

Topics in Computational Economics

Lecture 2

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Today's Lecture

- Internet connection
- Review of VM installation
- UNIX shell quick start
- A primer in C
- Version control (Git and GitHub)



Review of VM and Ubuntu Installation

Working?

Ubuntu installed?

Next steps:

1. `sudo apt-get install virtualbox-guest-dkms`
2. Restart Ubuntu

Review Matt's notes (updated, see lecture 1 folder)



The Desktop and the UNIX Shell

First step: Vim review

- `sudo apt-get install vim`

Installing your .vimrc

- <https://gist.github.com/jstac/3bec513653382a4a903b>

Copy and paste, wget, etc.



Basic Shell Commands

- `cd`, directory tree, home directory
- `ls`, `ls -a`, `ls *.py`
- `mkdir`
- `touch`
- `rm`, `rm -r`



A Primer in C

Start with `sudo apt-get install build-essential`

Next write file `hello.c` with

```
#include <stdio.h>

int main(void) {
    printf("hello world\n");
    return 0;
}
```

Compile with `gcc hello.c -o hello`

(Try also `make hello`)

Execute with `./hello`



Now let's use the math library (file name `sin_func.c`)

```
#include <stdio.h>
#include <math.h>

int main() {
    double x;
    int i = 3;
    x = 1.0 / (double) i;  /* cast i to double */
    double y = sin(x);
    printf("i = %d, x = %f, y = %f\n", i, x, y);
    return 0;
}
```

Compile with `gcc -Wall sin_func.c -o sin_func -lm`



Let's have a look at functions

The first example shows pass by value

The second example illustrates pass by reference

Filenames are

- `function.c`
- `function_ref.c`



```
#include <stdio.h>
```

```
double f(double x)
{
    return 1.0 / x;
}
```

```
int main(void)
{
    double x = 4.0;
    double y = f(x);
    printf("y = %f\n", y);
    return 0;
}
```



```
#include <stdio.h>
```

```
void f(double x, double *y_pointer)
{
    *y_pointer = 1.0 / x;
}
```

```
int main(void)
{
    double x = 4.0;
    double y;
    f(x, &y);
    printf("y = %f\n", y);
    return 0;
}
```



GNU Scientific Library

Download from <http://www.gnu.org/software/gsl/>

cd to location of file (Downloads?)

Unpack: `tar -xzf gsl-2.1.tar.gz`

Build and install

- `cd gsl-2.1`
- `./configure`
- `make`
- `sudo make install`

Compile:

```
gcc -Wall filename.c -lgsl -lgslcblas -lm -o filename
```



To make sure that gcc can find the libraries:

1. Open the file `.bashrc` in your home directory
2. Add the following lines

```
LD_LIBRARY_PATH=/usr/local/lib  
export LD_LIBRARY_PATH
```

Now close and reopen your terminal

For more information see

https://www.gnu.org/software/gsl/manual/html_node/Shared-Libraries.html



An example program using GLS

Simulate the time series

$$X_{t+1} = \beta + \alpha X_t + \sigma W_{t+1}, \quad \{W_t\} \sim N(0, 1)$$

Compute the sample mean $\frac{1}{n} \sum_{t=1}^n X_t$

(Set $\alpha = 0.9$, $\beta = \sigma = 1.0$ and $n =$ some large number)

Sample mean should be close the mean of the stationary distribution, which is

$$\frac{\beta}{1 - \alpha} = \frac{1}{0.1} = 10$$

See `ar1_sample_mean.c`

