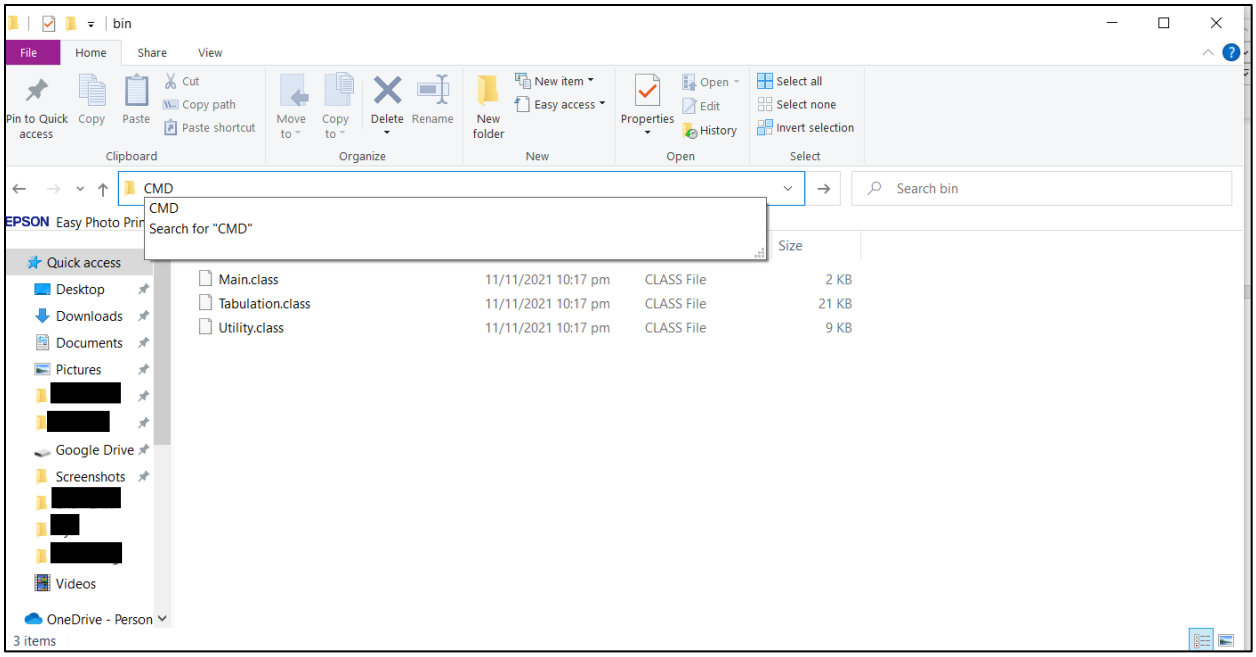
2. Open ‘bin’ folder.



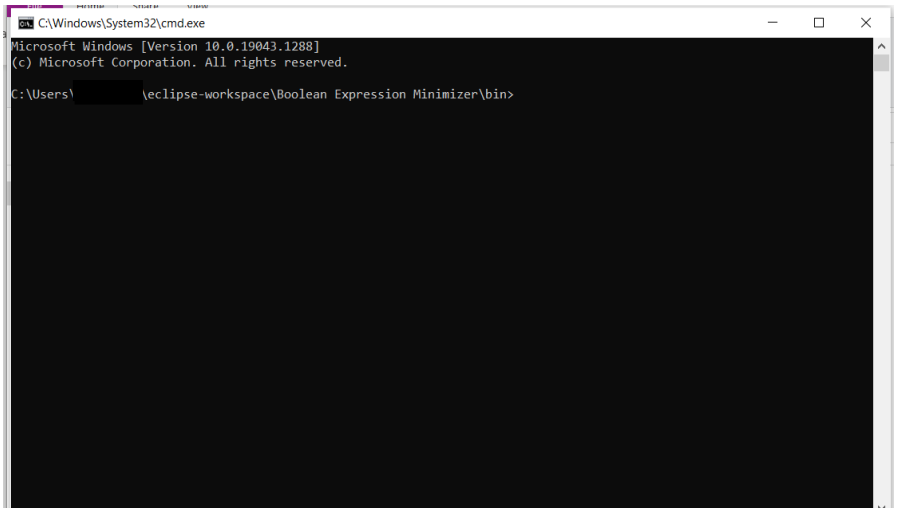
3. After opening the folder, change the address line into ‘CMD’. The press ‘ENTER’.

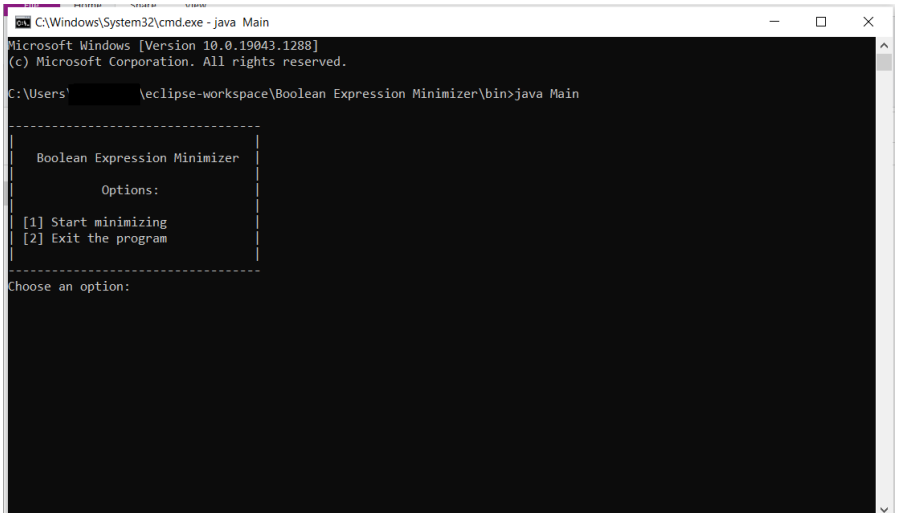






4. After that, Command Prompt will pop up. Then, enter ‘java Main’ and press ‘ENTER”. You should be able to use the program now.





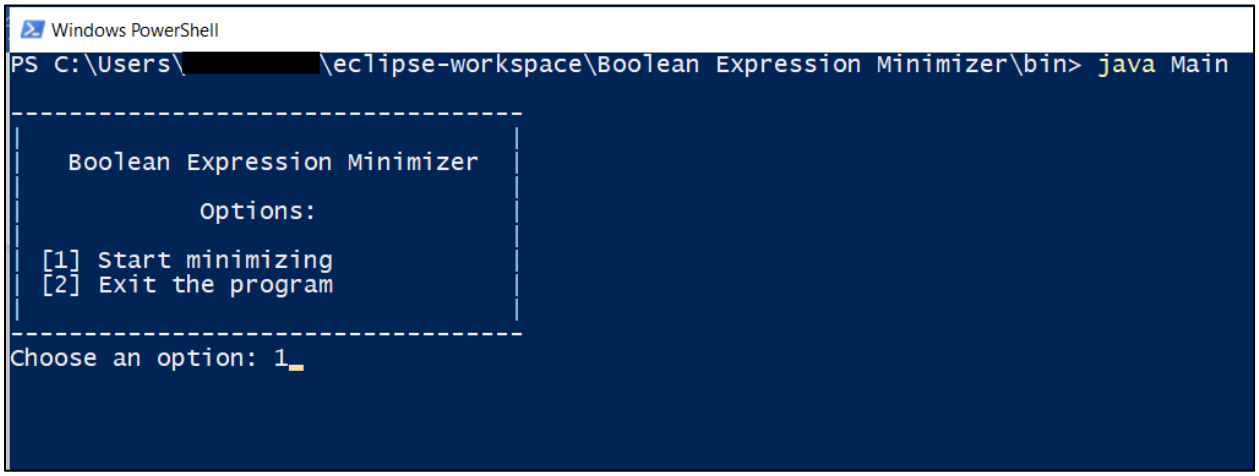
How to Use BooM

After knowing the different ways to run BooM, you can now use the program. This part of the guide will teach you how.

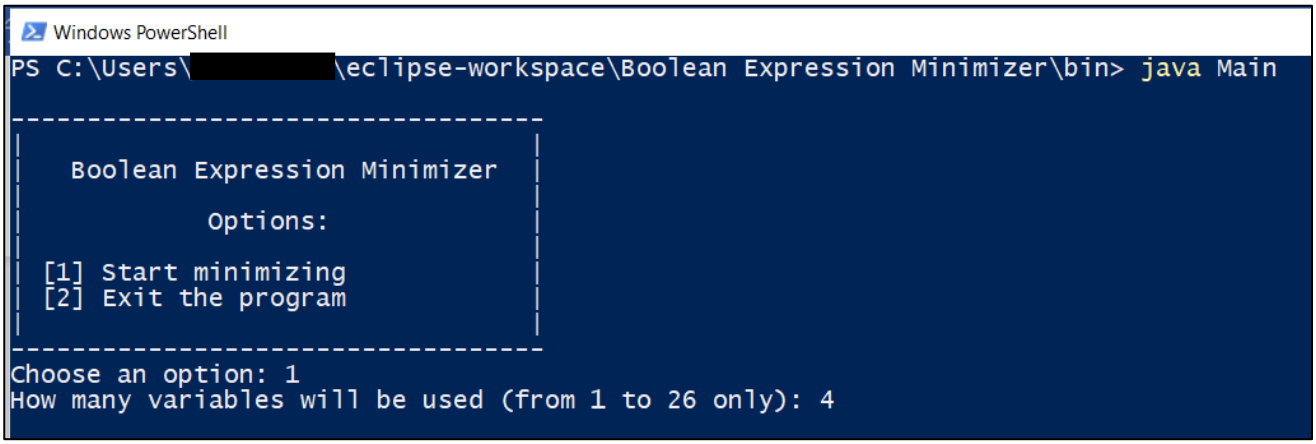
Steps:

Note: The steps here is applicable to all methods of running BooM. The pictures below will only show the application being run in Windows PowerShell.

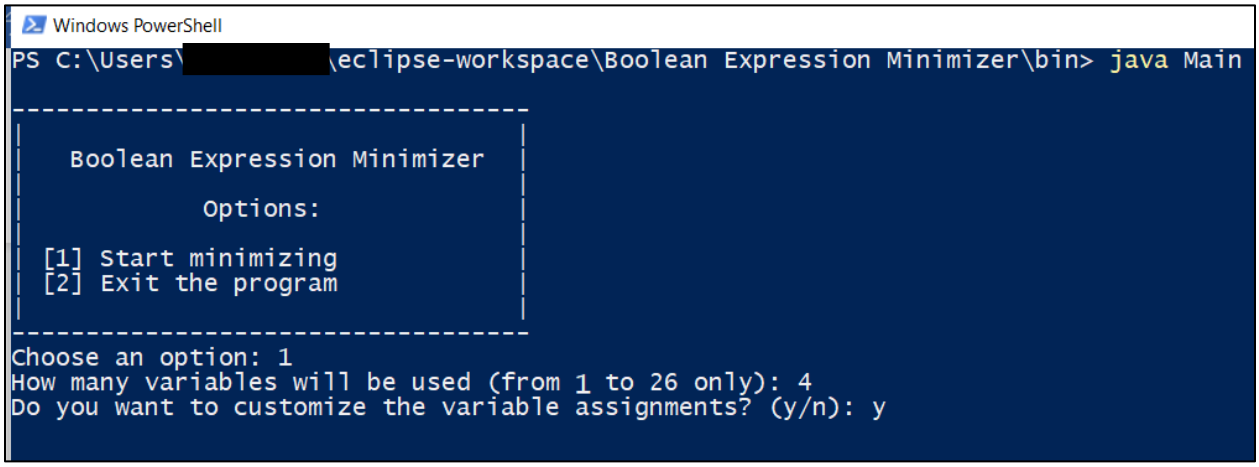
1. Select Option '1' by typing '1', then press 'ENTER'.



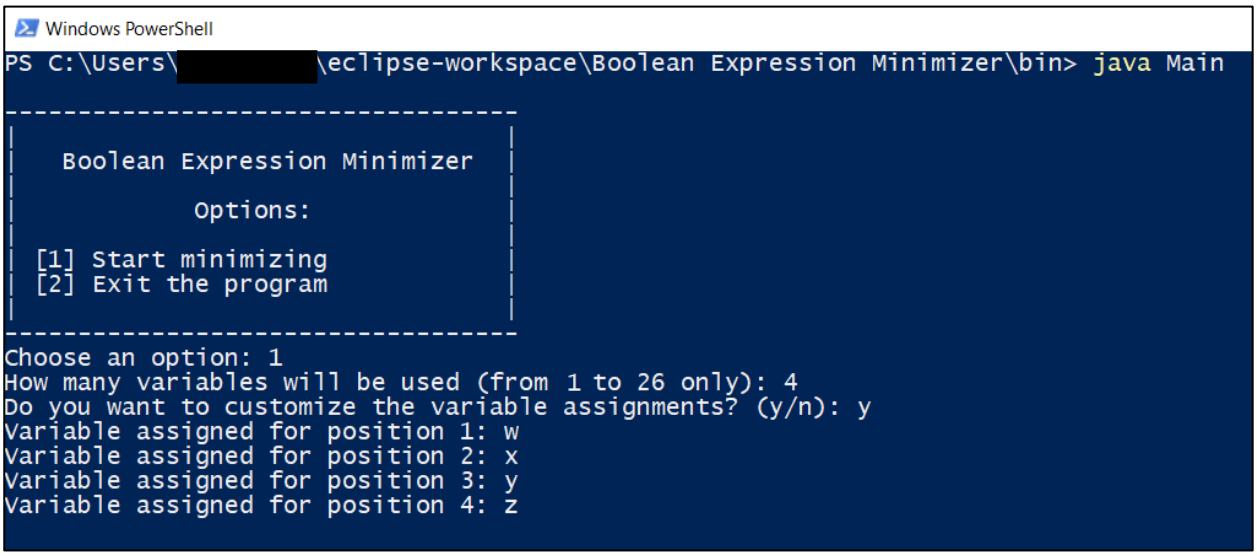
2. Enter the number of variables, then press 'ENTER'. Note: The application supports up to 26 variables only. In the example, '4' is set as number of variables.



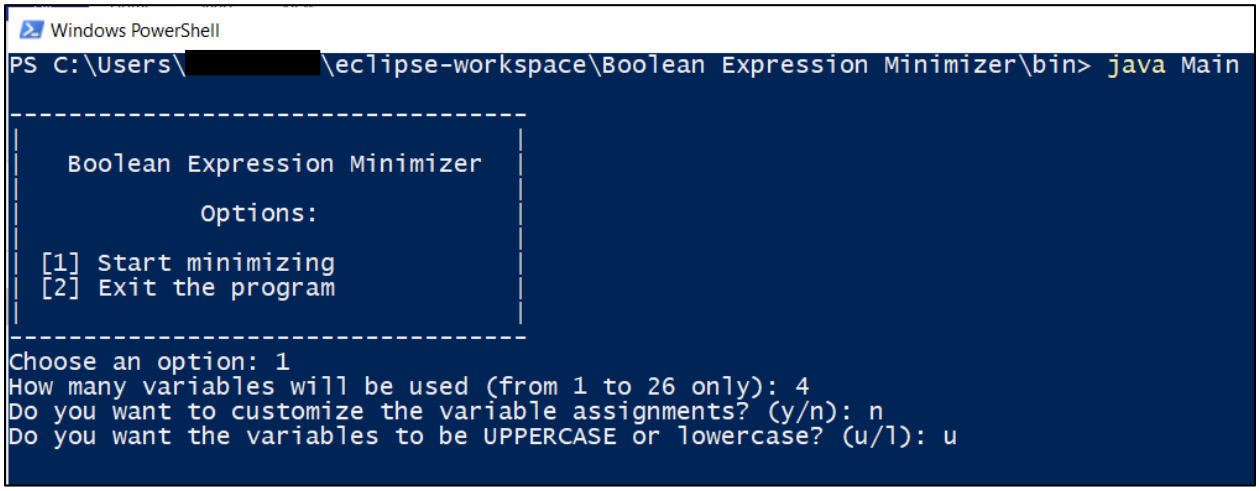
3. The user will be asked if the user wants to customize the variable assignment. Type ‘y’ if you want to customize, otherwise type ‘n’, then press ‘ENTER’. In this example, ‘y’ is entered.



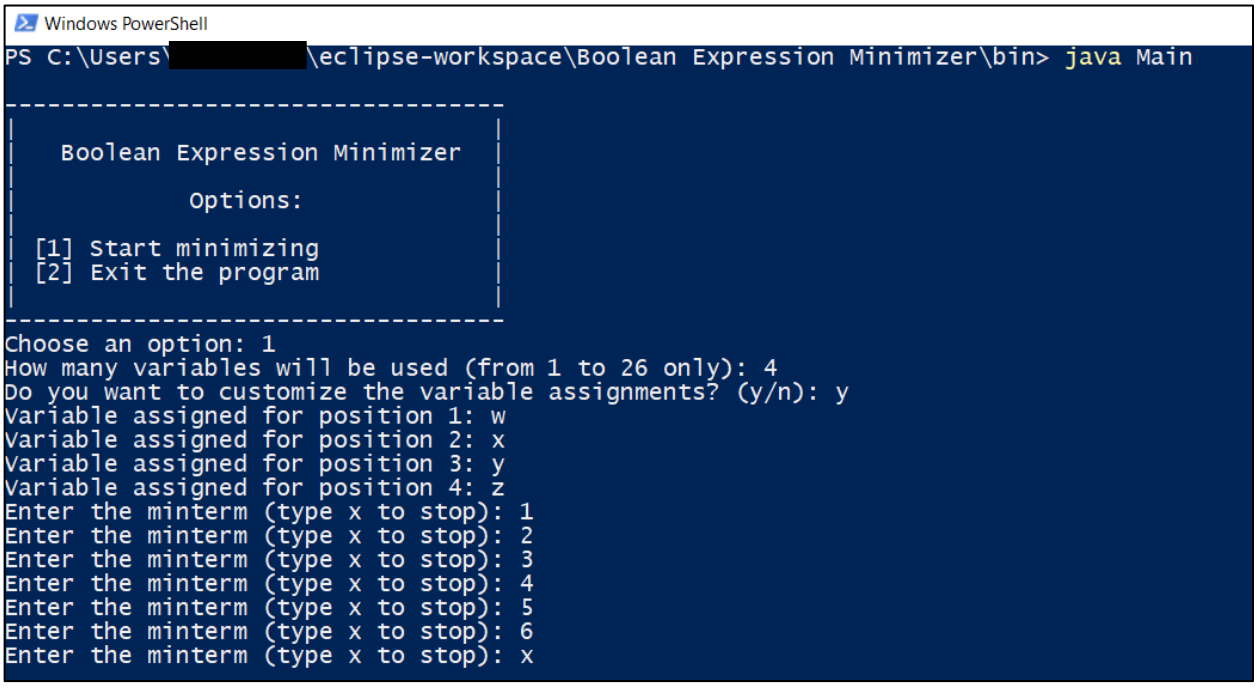
4.1. If you entered ‘y’, you will be asked to enter variable assignment from left to right. Enter the variable assignment (should be one letter), then press ‘ENTER’ to assign.



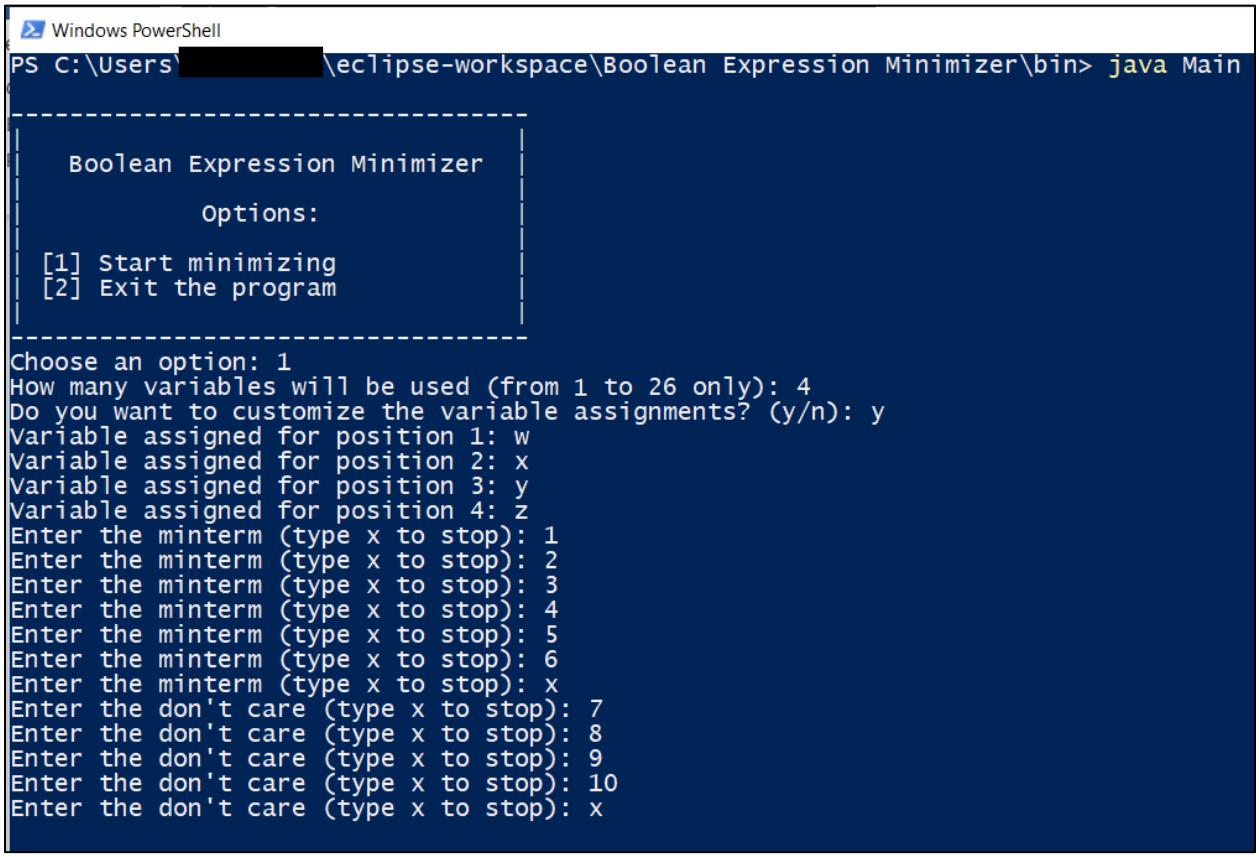
4.2. If you entered ‘n’, you will be asked if the default variables will be in uppercase or lowercase. Enter ‘u’ if you want the variables to be in uppercase, otherwise enter ‘l’ (lowercase L).



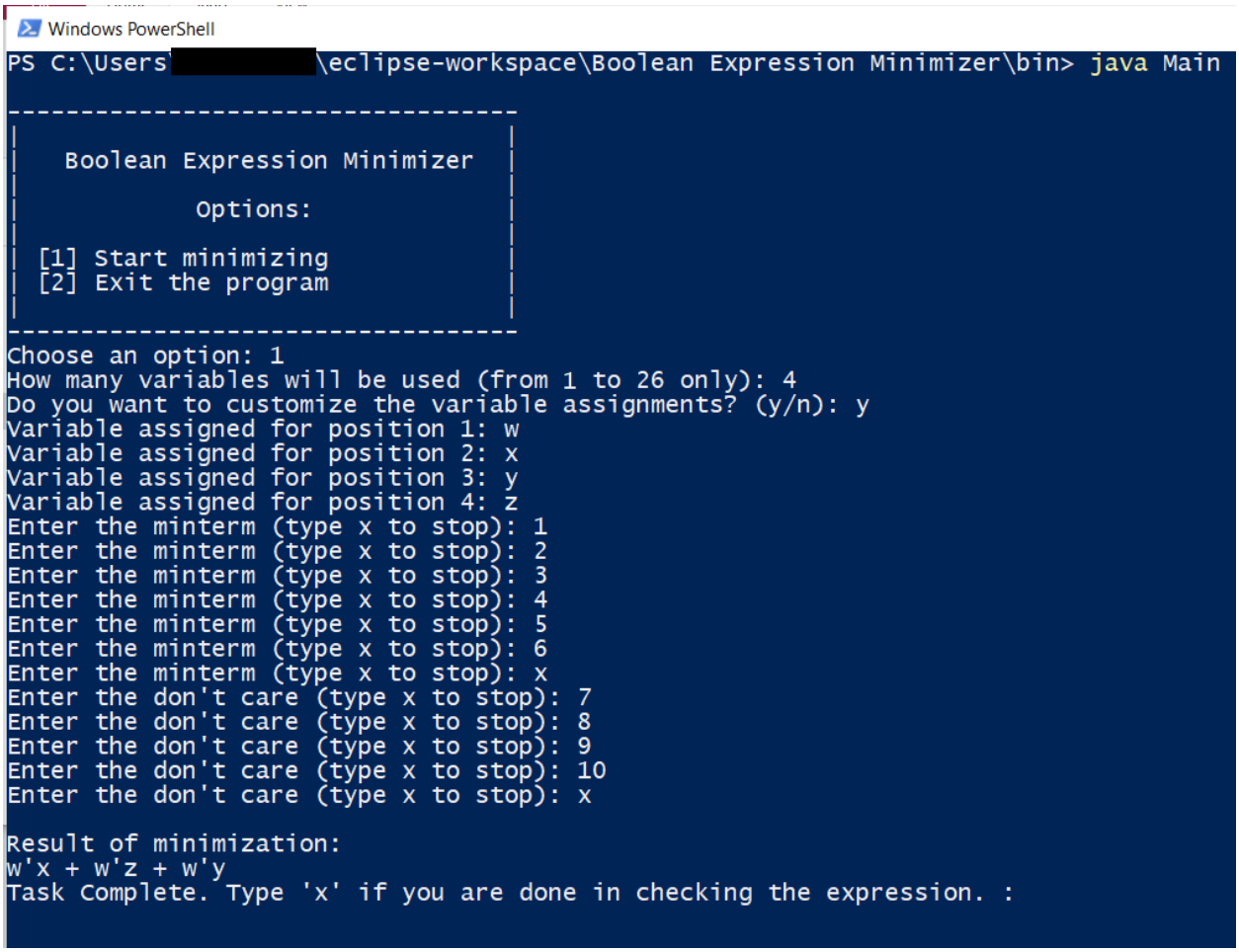
5. Regardless of your previous choices in step 4, the next step is entering the minterms. Enter the minterm, then press ‘ENTER’, and then repeat for the next minterm. If you are done entering the minterms, type ‘x’ to proceed to the next step.



6. After entering the minterms, you can also indicate the don't cares. To do that, enter the don't cares, then press 'ENTER'. Repeat this until you have entered all the don't cares and enter 'x' then press 'ENTER' to proceed. In the case that you do not need to assign don't care conditions, just enter 'x' then press 'ENTER' to proceed.



7. The result of minimization will show up. To go back to the options after seeing the result, enter ‘x’ then press ‘ENTER’.



8. The options will show up again. If you want to minimize another expression, just repeat from step 1. Else, enter ‘2’ and press ‘ENTER’ to exit.

With that, you are done. You can now use the program. To know more about the Tabulation Method, the program, and how it works, you can read the Technical Manual that comes with this User’s Manual. Thank you for using Boolean Expression Minimizer!

References:

Java Getting Started. (n.d.). W3schools. Retrieved November 12, 2021, from https://www.w3schools.com/java/java_getstarted.asp

Tabular Method of Minimisation. (n.d.). University of Surrey. http://www.ee.surrey.ac.uk/Projects/CAL/digital-logic/minimisation/tabular.html

What are the advantages of using the tabulation method in digital electronics? (2017). Quora. Retrieved November 12, 2021, from https://www.quora.com/What-are-the-advantages-of-using-the-tabulation-method-in-digital-electronics