Assignment 0: Utilize of Virtual Machine

1. Utilize of Virtual Machine

   The Virtual Machine provides a full coding environment for assignments. Students can code, compile, and run the code in Virtual Machine. After the insertion of our virtual disk, no more operations are needed for all the assignments.

   1.1. Installation of Virtual Machine

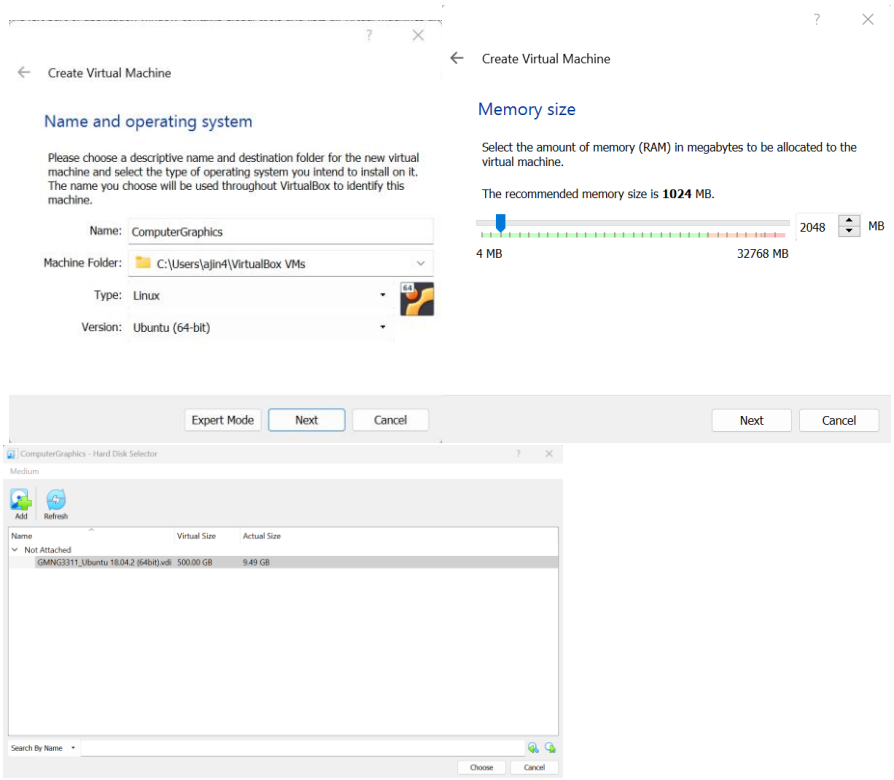
   Oracle VM VirtualBOx is the one we used. The download link is following:
   For Windows: https://download.virtualbox.org/virtualbox/6.1.4/VirtualBox-6.1.4-136177-Win.exe
   For MacOS: https://download.virtualbox.org/virtualbox/6.1.4/VirtualBox-6.1.4-136177-OSX.dmg
   Follow the installation instructions to install the Virtual Machine.
   If your operating system is based on Linux, you can check:
   https://www.virtualbox.org/wiki/Linux_Downloads to find the proper operation system and follow the instructions to install the Virtual Machine.

   1.2. Download the virtual disk

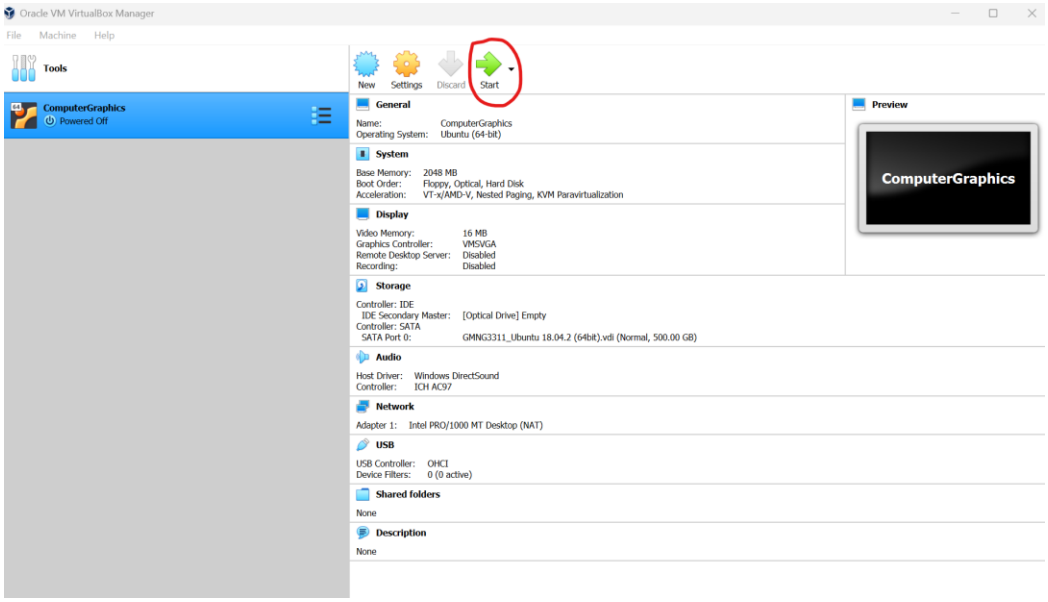
   The download link is: https://drive.google.com/file/d/1OzcJpMKdUWU_kbnzd-RQtQrCdFoOMusO/view?usp=sharing
   After the downloading, you will get the virtual disk file: GMNG3311_Ubuntu 18.04.2 (64bit).vdi

   1.3. Virtual Machine Configuration

   Open Virtual Box, click Machine->New, Name the operating system with anything you want, Type: Linux, Version: Ubuntu-64 bit. The suggested memory size is 2GB. Then select Use an existing virtual hard disk file and locate the disk file: GMNG3311_Ubuntu 18.04.2 (64bit).vdi by clicking Add and find the file. Finally, click create to finish the configuration.

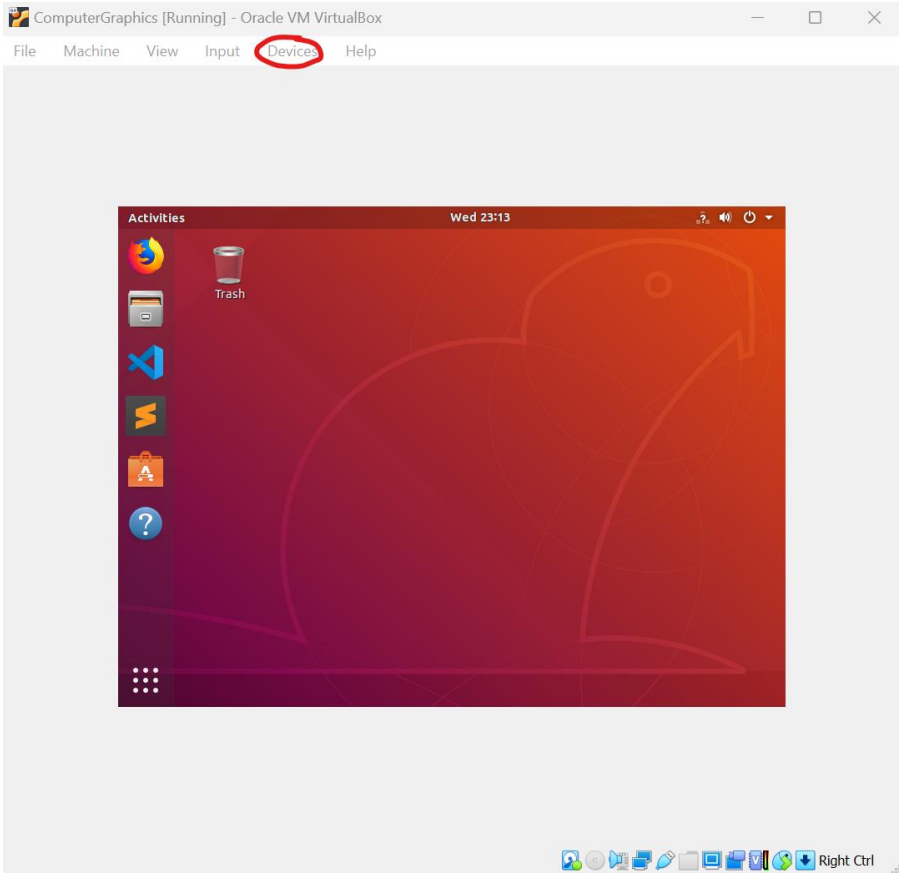


Then we can use the created virtual machine, click the start button to run the virtual machine. The password is Ilovegraphics.



1.4. Install Guest Additions

When the system fully run, click Devices-> Insert Guest Additions CD image…



If this step fails, call the Terminal by using ctrl+alt+t, use the following command to install Guest Additions function.

sudo mkdir -p /media/cdrom

sudo mount -t auto /dev/cdrom /media/cdrom/

cd /media/cdrom/

sudo sh VBoxLinuxAdditions.run

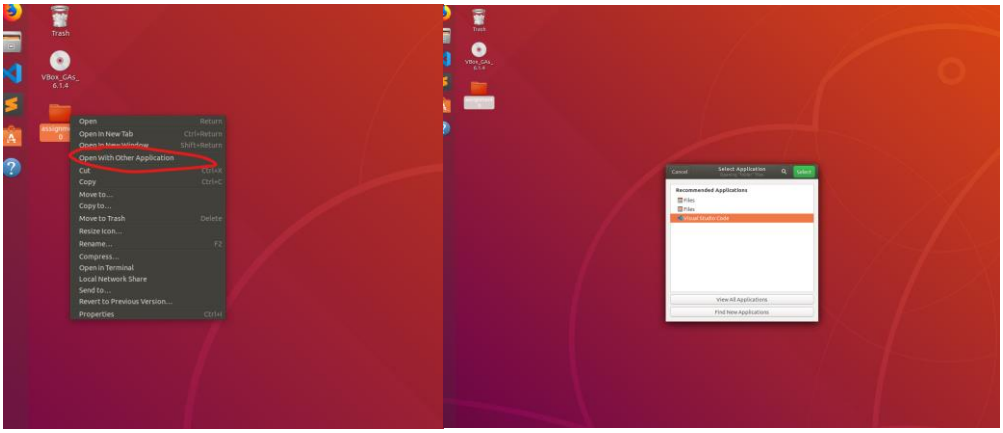
Then restart the system and finish the installation of Guest Additions.

1.5. Assignment programs import and edition

There are many ways to import your assignment framework. When you get the assignment framework(source codes), you can directly drag the folder to desktop of virtual machine. You need to enable the drag function by click Devices->Drag and Drop->Bidirectional.

After the import of your assignment framework, you can utilize Visual Studio Code to check and edit. Right click on the folder, select Open With other Application and select Visual Studio Code.

You can change the screen size with Right Ctrl + F.



2. Assignment framework details

Here the main.cpp will utilize as example.

2.1. IDE details

Visual Studio Code (Recommanded) and Sublime are provided in virtual machine.

2.2. C++ details

This section will only introduce some simple c++ information, for more information, please check https://devdocs.io/cpp/ or Stack Overflow.

2.2.1.Head files

In C and C++, head file is a file end with .h, usually included by programmer.

In this example, cmath.h and iostream.h are included.

```
#include <cmath>

#include <iostream>
```

2.2.2..cpp file

The main() function is the entry of the program.

```
int main(){
        float a = 1.0, b = 2.0;
        std::cout << a << std::endl;
        std::cout << a/b << std::endl;
        std::cout << std::sqrt(a) << std::endl;
        std::cout << std::acos(-1) << std::endl;
        std::cout << std::sin(30.0/180.0*acos(-1) << std::endl;
        return 0;
}
```

Previous code will print out the calculation results of a, a/b, sqrt(a), arccos(-1), and sin(30).

2.2.3. Normal Errors in C++

1. Compile Error: read the error information, locate the line of error and try to fix; if you cannot fix the error, try to copy paste the error information to Stack Overflow to check similar situations.
2. Undefined reference to xxx: usually linking error, check if the relative library(package) included in CMakeLists.txt.
3. Segmentation Fault: usually array overflow error, or the stack overflow error.
4. Bus Error: similar with Segmentation Fault.
5. Math Error: usually the calculation included with divided by 0.

2.3. Eigen Library

Eigen Library is the main library used in this course to do linear algebra, official documents can be found: http://eigen.tuxfamily.org.

2.3.1. .h file

In the main.cpp file, eigen need to be included as <eigen3/Eigen/Core>.

2.3.2. Vector, Matrix

More details should be found in https://eigen.tuxfamily.org/dox/group__TutorialMatrixArithmetic.html.

The example shows how to define a 3D float vector and do the math +, -, *. Please try to check how to do dot product and cross product between to vectors.

The example shows how to define 3D float Matrix and do the math. Try to check how to do matrix addition, deduction, matrix multiplication, and matrix multiply vector.

3. Compiling and submission

3.1. Compiling

Each assignment will use cmake to compile the code.

First edit the main.cpp file with Visual Studio Code.
Then open Terminal under the path of main.cpp and input the following command:
mkdir build ## create a build folder under the current path.
cd build ## move into build folder
cmake .. ##notice '..' represent the upper path folder
make ##compile the program, if meet errors, the errors information will show in Terminal.
./Transformation ## run the program with name Transformation(executable file). (You can change the name in CMakeLists.txt).

3.2. Submission

Submit the zip folder (with the build folder) to blackboard.

3.3. Score

This assignment will not be credited.