This is the code used to produce the "Evolutionary Origin of Hierarchy" paper, http://arxiv.org/abs/1505.06353

If you use this software in an academic articles, please use the following citation:

```
@article{DBLP:journals/corr/MengistuHMC15,
  author    = {Henok Mengistu and
               Joost Huizinga and
               Jean{-}Baptiste Mouret and
               Jeff Clune},
  title     = {The evolutionary origins of hierarchy},
  journal   = {CoRR},
  volume    = {abs/1505.06353},
  year      = {2015},
  url       = {http://arxiv.org/abs/1505.06353},
  timestamp = {Mon, 01 Jun 2015 14:13:54 +0200},
  biburl    = {http://dblp.uni-trier.de/rec/bib/journals/corr/MengistuHMC15},
  bibsource = {dblp computer science bibliography, http://dblp.org}
}
```

The code is based on the sferes framework. Sferes is a software framework for conducting experiments with Evolutionary Algorithms. The main advantages of the framework are that it is fast and fully supports parallel runs. This document explains how to install sferes and working with it. It can specifically be followed to reproduce the main results from the Evolutionary Origin of Hierarchy (EOH) paper.

Installing sferes

1) Get the sferes source code. https://github.com/henokyen/EOH
2) Extract the code to your Sferes project directory
3) cd to sferes
4) Two ways to configure sferes. NOTE: change “home” to the name of the root directory where you extracted the sferes code

   If the means of parallelization is MPI use this command to configure sferes

   ./waf configure --boost-include=/home/sferes/include/ --boost-libs=/home/sferes/lib/ --eigen2=/home/sferes/include/ --mpi=/usr/mpi/gcc/mlnx-openmpi-1.6.2/

   or your preferred means of parallelization is TBB, use this command to cofigure sefers

   ./waf configure --boost-include=/home/sferes/include/ --boost-libs=/home/sferes/lib/ --eigen2=/home/sferes/include/ --no-mpi –tbb=/apps/l_ics_2012.0.032/composer_xe_2011_sp1.6.233/tbb

   NOTE: the Evolutionary origin of hierarchy project currently runs with TBB

5) now let's build sferes with this command:

./waf build

6) Run the sferes tests to make sure everything is working:
./waf check

7) Compiling experiments. All experiments are placed in the folder:

/exp

to compile an experiment run the following command from:

./waf --exp NAME_OF_EXPERIMENT

For example to compile the main experiment from the EOH paper run the following command

./waf –exp modularity

8) Running experiments. You can find the executables in the following folder
/build/debug/exp/modularity

to run the PA treatment, run this executable: **andxorand_fg_pnsga_div**
to runt the P&CC treatment , run this executable: **andxorand_fg_onp_length_pnsga_pr100_div**

You can get more information/tutorials on how to use sferes from this site:
https://github.com/jbmouret/sferes2
If anything goes wrong please contact me: hmengist@uwyo.edu