

Galaxy Distribution Problem

October 15, 2021

Real data of 100000 galaxies and the same size of randomly positioned synthetic galaxies are given. By calculating the angles between each pair of real galaxies, each pair of real-random galaxies and each pair of random galaxies we can build histograms of the angle distributions. Based on these histograms we can measure the difference (denoted by ω) between the distribution of the real galaxies and synthetic galaxies. The results of our calculations are as many ω values as many bins we have in our histogram. If all ω values are in the range $[-0.5, 0.5]$ we have a random distribution of real galaxies.

Four different solution of the calculations will be given: one sequential and three parallel. The calculations were performed on Dione. Each folder of the repository contains a different solution of the galaxy distribution problem, except the common folder, which contains implementation independent functions (ex. angle distance formula, reading input files). Each solution has it's own c source, makefile, the outputted ω values, and some information regarding the program execution in the log file. The first 5 ω values are:

```
[randras@dione openmp]$ cat omega.out
0.00 : 2.366
0.25 : 1.744
0.50 : 1.418
0.75 : 1.215
1.00 : 1.087
```

Sequential Version

- run command:

```
srunk -N 1 -c 40 ./galaxy_sequential ../common/RealGalaxies_100k_arcmin.txt
../common/SyntheticGalaxies_100k_arcmin.txt omega.out >> log
```

- run time: 2157.6 secs

OpenMP

- run command:

```
srun -N 1 -c 40 ./galaxy_openmp ../common/RealGalaxies_100k_arcmin.txt  
../common/SyntheticGalaxies_100k_arcmin.txt omega.out >> log
```

- run time: 218.2 secs
- Number of threads = 40
- $S_{40} = 9.89$

to be continued...