

- Suppose 2 distinct roombas operate in the grid world in the figure. Two roombas can not occupy the same position simultaneously. At most 3 positions are dirty at any given time. A dirty position has an integer dirtiness level between 1 and 1 (inclusive). How many possible states are there in this problem? Provide an exact number if you can. Otherwise, provide an estimate that is as accurate as possible.

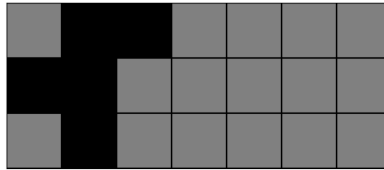


Figure 1: Roomba grid world. Black = wall, white = charging station, grey = empty cell.

- Suppose 1 distinct roombas operate in the grid world in the figure. 3 grid positions have a charging station. Each roomba has an integer power level between 0 and 2 (inclusive). At most 3 positions are dirty at any given time. A dirty position has an integer dirtiness level between 1 and 3 (inclusive). How many possible states are there in this problem? Provide an exact number if you can. Otherwise, provide an estimate that is as accurate as possible.



Figure 2: Roomba grid world. Black = wall, white = charging station, grey = empty cell.

- Suppose 1 distinct roombas operate in the grid world in the figure. 1 grid position has a charging station. Each roomba has an integer power level between 0 and 1 (inclusive). At most 1 position is dirty at any given time. A dirty position has an integer dirtiness level between 1 and 2 (inclusive). Every time a roomba moves one position, its power level decreases by 1 (down to 0). If its power level is 0, it cannot move. When a roomba is at a charging position, its power level is restored to 1. How many possible states are there in this problem? Provide an exact number if you can. Otherwise, provide an estimate that is as accurate as possible.

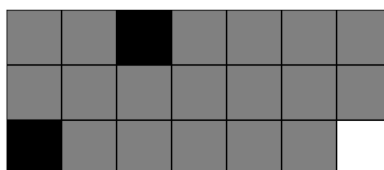


Figure 3: Roomba grid world. Black = wall, white = charging station, grey = empty cell.