Progress report:
Ensemble learning & Euler cluster

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1 Setting up simulations in Euler

Making a ensemble version of the learning schema simulations was rather easy. As the simulations are quite time consuming the logical next step seemed to be to set-up simulations in the Euler cluster. Euler has *Boost* installed, it's just necessary to load the module. But neither *GMP* nor *MPFR* seemed to be pre-installed. Getting the code to compile took some time and googling, so just in case you haven't done it before (or I need to do it again ...) I'll document the steps I took to make our code to work (the steps necessary for the learning schema code should be the same as those necessary for the Nash eq. code). **WARNING: I'm no expert on these topics, so my solution might not be the optimal nor the standard one, but it seems to be a solution.**

1.1 Useful websites

- Euler doesn't seem to have much documentation online, but once I went over my storage limit and the administrator sent me this link to a wiki. Most of it is directly related to Brutus cluster, but it's still helpful for Euler:
  `<http://brutuswiki.ethz.ch/brutus/Getting_started_with_Euler#Storage>`
- GMP website, where to download GMP: `<https://gmplib.org/>`
- MPFR website, where to download MPFR: `<http://www.mpfr.org/>`

1.2 GMP & MPFR installation

You have already installed both on you own computer. That was rather easy, needing just: *configure* → *make* → *make check* → *make install*. Now on Euler you don't have writing permission everywhere nor is the cluster file system structured exactly the same way as a PC. Thus we can't always use the default path for the installation. Typing *configure -h* gives you the list of options you

can enter for *configure* command (which is the command which set up you paths depending on the machine you're using). So what I did was:

- First I made a *bin* directory and added directories for *GMP* and *MPFR* inside it.
  - → *cd*
  - → *mkdir bin*
  - → *mkdir bin/GMP bin/MPFR*
- Then I installed GMP:
  - → *configure - -prefix=$HOME/bin/GMP*
  - → *make*
  - → *make check*
  - → *make install*
- Finally I installed MPFR:
  - → *configure - -with-gmp=$HOME/bin/GMP - -prefix=$HOME/bin/MPFR*
  - → *make*
  - → *make check*
  - → *make install*

1.3 Compiling the code

I added a directory called *ensemble_SML_LFO_EULER* into the git repository. If you upload that into Euler, it should be possible to compile the code. If you look at the *makefile* you'll see that there is a bit of extra linking for the libraries, because they weren't in the default places etc. But before you can compile the code you also must load the Boost module. Typing *module avail* gives you the list of modules available. Typing *module load MODULE_NAME* allows to load the module. Typing *module - -help* gives you the help menu. Typing *module show boost/1.55.0* gives you the information about the Boost module and its location, which is needed for the *makefile* (I have already set it, but just to let you know how to find it). Now the compiling part itself is rather straight forward, you just type *make* as usual.

1.4 Runtime linking

Now as the libraries were not in the standard location, then it is necessary to also to make a *LD_LIBRARY_PATH* variable for your environment, so that the program could find the library during runtime. You can put it into to your *.bashrc* or *.bash_profile* file. Basically you just write down the paths to your *GMP* and *MPFR* libs (located inside the install directories). You'll find a copy of my *.bash_profile* file below.

```
# .bash_profile

# Get the aliases and functions
if [ -f ~/.bashrc ]; then
        . ~/.bashrc
fi

# User specific environment and startup programs

PATH=$PATH:$HOME/bin:$HOME/bin/GMP/include:$HOME/bin/MPFR/include

LD_LIBRARY_PATH=$LD_LIBRARY_BATH:$HOME/bin/GMP/lib:$HOME/bin/MPFR/lib

export PATH LD_LIBRARY_PATH
```

Code 1: My .bash_profile file (found in the home dir in Euler)