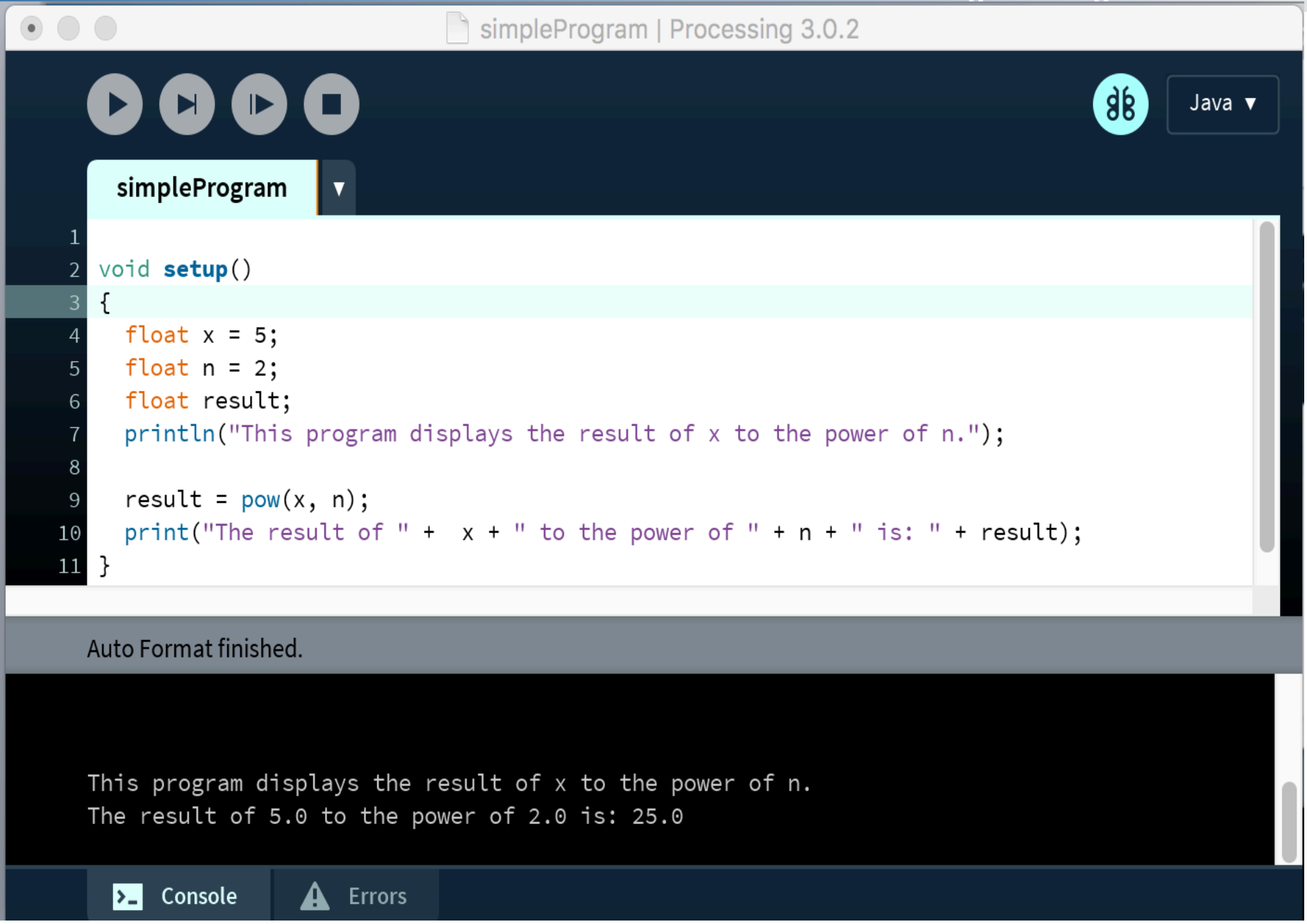
Getting Started

- I assume students taking this course, have a programming background either in C++ or Processing.
  - These are the two programming languages that have been taught in ENGG 233 in the last few years.
  - Learning C is somewhat easier for those who have a C++ background. But the good news is that many of the basic constructs of the three languages are similar.
- The development environment and tools that we will use in our ICT 320 lab include:
  - Operating System: Windows
  - Development Environment: Cygwin
    - Cygwin is used to give you a very basic understanding of Linux operating system.
    - Cygwin is a Unix-like environment and command-line interface for Microsoft Windows.
- You might be already familiar with the development environments such Visual Studio, Eclipse on , Xcode , etc.
  - If these are your preferred tools, for most of the assignments you should be OK.
  - Exceptionally, we may recommend you use an specific tool.

Similarities Between C, C++, and Processing

- To help you realizing how a C program is similar or different from C++ or Processing, we will write a simple program in these languages.
- For the simplicity purposes our program will not interact with the user.
  - We will write a program that calculates and displays the value of $\mathbf{x^n}$ (**x** to the power of **n**)
    - First we will try it in Processing, for those who have take ENGG 233 last fall.
    - then in C++, for those who have taken ENGG 233 in fall 2014 or earlier.
    - And, finally we will take a quick look at its C version of the program.

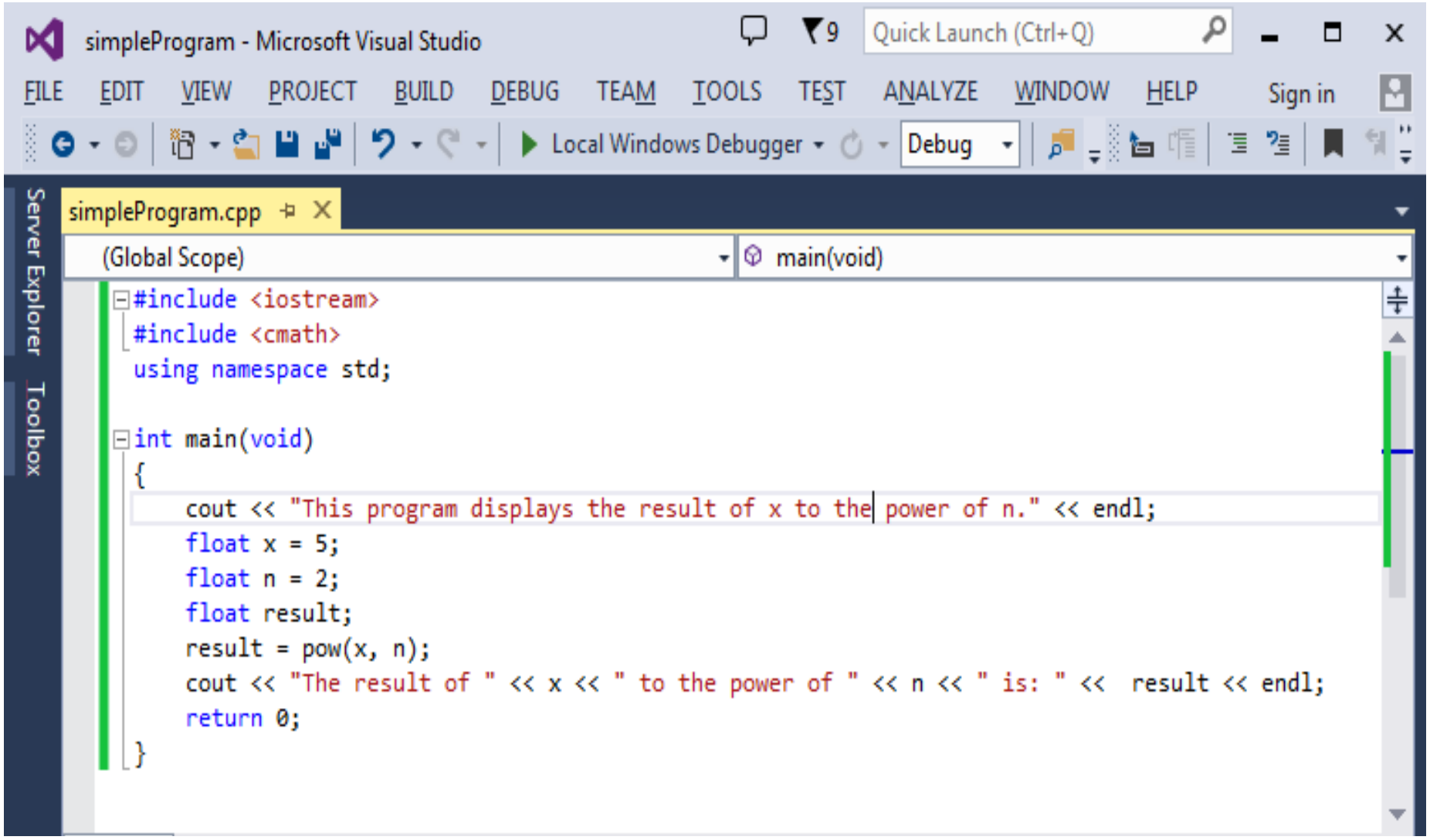
Screenshot: A Simple Processing Program

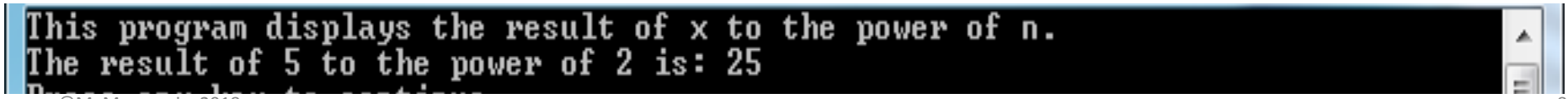

simpleProgram | Processing 3.0.2
Java
simpleProgram
1
2 void setup()
3 {
4 float x = 5;
5 float n = 2;
6 float result;
7 println("This program displays the result of x to the power of n.");
8
9 result = pow(x, n);
10 print("The result of " + x + " to the power of " + n + " is: " + result);
11 }
Auto Format finished.
This program displays the result of x to the power of n.
The result of 5.0 to the power of 2.0 is: 25.0
Console
Errors

Screenshot: A Simple C++ Program

Using Visual Studio IDE

Editing and Running a Simple C++ Program Using Visual C++





Screenshot: A Simple C Program

Using Notepad++ Editor

Editing a Simple C Program, Using Notepad++, and Cygwin Terminal

C:\Users\moussam\Desktop\simpleProgram.c - Notepad++

File Edit Search View Encoding Language Settings Macro Run Plugins Window ? X

simpleProgram.c

```
1   #include <stdio.h>
2   #include <math.h>
3   int main(void)
4   {
5       printf("This program displays the result of x to the power of n.\n");
6       float x = 5;
7       float n = 2;
8       float result;
9       result = pow(x, n);
10      printf("The result of %f to the power of %f is: %f", x, n, result);
11      return 0;
12  }
```

length : 284 lines : 12 Ln : 1 Col : 4 Sel : 0 | 0 Dos\Windows ANSI as UTF-8 INS

~/Desktop

```
This program displays the result of x to the power of n.
The result of 5.000000 to the power of 2.000000 is: 25.000000
moussam@ICT3201101 ~/Desktop
```

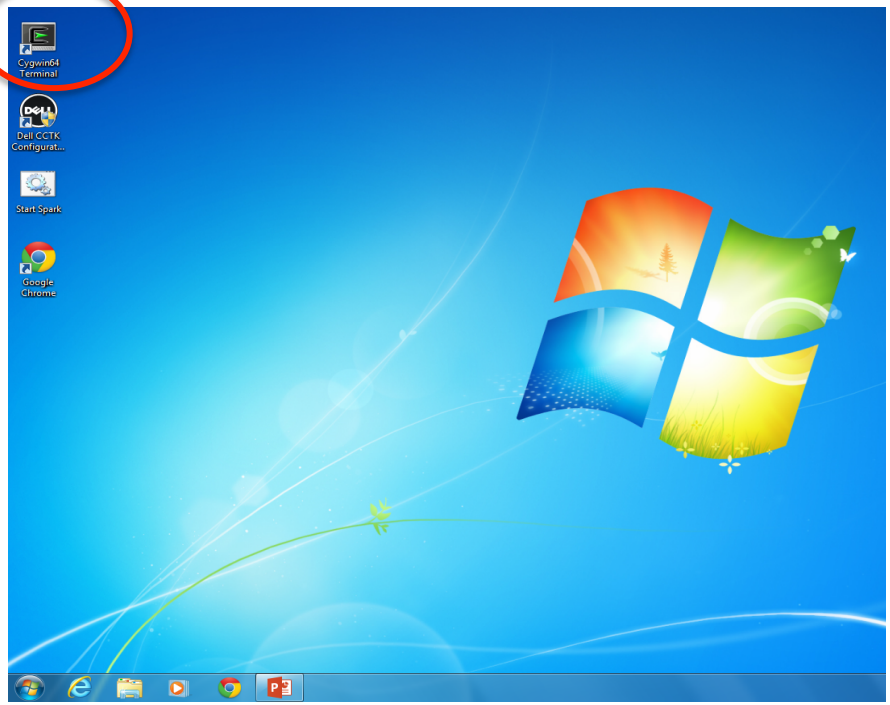
Introduction to Program Development Environment in ICT 320 Computer Lab

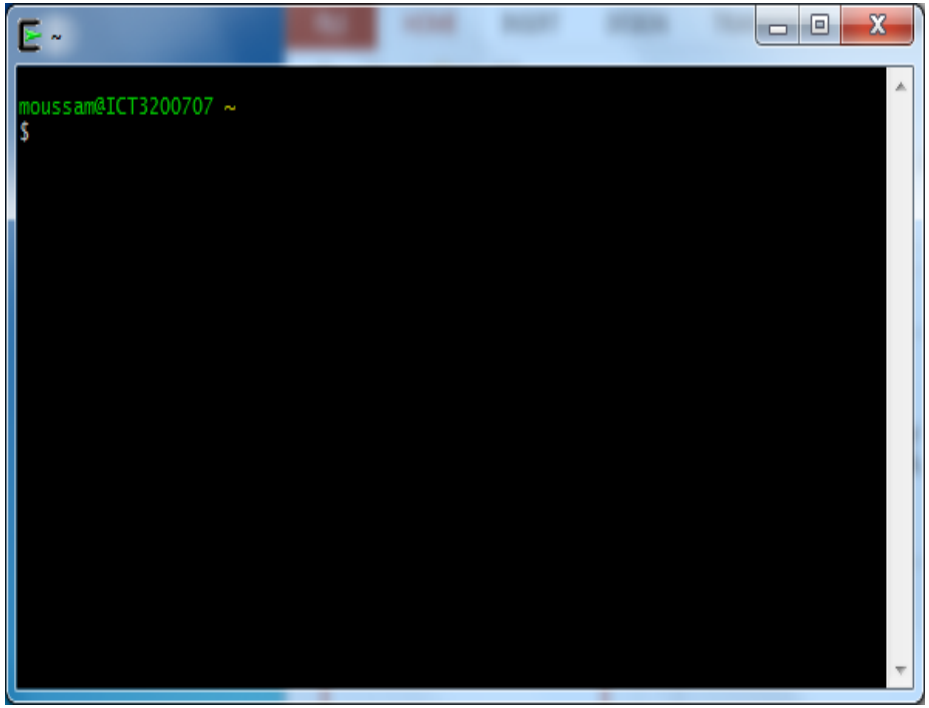
Quick Introduction to Cygwin

How to Start Cygwin Terminal Window

- The easiest way to open a Cygwin terminal window under Windows operating systems is to double click on the Cygwin-Terminal icon that appears on your desktop window on the computers in our ICT 320 lab.
- Here is an example of Cygwin Terminal Window

Cygwin Icon





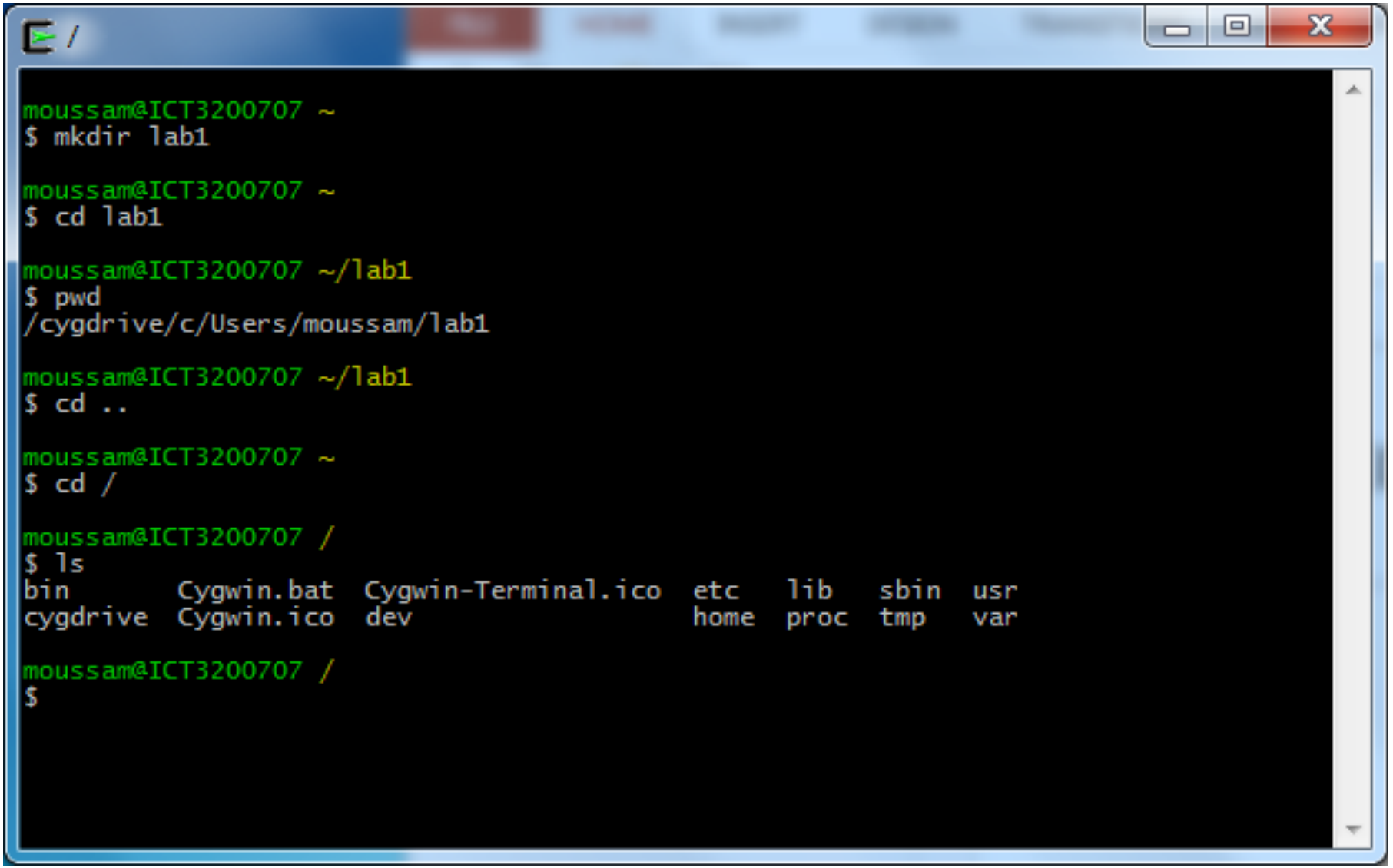
Linux File System

- The Linux file system is composed of directories and files.
  - They are arranged in a hierarchical structure, as specified by the user.
  - The root directory is slash: /
- File names can be up to 255 characters.
  - Can use case-sensitive letters, numbers, “_”, “.”, “,”.
  - To see the list of files in your folder use: ls
- Pathnames are specified using directory names separated by a “/”.
  - E.g. /home/moussam/lab1/test.c

Examples of Linux Commands

- `pwd` print working directory
- `cd` change to another directory
- `mkdir` create a new subdirectory
- `rmdir` remove the specified directory
- `mv` move a file to a new name or new directory
- `rm` remove the specified file (careful!!)
- `ls` list the files in the current directory
- `cp` copy files
- `man` Linux manual for help
- `gcc` compiles a C program

Examples of Linux Commands on the Cygwin Terminal Window:



Writing and Running a C Program

How to Write and Run A C-Program

- To develop and run a C program, you may use an Integrated Development Environment (IDE) tool.
- Or just edit your code in a text-editor. Then, compile and run it from a command line in a terminal window.
  - **This is a preferred method in ENSF 337**, as it helps you to understand some of the details of compilation and execution of a C program.
  - Here are the steps to follow:
    - Use a Text Editor like Notepad++ to edit your program
    - Save it with the `.c` extension. For example: myFirst_c_program.c
    - Compile it with the gcc command.

```
gcc -Wall myFirst_c_program.c
```

    - Run the the executable file which its name by default is `a.exe`

```
./a.exe
```

  - **Note**: More details will be discussed in the lab 1 assignment.
- Lets now take a quick look at a simple C program that reads two integer numbers and displays the sum of these numbers.

More on Similarities/Differences Between C, C++, and Processing Languages

Similarities Amongst Three Languages

- Many of the basic constructs amongst C, C++ and Processing are similar:
  - Rules for naming variables
  - Selection structures: if … else statements
  - Switch statements
  - Repetition structures: while loop, do loop, for loop
  - Jump statements: break, continue
  - General format of function: rules for the function name, arguments, and return value(s).
  - Most of the operators:
    - Arithmetic operators: addition, subtraction, multiplication, modulus, division: +, -, *, %, /
    - Relational operators: <, >, <=, >=, ==, etc.
    - Logical operators: &&, ||, !
    - Assignment and updating operators: =, +=, -=, *=, /=, %=
    - Increment and decrement operators: ++, -- (prefix and post-fix)

Differences Amongst Three languages

- Standard Input output
- Minor differences among some data type
- C and C++ doesn't support data type **byte**
- C is a procedural programming language and doesn't support **class** type.
- C doesn't support any library class such as: String (in processing), string (in C++), vector (in C++), etc.
- C uses different syntax for dynamic allocation of memory, doesn't support garbage collection approach like processing, and uses different syntax for memory de-allocation.
- The three languages use different methods and libraries for File I/O
- The three languages use more or less different syntax to **import** or **include** files necessary to use library functions or data type.
- While C and C++ support pointer, Processing doesn't.
- There are more difference that we will discuss as we go.

Anatomy of a Simple C Program

Problem Statement

- Lets write another simple program that interacts with the user: Asks the user to enter the length in feet and displays the value of the length in inches.
- Here is a sample run of the program on the screen, when user enters 10 for the length:

```
Enter the length in feet:  10
10 feet equals 120 inches
```

- Now lets review the organization and the anatomy of the program on the next slide

Anatomy of a Simple Computer Program

```
// File: convertFeetToInch.cc
// My first C program

#include <stdio.h>

int main (void)
{
   int length_ft;
   int length_inches;

   const int conversion_factor = 12;

   printf("Enter the length in feet:");

   scanf("%d", &length_ft);

   length_inches = length_ft * conversion_factor;

   printf( "%d feet equals: %d.\n", length_ft, length_inches);

   return 0;
}
```

comments

Including standard library info

Variables declaration

Constant declaration

Prompt for input

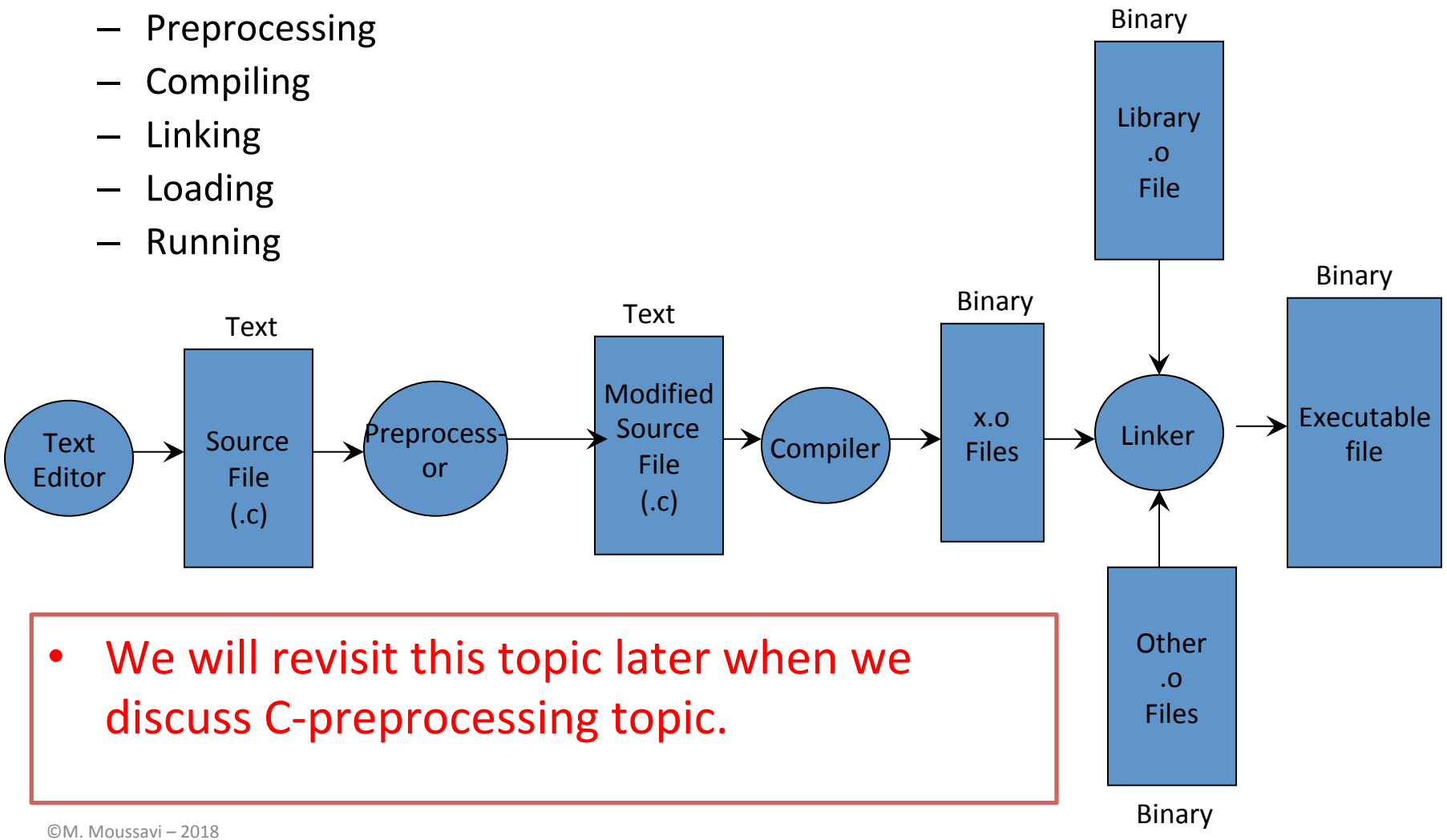
Read user input from keyboard

Arithmetic expression

Quick Look at the Development Process

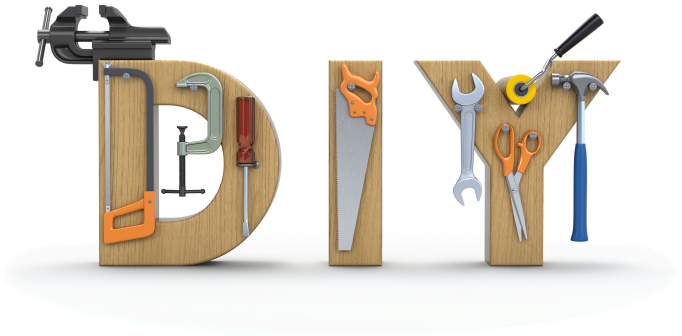
Program Development

- The process of developing a program and running an executable file consists of several operations:
  - Editing
  - Preprocessing
  - Compiling
  - Linking
  - Loading
  - Running



- We will revisit this topic later when we discuss C-preprocessing topic.

Do It Yourself!

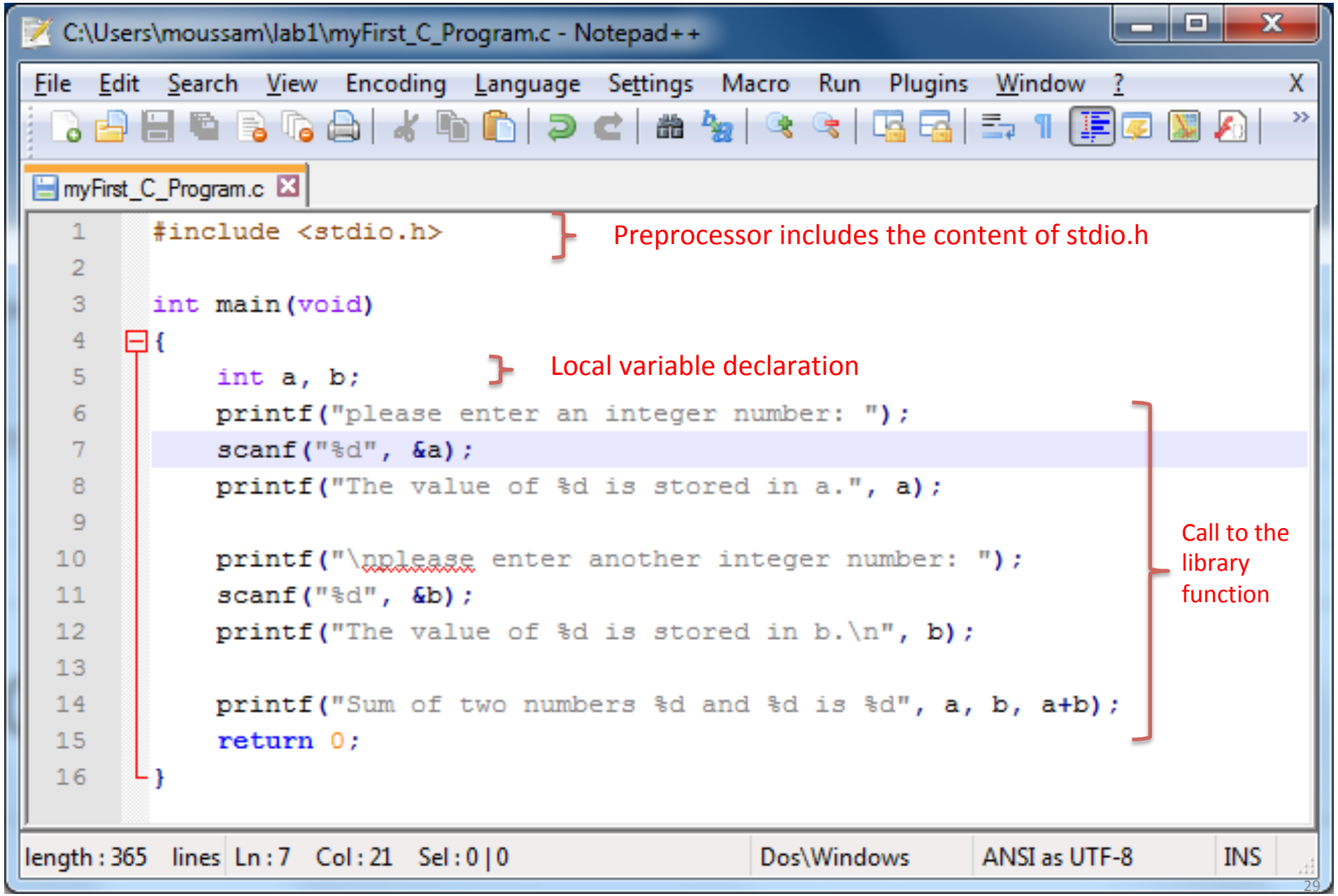


- Write a C program that prompts the user to enter two integer numbers and displays the sum of two integers.

Using Notepad++ - Text Editor

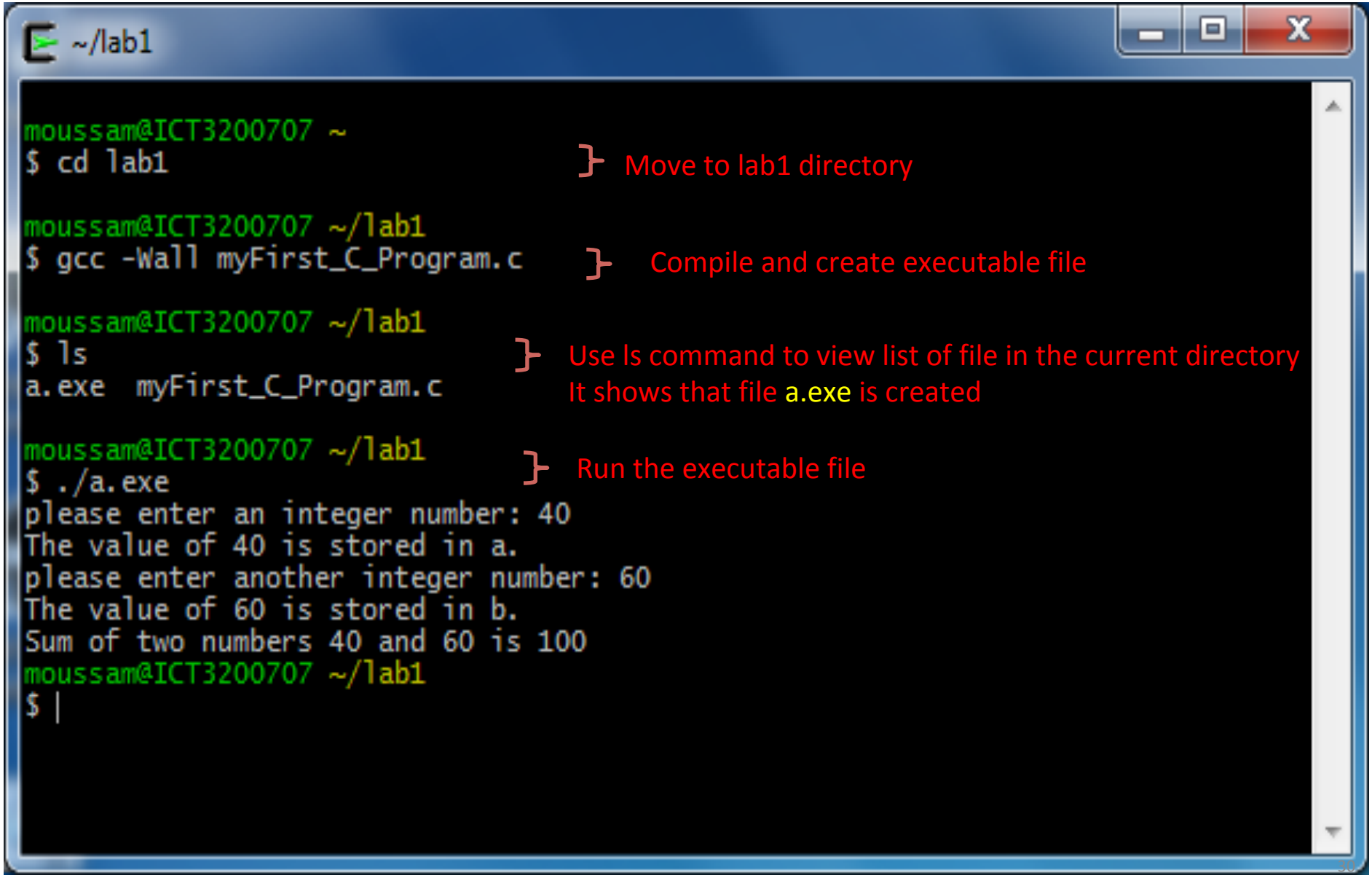
- Notepad++ is the recommended text editor for work in the ENSF337 labs. Note that Notepad++ is a free and powerful editor, which is designed to be used for writing code.

Solution: Program Edited in Notepad++



Compiled and Executed in Cygwin

- Assume the source file that was edited in Notepad++, was saved as `myFirstProgram.c` in the directory called `lab1`



Saving Your Files When Working in School Labs

Saving accessing you files in our computer labs:

- With a file system you can have hierarchy of directories.
  - Terms folder and directory are the same.
- Microsoft Windows uses drive letters such as C, D, E, … to each of the file systems accessible on a computer.
- You should not save your files to the C: drive, as you may not use the same computer next time and files on this drive will not be permanently kept.
- Your best choice is to use the H: drive or save your work on a USB memory stick.
  - When you plug a USB memory stick " into a computer, it will most likely appear as E: drive (or it may get some other letter).
  - When using USB always eject the drive safely and take it with you when you leave the lab!.
- Each student has a H: drive. You can access your files from any of the computer labs at the School of Engineering on this drive.

How to Navigate between Directories/Folder in Cygwin

- Cygwin uses a special directory called cygdrive to provide access to the Windows drives. The following table table shows the equivalent Cygwin name for each C:, E:, ad H: drive under the Windows.

Drive	Cygwin equivalent
C:	/cygdrice/c
E:	/cygdrice/e
H:	/cygdrice/c

- For example if your currently working in a directory in the Window's C: drive and want to move to your Window's H: drive, you can enter the following command on the Cygwin command line:

```
cd /cygdrive/h
```

- Now if you want to again back to the C: drive, you need to enter the command:

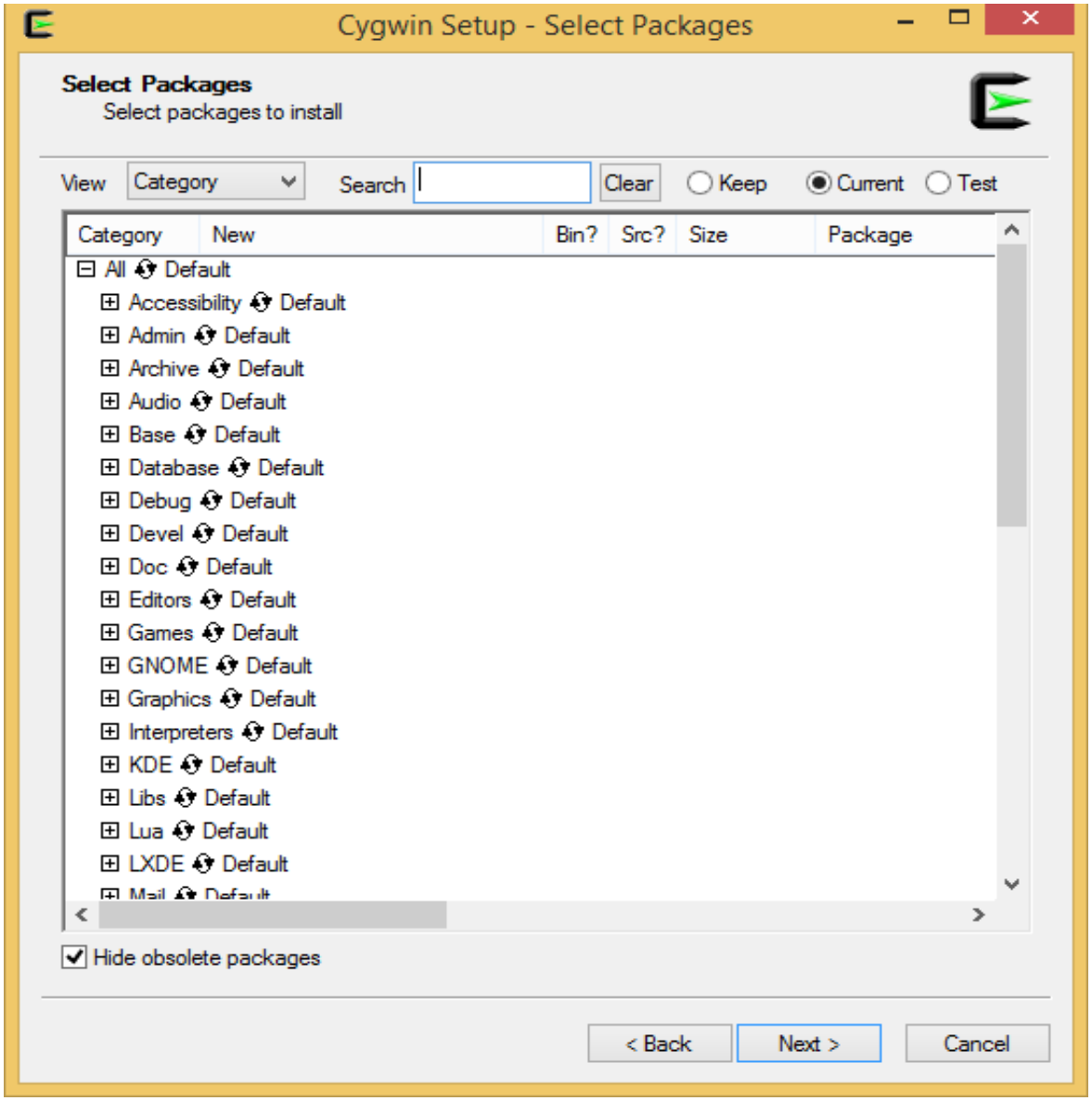
```
cd /cygdrive/c
```

How to Install Cygwin

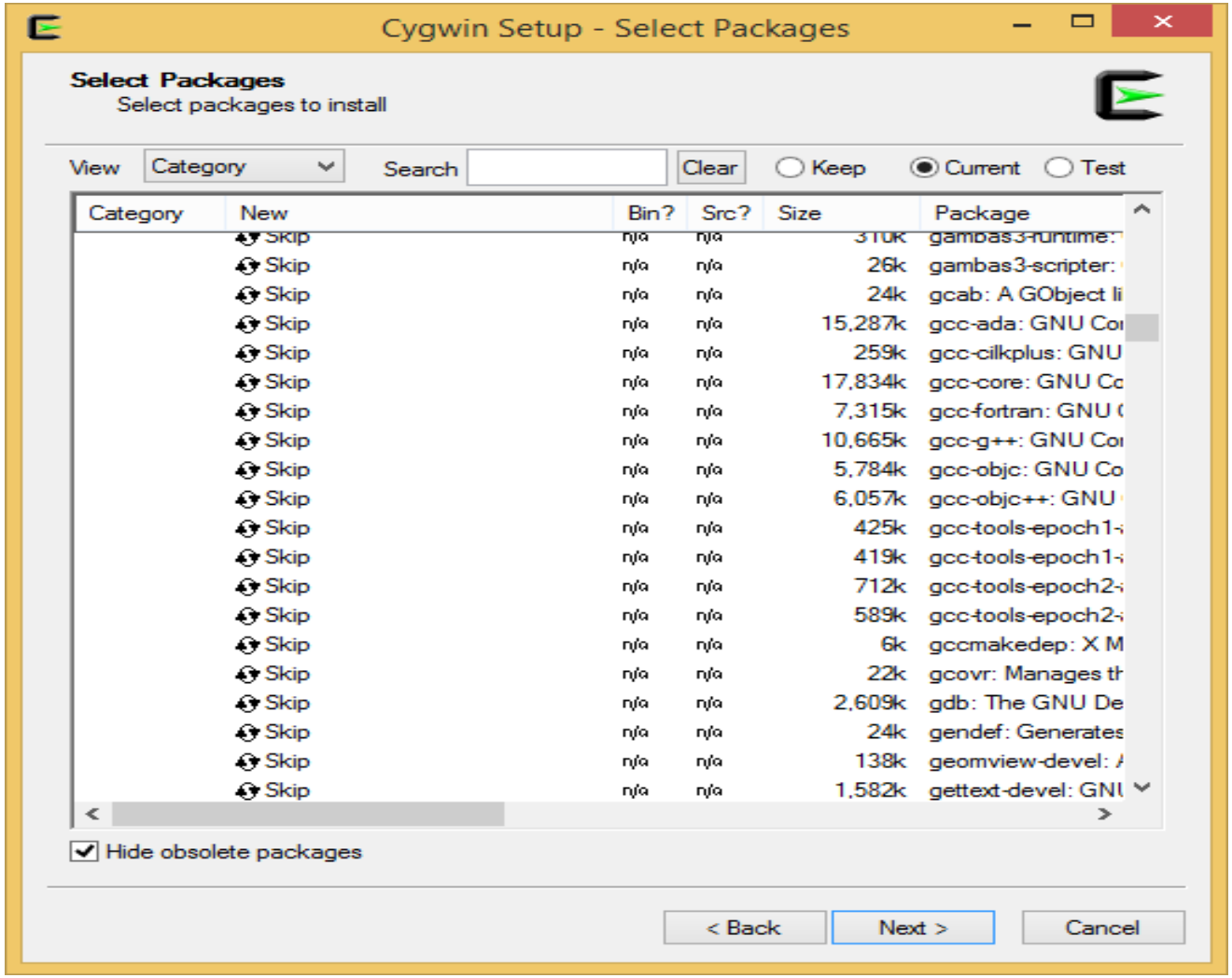
Installing Cygwin:

- To install Cygwin, or updating installation visit: https://www.cygwin.com/install.html.
- In this page download the setup-x86_64.exe and run this executable file.
- You can also use the **setup-x86_64.exe** any time you want to update Cygwin package.
- You don't need to install all the packages, but for the purpose of ENSF 337 your need to have at least two packages:
  1. The packages in the "Base" category that is a default package.
  2. The package, `gcc-core, gcc-g++, clang` in the "Devel" category. These packages are needed for compiling C and C++ programs.

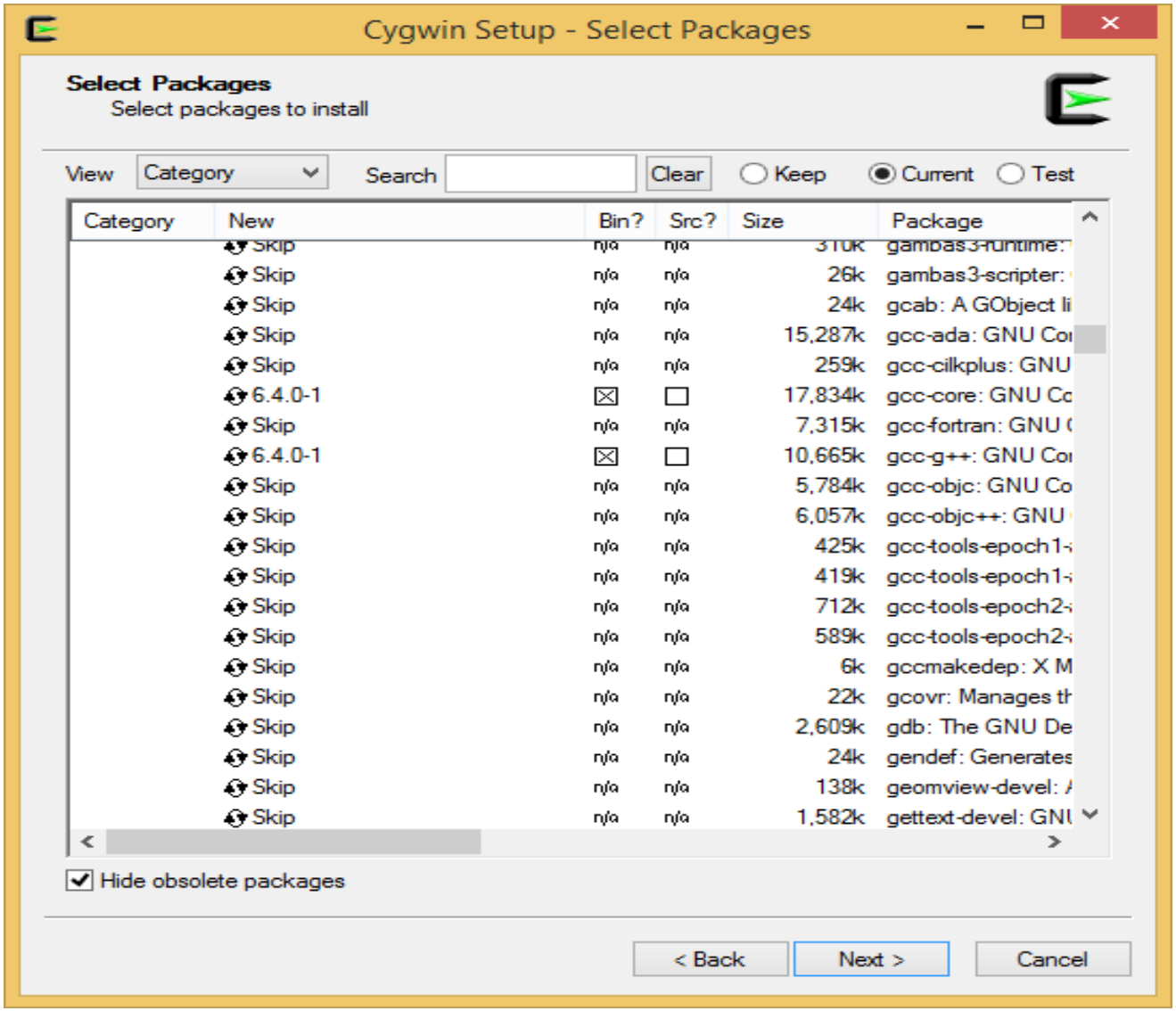
a screenshot of the page that allows you to select packages:



If you expand the category Devel, and scroll down you will see the packages shown in the following figure:



If you select gcc-core and gcc-g++ your screen will look like:



And, shows the version numbers of each package.