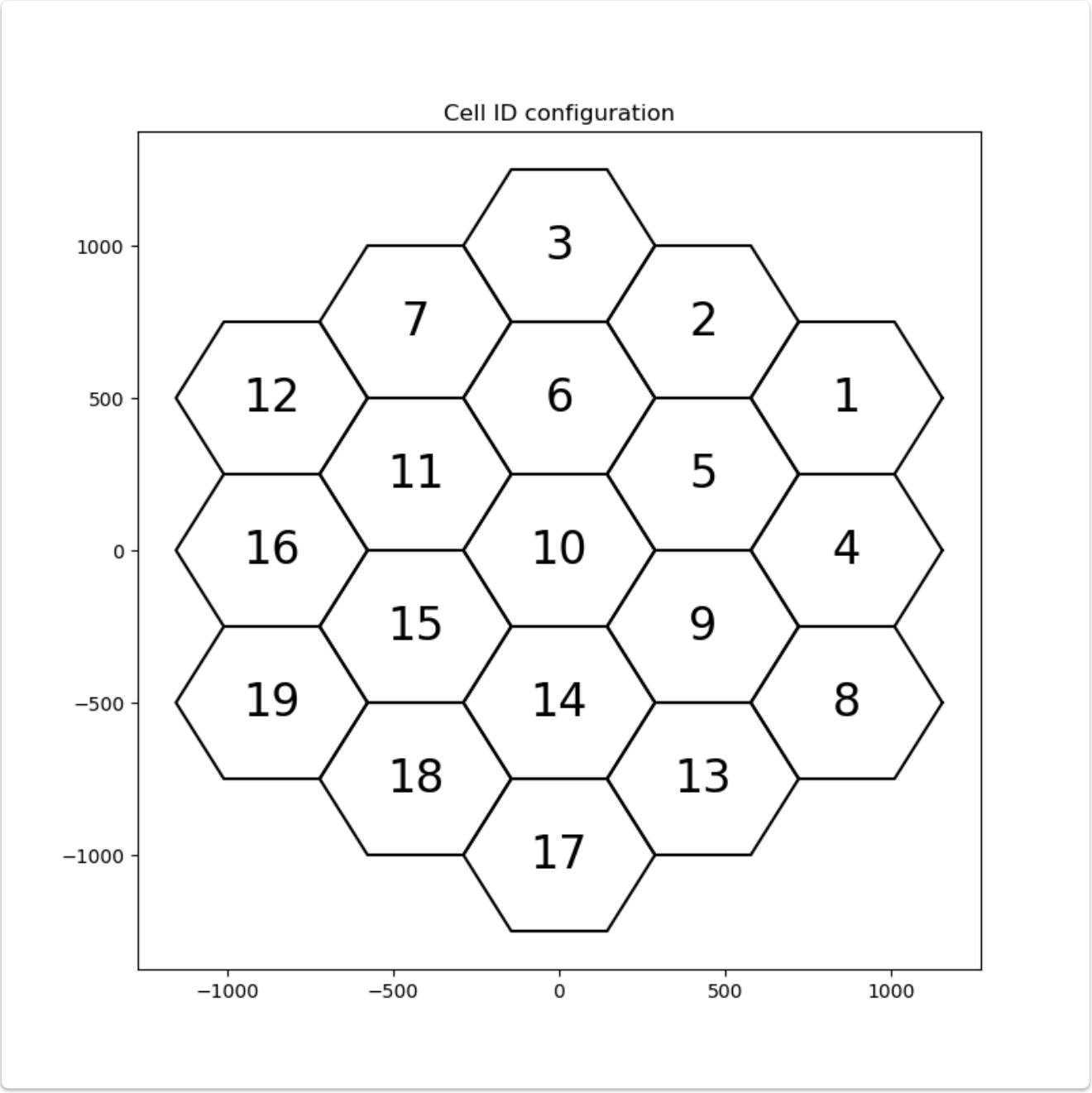
# Homework 3 Report

## A. Downlink

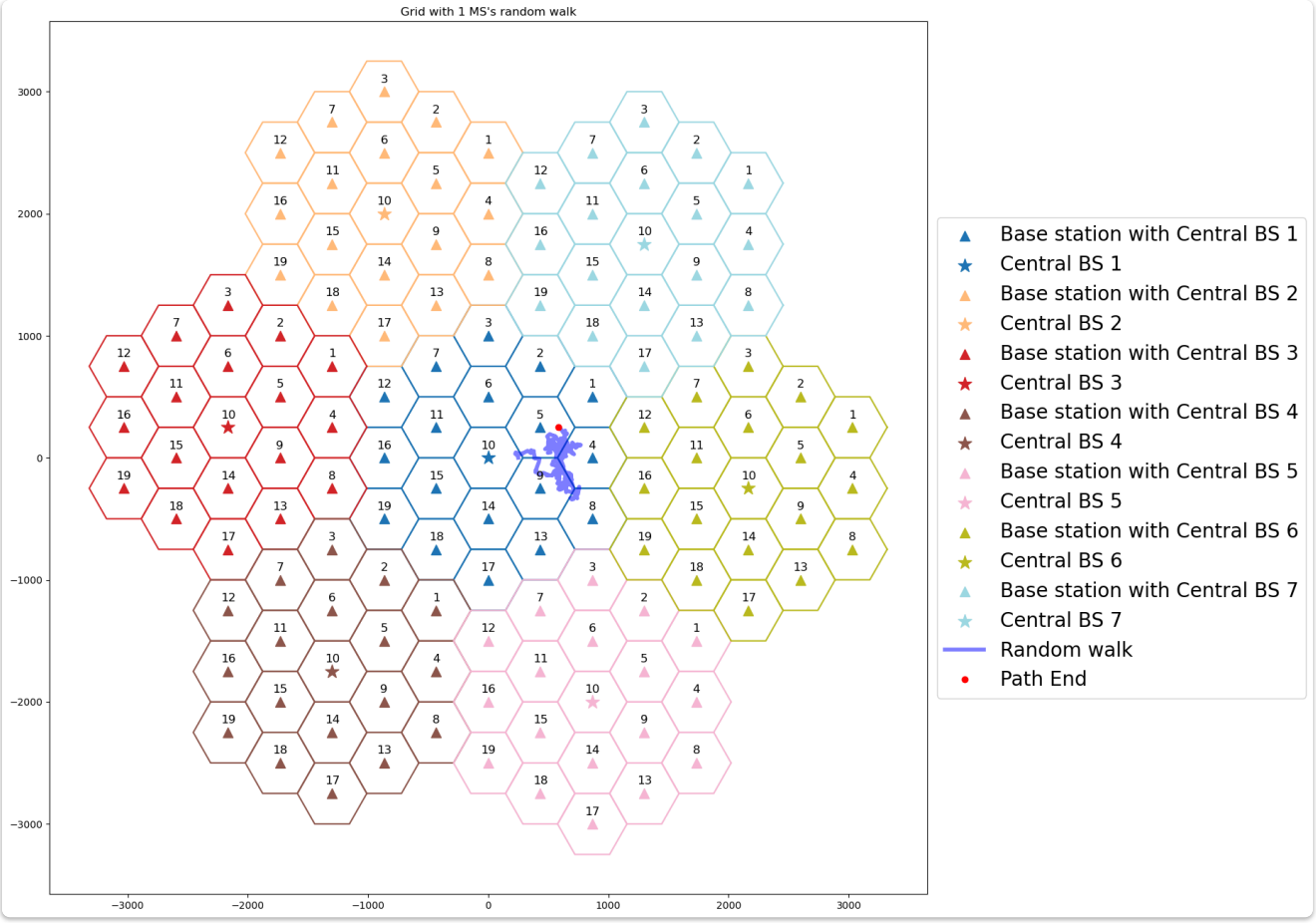
### A-1

I assigned the cell ID as follows:




### A-2

For convenience, I extended the original cell map like in figure 2. In other words, my simulation grid consists of 6 clusters, each cluster has a central BS at the cluster's center and there're total 19 BS along with their cells with ID from 1 to 19. Cell ID configuration is the same among all clusters. The graph with all clusters and the MS's random walk path is as below ( `dl_grid_with_walk.png` )




My criteria to the handoff events is SINR based.
For every second during the simulation time, I calculated the downlink SINR to the MS for every BS and **choose the best SINR** among all BS as the MS's new BS. If the new BS is different from the current BS, I records the handoff event in forms of `(time, old BS, new BS)`. The full list of handoff events will be saved to `dl_handoff.csv`.

### A-3

For the simulation in above graph, there were total 35 handoffs during simulation time.

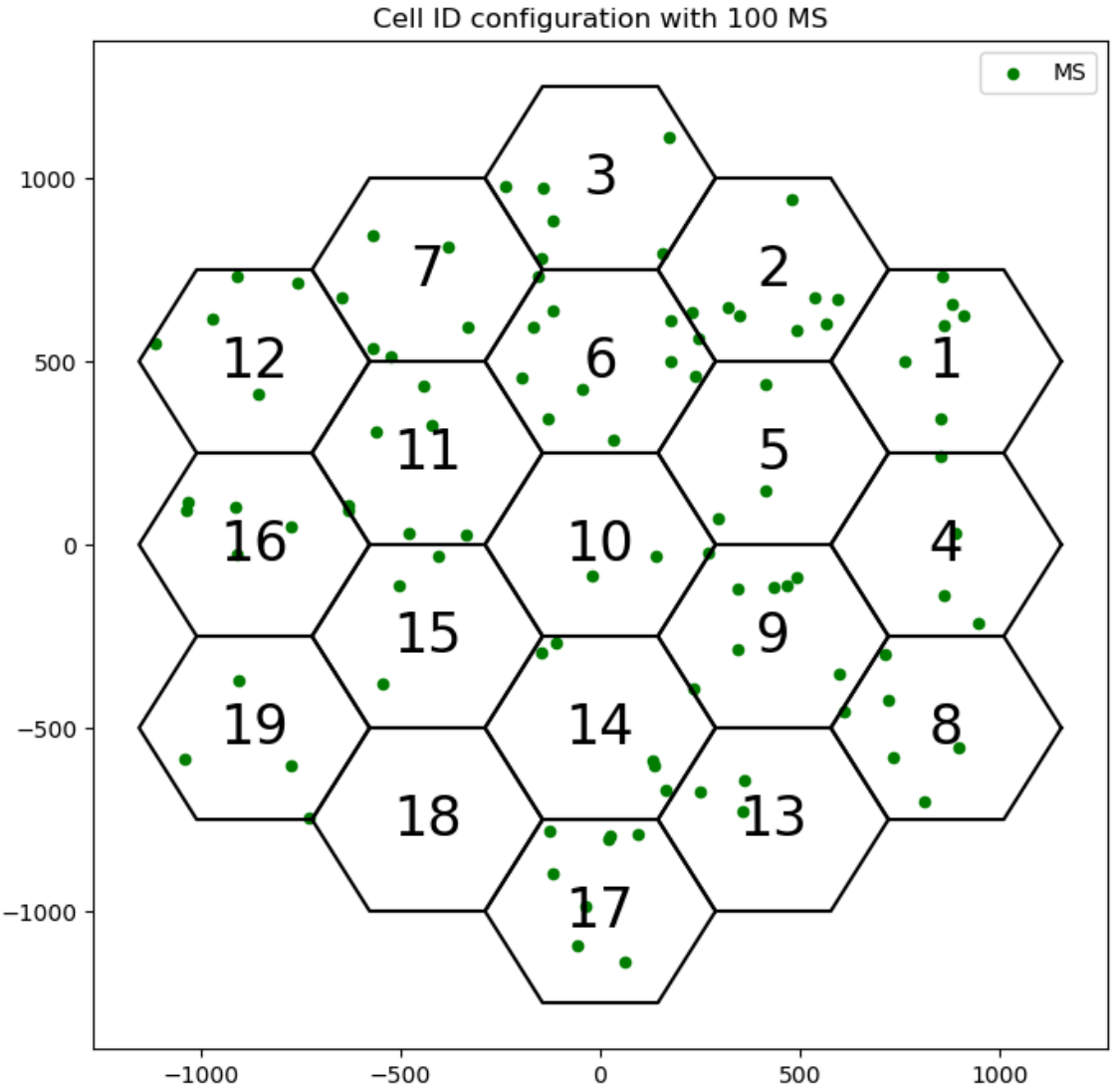
## B. Uplink - bonus

### B-1

The cell ID configuration is the same as in downlink.

### B-2

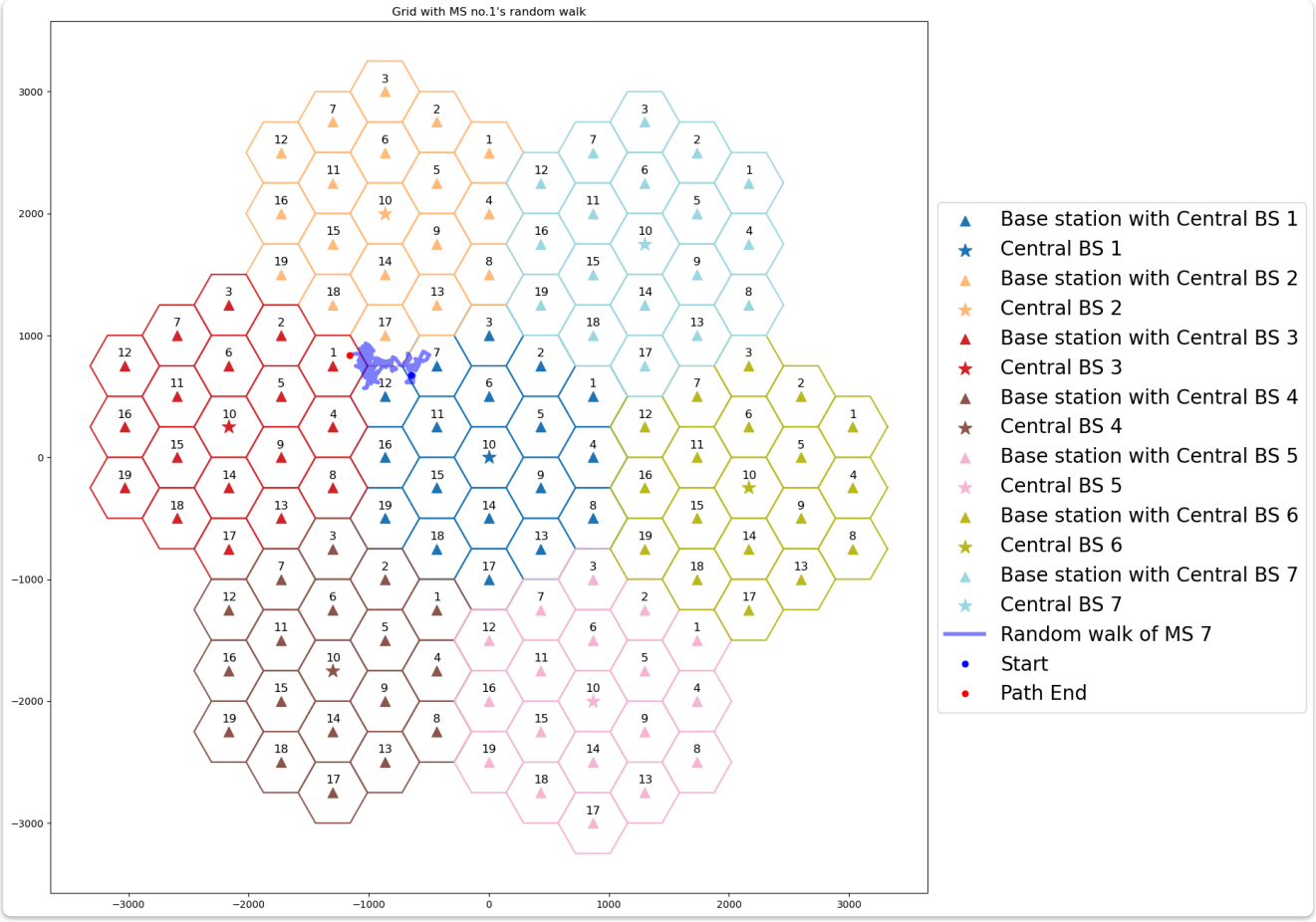
To uniformly decide the mobile devices location, first I choose one of the cell among all 19 cells uniformly, then I decide the initial location of that MS by rejection sampling. (i.e. I decide a location with the smallest rectangle that encloses the cell, repeat if the location do not fall inside the cell) The graph is as follows (`ul_msinit.png`)




## B-3

This problem forced us to use SINR-based criteria.
For every second during the simulation time, I basically calculates for every base station, the uplink SINR (i.e. S = the MS, I = other 99 MS) due to all 100 MS based on their current location. Then, I will choose the best SINR as the new BS for that particular MS, and if the new BS is different from the old one, record the handoff events in form of `(Time, MS, old BS, new BS)`. The full list of handoff events will be saved to `ul_handoff.csv`.

For reference, the graph below is a simulation with one of the MS (particularly, MS 7) path plotted.




## B-4

There were total 4358 handoffs during the simulation in the above graph.