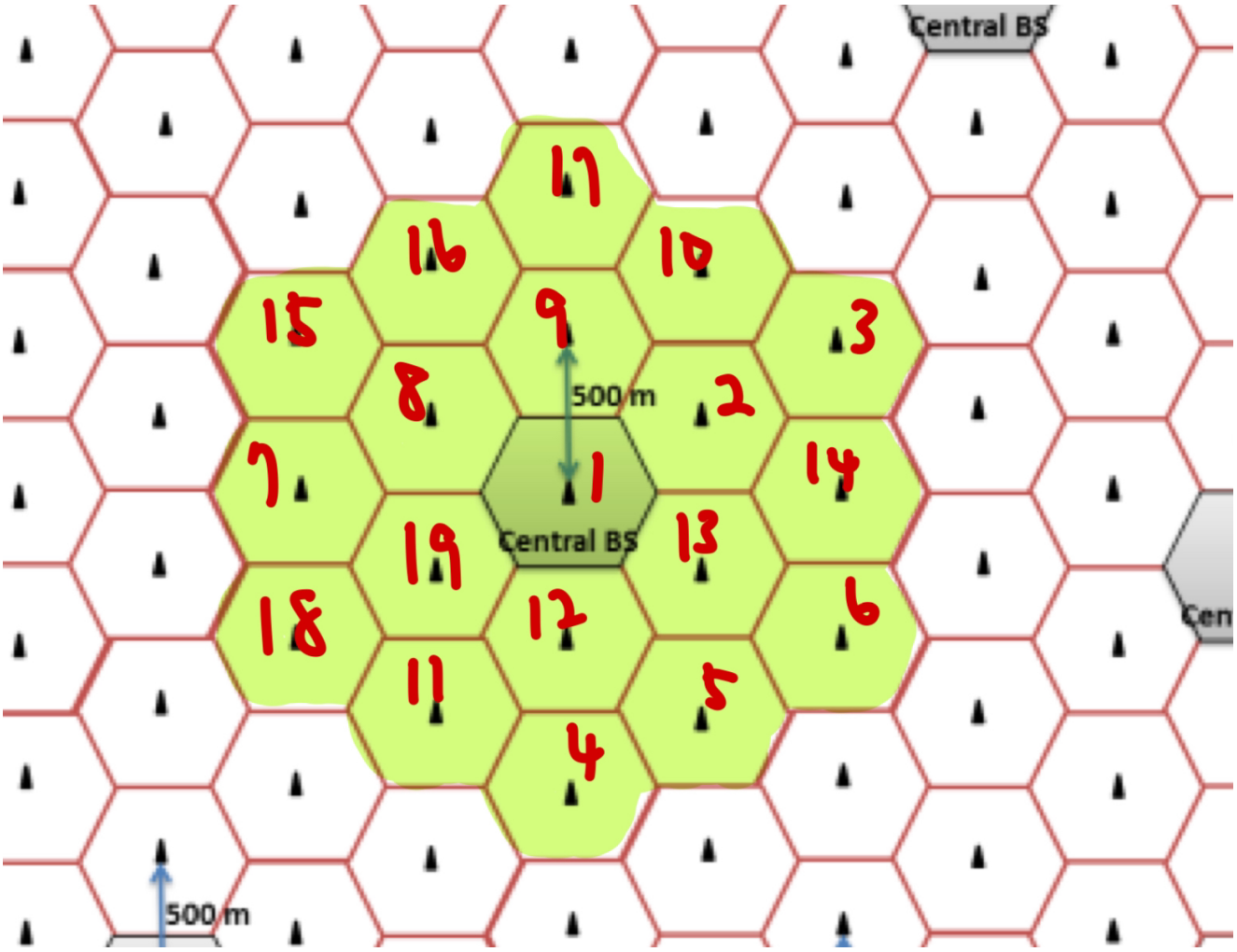
HW3 Report

Problem 1

1-1



1-2

- The list of all handoff events is saved in `./q1_handoffs.csv` as it is too long to fit in the report.
- The handoff criterion used in the simulation is SINR-based and is defined as follows:
  - For every mobile station ms, let $cell_t(ms)$ denote the cell where ms is located at time t.
  - For every cell c, define by $N(c)$ the set of 19 closest cells to c, including c itself.
  - Define the set of all considered (i.e., plotted) cells at time t:

$$S_t = \left(\bigcup_{c \in \Lambda} N(c) \right) \cup \left(\bigcup_{ms \in MS} N(cell_t(ms)) \right)$$

where Λ is the central 19 cells shown in Fig. 1 and MS is the set of all mobile stations (even though there is only one mobile station).

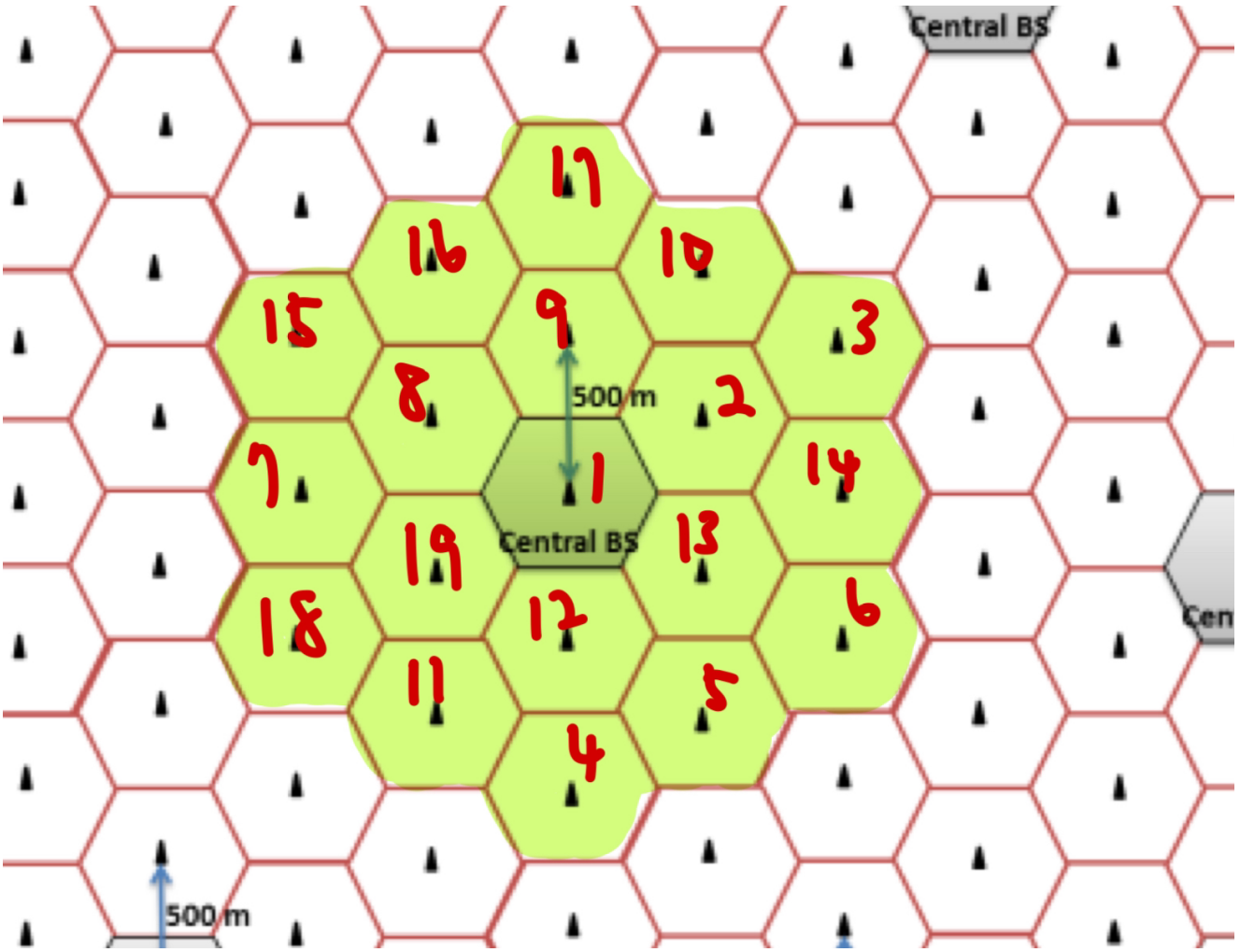
- At time t, for each mobile station $ms \in MS$, find the cell $c \in S_t$ such that the downlink SINR from the base station in c to ms is no less than the downlink SINR from the base station in any cell $c' \in S_t$ to ms. In cases where multiple cells c meet this condition, one is chosen arbitrarily.
- If the base station (BS) in c is the same as the BS ms was connected to at time $t-1$, no handoff is performed. (If $t = 0$, then connect ms to the BS in c.) Otherwise, perform a handoff from the previous connected cell to c.

1-3

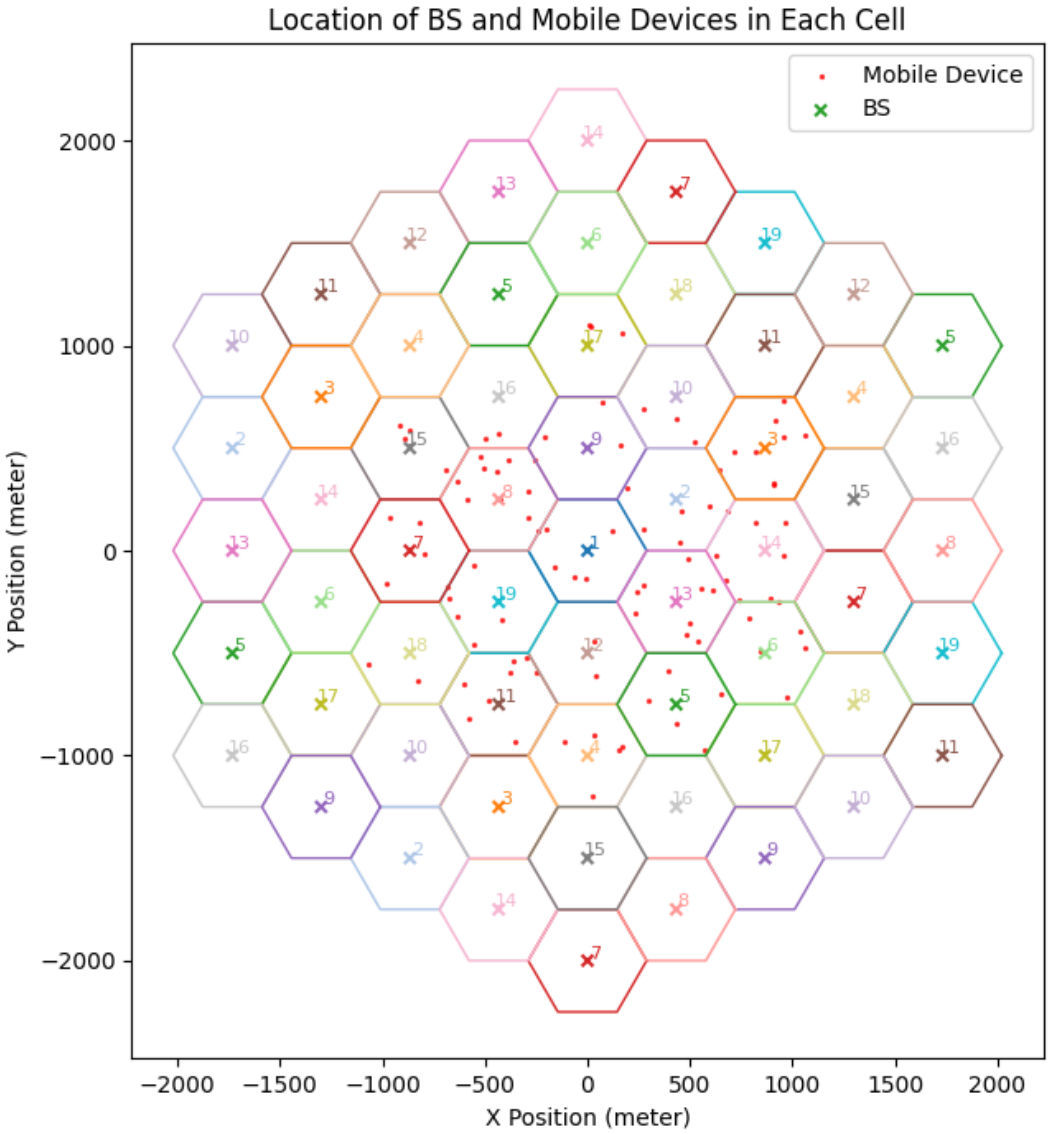
62 handoff events happened during the total simulation time.

Bonus

B-1


Central BS
17
16
10
15
9
3
500 m
8
2
7
1
14
Central BS
19
13
18
12
6
11
5
4
500 m

B-2



The algorithm used to randomly generate a point in the central 19 cells, which is assigned to a cell as its initial location:

```
RandomPoint()
    l := ISD/sqrt(3)
    cell_id <- uniformly choose an integer in [0, 18]
    cell_center := the coordinate of the BS in cells[cell_id]
    v1, v2 <- uniformly choose 2 distinct vectors from the list
                [(-l,0), (l/2,l/2*sqrt(3)), (l/2,-l/2*sqrt(3))]
    x1 <- uniformly choose a real number in [0, 1)
    x2 <- uniformly choose a real number in [0, 1)
    return cell_center + x1 * v1 + x2 * v2
    // the multiplication (*) here is scalar multiplication
```

In the pseudocode above, `ISD` represents the ISD (inter site distance) and `cells` is the

array of the central 19 cells.

B-3

- The list of all handoff events is saved in `./bonus_handoffs.csv` as it is too long to fit in the report.
- The handoff criterion used in the simulation is SINR-based and is defined as follows:
  - For every mobile station ms, let $cell_t(ms)$ denote the cell where ms is located at time t.
  - For every cell c, define by $N(c)$ the set of 19 closest cells to c, including c itself.
  - Define the set of all considered (i.e., plotted) cells at time t:

    $$S_t = \left(\bigcup_{c \in \Lambda} N(c) \right) \cup \left(\bigcup_{ms \in MS} N(cell_t(ms)) \right)$$

    where Λ is the central 19 cells shown in Fig. 1 and MS is the set of all mobile stations.
  - At time t, for each mobile station $ms \in MS$, find the cell $c \in S_t$ such that the uplink SINR from ms to the base station in c is no less than the uplink SINR from ms to the base station in any cell $c' \in S_t$. In cases where multiple cells c meet this condition (which should be extramely rare), one is chosen arbitrarily.
  - If the base station (BS) in c is the same as the BS ms was connected to at time $t-1$, no handoff is performed. (If $t = 0$, then connect ms to the BS in c.) Otherwise, perform a handoff from the previous connected cell to c.

B-4

5403 handoff events happened during the total simulation time.