CS1020E: DATA STRUCTURES AND ALGORITHMS I

Lab 0 – Start Coding?¿?
(Week X, *the moment you see this*)

This guide is meant to help you prepare a few C++ programming environments. The **second section MUST be done before attending labs**, while the first and third sections are optional.

1. I am Lazy

Don't feel like installing anything[1] now? Never mind...

Here are some **online** Integrated Development Environments (IDEs) where you can write, compile and run your code, in descending order of preference:

1. http://www.tutorialspoint.com/compile_cpp11_online.php **simulates a UNIX environment**
2. http://cpp.sh/   but make sure you select the C++11 radiobutton instead of C++14
3. http://ideone.com   but choose language C++ 14 and make sure you only use C++ 11 functionality

Since this is an *online* IDE, make sure you **download your code regularly**, just like how you should be regularly saving the newly-written files to your hard disk.

Why should you be concerned with using a UNIX environment? Find out in the second section...

2. UNIX is My Best Friend in CS1020E

Google "why learn unix". There are many UNIX-/Linux-based systems around, especially on enterprise servers. Some interviewers for programming jobs may expect you to have used a UNIX system before. Anyway...

Practical Exam 1 will be conducted on a Sun Fire SPARC Solaris server. Solaris is a UNIX-based operating system. This means that you will need to use command line, and NOT use your mouse most of the time.

This guide helps you to get connected to the Sun Fire server:
- a) Create an NUS SoC UNIX account
- b) Get an SSH client to connect to the server
- c) Play around
- d) Configure your environment

(a) Create an NUS SoC UNIX account

Create, retrieve, or re-enable your UNIX account at:
     https://mysoc.nus.edu.sg/~newacct
Your **UNIX** id and password are **different** from your NUSNET id and password.

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[1] Even if you are not installing anything now, you should be revising your lecture material, assessing your understanding with the tutorial, and then working on the labs...

(b) Get an SSH client

In SoC programming labs, SSH Secure Shell Client and SSH Secure File Transfer Client are already installed.

Download: http://www.comp.nus.edu.sg/~cs1020/2_resources/SSHSecureShellClient-3.2.9.exe

Open SSH Secure Shell Client:

Host Name: sunfire.comp.nus.edu.sg

User Name: Your UNIX ID

Port Number: 22

Click on the Connect button

Just click "No" when you encounter the "Host Identification" dialog

You may change your password at:

https://mysoc.nus.edu.sg/~myacct/changepass.cgi

(c) Play around

DON'T:

- × close SSH Secure Shell before disconnecting. ✓ Type `exit` or `logout` to disconnect gracefully
- × press Ctrl+Z: Sends the UNIX job to the background. ✓ Type `fg` to bring the job back
- × press Ctrl+S: Locks the screen. ✓ Press Ctrl+Q to unlock.
- × use the mouse. ✓ If you did use the mouse and don't see the UNIX shell prompt, scroll back down

  Bash shell prompt: `a0080855@sunfire:~[1001]$`
- × expect an output when a command successfully completes execution

DO:

- ✓ use the `man` (manual) command for help
- ✓ familiarize yourself with command UNIX commands, some of which can be found in the appendix
- ✓ try to press `q` (quit) if you get stuck in the middle of an application

  if that still does not work, press Ctrl+C a few times to interrupt the application

For C++ programs:

- Compile: `g++ -std=c++11 hello.cpp`   where hello.cpp is the source file
- Run: `./a.out`   where a.out is the executable file

(d) Configure your environment

Some steps can be taken to configure the look of the UNIX shell prompt, and enhance the functionality of a text editor called vim. Run the setup program, taking care not to miss out the tilde character '~':

`~cs1020/workshop/setup`

You will be prompted to continue. On successful completion, you will see:

```
Setup successfully completed.
Please type the following (exactly!) now:
     source .bash_profile
```

Follow the instruction, taking care not to miss out the full stop '.', by typing `source .bash_profile`

3. The Internet Connection is Down

Anything that can go wrong, will… =X

Some of you prefer to have a C++ compiler[2] and linked text editor locally.

Minimalist GNU for Windows

MinGW provides C++ compilers and other UNIX utilities ported to Windows, free, under the GNU public license.

> http://www.mingw.org/wiki/Getting_Started

(a) Download the downloader for the installer
- Download from https://sourceforge.net/projects/mingw/files/latest/download
- Run the downloader for the installer. Leave GUI support checked to make life easier
- A few downloads may take place and you have to wait awhile for the progress bar to move
- When done, check the "Details" pane for errors. Click continue.
- DO NOT move iMinGW to any folder with spaces, e.g. "Program Files\MinGW" is BAD

(b) Installing minGW
- Choose these 4 packages:

mingw-developer-toolkit	vim and some other commands
mingw32-base	essentials
mingw-32-gcc-g++	compiler for C (gcc) and C++ (g++)
msys-base	bash shell and some other utilities

- Installation > Apply Update. Wait even longer
- Check that the updates have completed successfully
- To run the installer/updater in the future, run " C:\MinGW\bin\mingw-get.exe"

(c) Adding MinGW and MSYS to your PATH environment variable
- Control Panel > Advanced System Settings > Environment Variables > PATH
- CAREFULLY append a **semicolon**, followed by **C:\MinGW\bin**
  - e.g. "C:\Windows" becomes "C:\Windows**\;C:\MinGW\bin**"
- CAREFULLY append a **semicolon**, followed by **C:\MinGW\msys\1.0\bin**
  - e.g. "C:\Windows;C:\MinGW\bin" becomes
  - "C:\Windows\;C:\MinGW\bin**;C:\MinGW\msys\1.0\bin**"

Alternative: Use Cygwin

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[2] For Mac OS X, you may want to try, at your own risk, https://solarianprogrammer.com/2016/05/10/compiling-gcc-6-mac-os-x/

Sublime text editor

Sublime Text is not free. However, evaluation of the product is free, and at present, there is no enforced time limit for the evaluation...

(a) You may consider the portable version. Either way, download from https://www.sublimetext.com/3

(b) Test linking with MinGW's g++
- Create a new file and paste a working C++ program within
- Save the program as a .cpp file
- Tools menu > Build System > C++ Single File
- Press Ctrl+B to build (compile) and run

If you get the desired output, it works!

Don't forget to logout gracefully using `exit` or `logout`!

- End of Lab 0 -

2 Appendices:
> Useful UNIX commands
> Connecting to Sun Fire for Mac users

Useful UNIX Commands
Prepared by Prof Tan Sun Teck

(a) Directory commands

pwd	to **P**rint current **W**orking **D**irectory to show you which directory you are currently in

```
u0801234@sf3:~[xxx]$ pwd
/home/nusstu/u0801234
```

ls	to **LiS**t files in your current directory

```
u0801234@sf3:~[xxx]$ ls
cpp          doc
```

You may also use "ls -F" for more information (-F is one of the many options/flags available for the ls command. To see a complete list of the options, refer to the man pages, ie. "man ls".)

```
u0801234@sf3:~[xxx]$ ls -F
cpp/         doc/
```

The slash (/) beside the filename tells you that the file is a directory (folder). A normal file does not have a slash (/) beside its name when "ls -F " is used.

Note that the directories c/ and doc/ are created by the setup program in section A.3. If you did not run the setup program, you will not see any file at all.

You may also use the "ls -l " command (dash lowercase L) to display almost all the file information, include the size of the file and the date of modification. Try it now!

cd	to **C**hange **D**irectory from current directory to another

```
u0801234@sf3:~[xxx]$ cd cpp
u0801234@sf3:~/cpp[xxx]$ ls -F
ch1_1.cpp    ch2_1.cpp    ch2_2.cpp    ch2_3.cpp    ch2_4.cpp
```
(Note that you will see a different list of files in your directory)

Note that the prompt changes to ~/cpp to indicate that you are now in the cpp directory below your HOME directory. Entering "cd" alone brings you back to your HOME directory, ie. the directory in which you started with when you first logged into the system.

```
u0801234@sf3:~/cpp[xxx]$ cd
u0801234@sf3:~[xxx]$
```

mkdir	to **M**a**K**e a sub**DIR**ectory in current directory

```
u0801234@sf3:~[xxx]$ mkdir another
u0801234@sf3:~[xxx]$ ls -F
another/     cpp/         doc/
```

rmdir	to **ReM**ove a sub**DIR**ectory in current directory -- note that a directory must be empty before it can be removed

```
u0801234@sf3:~[xxx]$ rmdir another
u0801234@sf3:~[xxx]$ ls -F
cpp/          doc/
```

(b) File commands

cp	to **CoP**y files

```
u0801234@sf3:~[xxx]$ cd doc
u0801234@sf3:~/doc[xxx]$ cp abridged.txt anotherfile
u0801234@sf3:~/doc[xxx]$ ls
abridged.txt   anotherfile   faq.txt        tutor
```

mv	to **MoV**e files from one directory to another; can also be used to rename files

```
u0801234@sf3:~/doc[xxx]$ mv anotherfile
abridged.txt   afile         faq.txt        tutor
```

rm	to **ReM**ove files -- Be careful, files are permanently deleted...!

```
u0801234@sf3:~/doc[xxx]$ rm afile
rm: remove `afile'? y
u0801234@sf3:~/doc[xxx]$ ls
abridged.txt   faq.txt        tutor
```

(c) Commands to display text files

cat	to string together or display (**CAT**enate) the contents of files onto the screen

```
u0801234@sf3:~/doc[xxx]$ cat abridged.txt
```

less	variant of "cat" (includes features to read each page leisurely)

```
u0801234@sf3:~/doc[xxx]$ less -e abridged.txt
```

In "less", use <space> to move down one page, 'b' to move **B**ack up one page, and 'q' to **Q**uit from "less". You can also use the ↑ / ↓ arrow keys to move one line at a time.

Don't forget to logout gracefully using exit or logout!

Mac Users

First created by an ex-LabTA, then updated with input from student and another LabTA.

How to connect to Sun Fire using SSH with Mac OSX?

(a) Run terminal

- Search in spotlight for 'Terminal' or
- Select 'Terminal' from the applications>utilities folder

(b) Type `ssh unixIdHere@sunfire.comp.nus.edu.sg`

- Use SoC UNIX id and password, NOT NUSNET id and password
- If you cannot connect from outside school, try replacing `sunfire` with `sunfire-r`

(c) Enter your password.

How to transfer files between Mac and Sun Fire?

With GUI: Use Cyberduck

Alternatively, you can use the command line to transfer files to and from Sun Fire. The scp (secure Copy) commands works like the cp command. In these examples, the scp command is given to the terminal, and NOT to sunfire while connected through SSH.

Syntax:

`scp [-r] <source> <destination>`

Use the `-r` flag if you are copying directories, to recursively transfer subdirectories and their files too. Source and destination can take the format:

`<username>@<host>:<folder>`

For example:

- Uploading a **directory** lab1 in your Downloads directory to your **home** directory on Sun Fire:
  `scp -r ~/Downloads/lab1 exxxxxxx@sunfire.comp.nus.edu.sg:~/`

- To download the file swing.cpp from your **lab3/ directory** in Sun Fire, to your computer:
  `scp exxxxxxx@sunfire.comp.nus.edu.sg:~/lab3/swing.cpp ~/Downloads/`

Don't forget to logout gracefully using `exit` or `logout`!