AI assignment 1

Description of the task

- Actor should reach home
- Actor cannot go thru covid cells
- Actor can visit cell with mask or doctor and will be resistant to covid
- Covid can spread on 1 cell or 2 around itself
- Show shortest path

PEAS description

Agent type: actor

Performance measure: find minimal path to home

Environment: table with home, mask, doctor, and covid

Environment properties:

- **Partially observable** since agent can see only for cell it's moving
- **Deterministic** since agent can completely determine next state of environment
- **Sequential** because agent has memory about past actions to choose the best path\
- **Single-agent** since rules are not allowed to have more than one agent
- **Static** because environment cannot change itself
- **Discrete** since there are finite amount of moves
- **Known** because agent know the result of all it's actions

Algorithm description

First method

First method is pure brute force in other words this algorithm is looking for all path's and when it's finding it it's comparing it with the smallest found one and if new path smaller then the smallest smallest updating to current. Also this algorithm has one optimization - if current length of the path is bigger then length of smallest found current is deleting.

Second method

Second method is an implementation of A-star algorithm. Link (https://en.wikipedia.org/wiki/A*_search_algorithm)

Statistical analysis

I've generated random maps and counted for how long does each algorithm work. 9×9 map was working too long with my first method (I've waited about 20 minutes), so I decided to work with maps 5×5.

Here is time periods of working program to calculate random maps. FM is first method, Sm is second method.

Time of working in random maps

FM covid 1	FM covid 2	SM covid 1	SM covid 2
5.5805	7,7965	0,0032	0,0043
0.1272	0.7621	0,0129	0,0233
0.7134	1.7925	0.0114	0.0259
35.1078	62.2138	0.2102	0.2242
0.1016	19.8672	0.0139	0.0184
5.0738	0.7603	0.0021	0.0009

fm - first method, sm - second method, c1 - covid spread for 1 cell, c2 - covid spread for 2 cells

$$\mu_{fmc1} = \sum_{i}^{N} \frac{x_i}{N} = \frac{46.7043}{6} = 7.7841$$

$$\mu_{fmc2} = \sum_{i}^{N} \frac{x_i}{N} = \frac{93.1924}{6} = 15.532$$

$$\mu_{smc1} = \sum_{i}^{N} \frac{x_i}{N} = \frac{0.2537}{6} = 0.4228$$

$$\mu_{fsmc2} = \sum_{i}^{N} \frac{x_i}{N} = \frac{0.297}{6} = 0.0495$$

$$s_{fmc1} = sqrt[\Sigma(x_i - \mu)^2/N] = 12.4259$$

$$s_{fmc2} = sqrt[\Sigma(x_i - \mu)^2/N] = 21.920$$

$$s_{smc1} = sqrt[\Sigma(x_i - \mu)^2/N] = 26.6229$$

$$s_{smc2} = sqrt[\Sigma(x_i - \mu)^2/N] = 0.0786$$

$$t = \frac{\mu_{fmc1} - \mu_{fmc2}}{s/\sqrt{6}}$$

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{s_{\bar{x}_1 - \bar{x}_2}}$$

T-value for fmc1 and smc1 = 0.6772

T-value for fmc2 and smc2 = 1.7301

From t-test we can see that there is not significant difference between the means of two groups

min values: fmc1 = 0.1016, fmc2=0.7603, smc1=0.0021, smc2=0.0009

max values: fmc1 = 35.1078, fmc2=62.7603, smc1=0.2102, smc2=0.2242

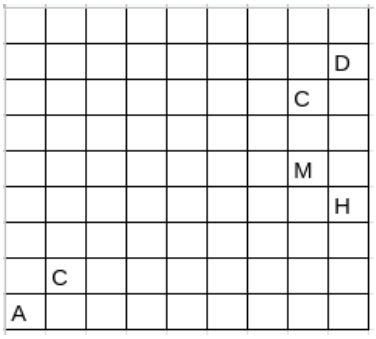
Standard deviation formula:

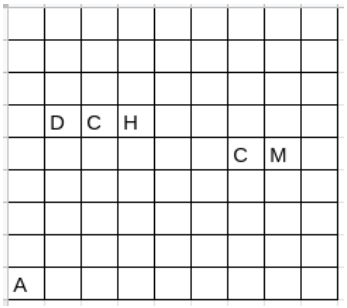
$$S = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2}.$$

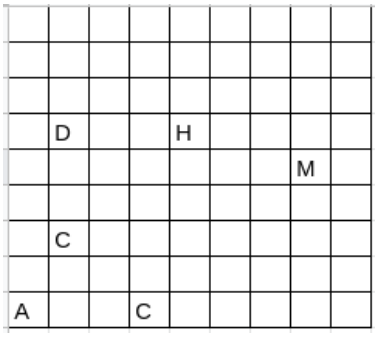
Standard deviations: fmc1 = 13.6119, fmc2 = 24.0122, smc1 = 24.0122, smc2 = 0.0861

Maps that is impossible to solve

I created maps that is impossible to solve, and also here is one generated. In all of this cases actor cannot reach mask or doctor or home.







First algorithm was working for a long time of actor had ways to go. If actor was blocked each of the algorithm's worked fast, since there are no ways to escape from covid zone.