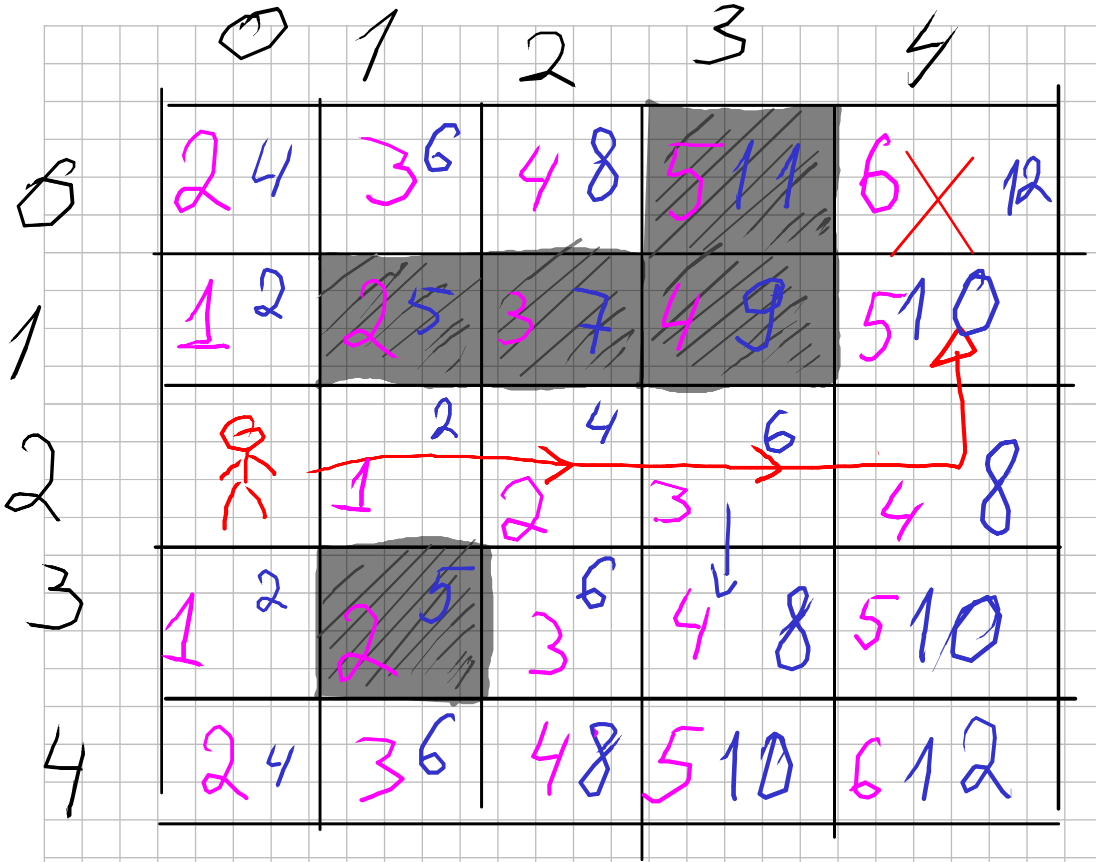
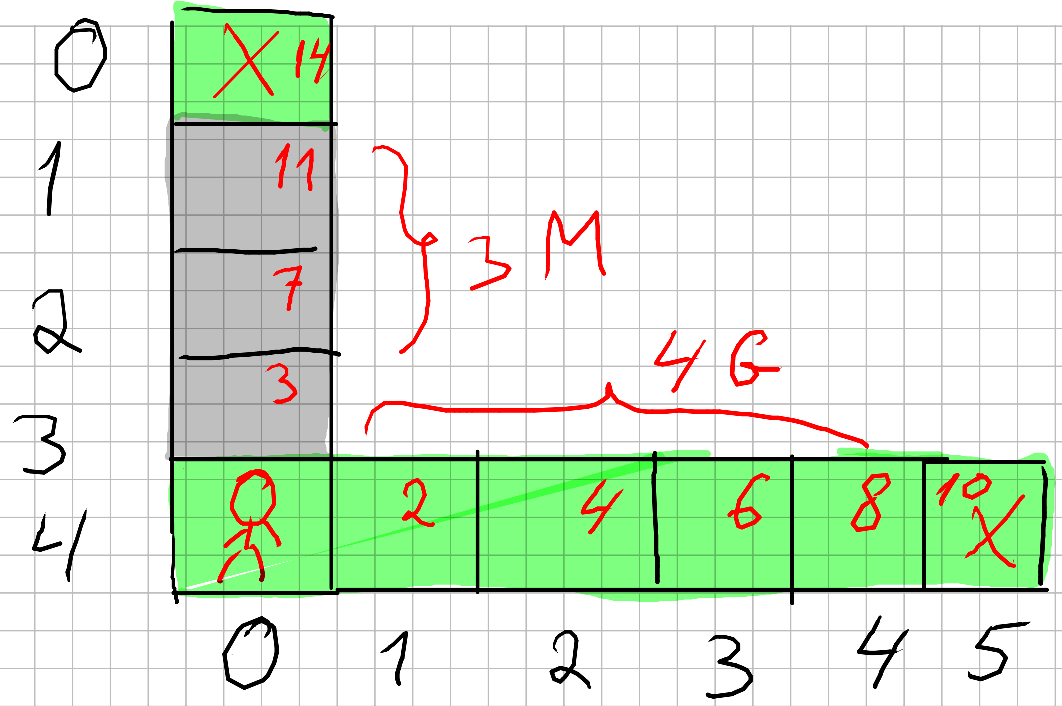


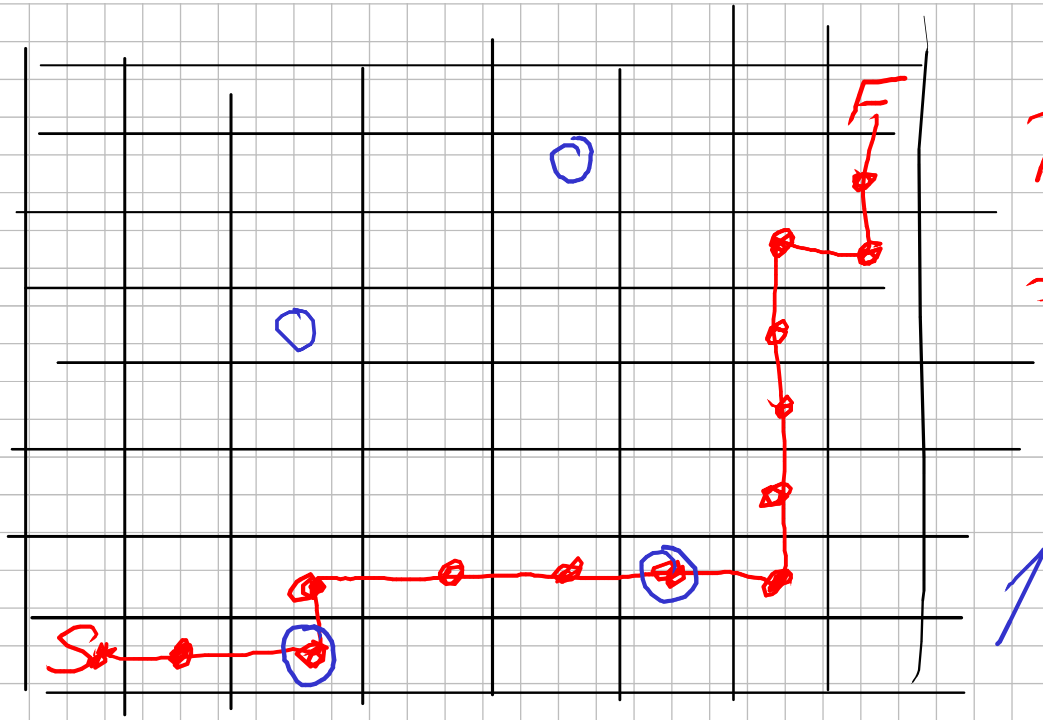
G - G = 2

G - M = 3

M - M = 4



0
1
2
3
4
14
11
7
3
3M
4G
2
4
6
8
10
0
1
2
3
4
5



Total cost =

$= \sum \delta(i, i+1) =$

$= \sum$ ter. cost

$14 \cdot 2 = 28$

$\delta(i, i+1) =$ terrain cost from i to $i+1$

$$\text{terrain\_cost} + a \cdot r + b \cdot \text{noise}$$

$$\underbrace{\left[\sum_{\text{trajectory}} a \cdot r\right]}_{\text{общий вклад}}$$

$$r = \begin{cases} 0 & \text{if node} \notin G \\ 1 & \text{if node} \in G \end{cases}$$

общий вклад

комп. ar на траектории

$$\sum_{\text{trajectory}} a \cdot r = a \cdot \sum_{\text{traj.}} r = \star$$

There are $|G|$ goals on the map in total

Any trajectory w/o loops visits no more than all Goals.

$$0 \leq \star \leq a \cdot |G|$$

Even if I can't compute (*) in advance because I don't know what trajectory we end up with, I can still assess lower and upper boundaries for the value.

terrain_cost + a *r + b * noise ← for each transition

Total Cost + Total Reward + Total Noise ← for the whole trajectory

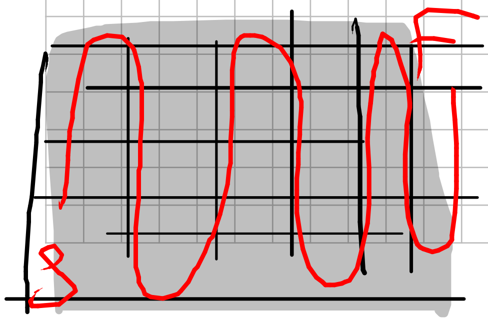
$$0 \le \text{Total Cost} = \sum_{\text{trajectory}} \text{terrain cost} =$$

$$= tc(0,1) + tc(1,2) + \dots + tc(n-1,n)$$

$n = |\text{traj.}|$

number of transitions

$$\le \text{Max}[\text{terrain\_cost}] \cdot \text{Max}[\text{trajectory length}] =$$



$$= 4 \cdot |\text{Map}|$$

even though the formula is Total Cost + Total Reward + Total Noise, we mainly optimize the Total Cost component (because we are looking for the shortest path).

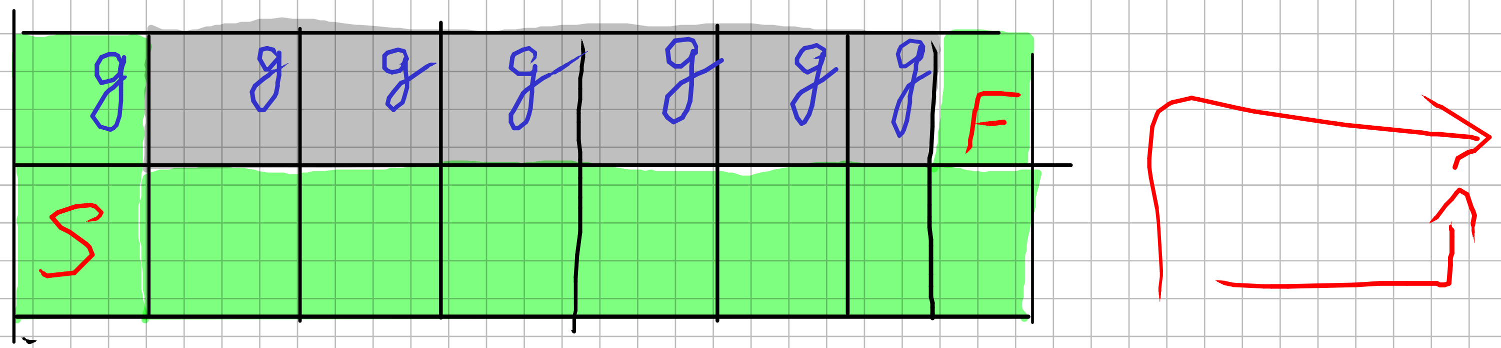
e.g. suppose we have two trajectories A and B.

Total Cost for A is 82

Total Cost for B is 83 $\Delta = 1$

A doesn't visit any goals, but B visits every single goal.

Regardless, we choose A over B because A is shorter.

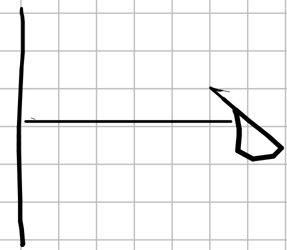


Total Cost is a descrete value with a step of "1".

So how do we choose formula for Total Reward so that it doesn't mess up priority over Total Cost.

$$V_1 = 82 + \theta$$

$$V_2 = 83 - a \cdot |G|$$



$$V_1 < V_2$$

$$82 + \theta < 83 - a \cdot |G|$$

$$a \cdot |G| < 1$$

$$a < \frac{1}{|G|}$$

$$a = \frac{1}{2|G|}$$

$$a = \frac{1}{|G|+1}$$

random variable that is uniformly distributed

$$\text{Total Noise} = \sum_{\text{traject}} b \cdot U[-1;1] =$$

$$= \underbrace{b\,U[-1;1] + b\,U[-1;1] + \ldots + b\,U[-1;1]}_{n = |\text{trajectory}| \text{ terms in total}} =$$

$$= b \cdot u_1 + b \cdot u_2 + \ldots + b \cdot u_{|traj|} =$$

$$= b \cdot \left(u_1 + u_2 + \ldots + u_{|traj|} \right) = (*)$$

$-1 \le u_1 \le 1$ $\quad$ $-1 \le u_1 \le 1$ $\quad$ $-1 \le u_{traj} \le 1$

$$b\left(-1 + (-1) + \ldots + (-1)\right) \le (*) \le b\left(1 + 1 + \ldots + 1\right)$$

$$-b \cdot |\text{traject}| \le (*) \le b \cdot |\text{traject}|$$

$$\sum_{i=1}^{30} \Longleftrightarrow 1 \leq i \leq 30$$

$$\sum_{i \in \{1..30\}} \Longleftrightarrow 1 \leq i \leq 30$$

$$\sum_{\{1..30\}} \Longleftrightarrow 1 \leq i \leq 30$$

$| \cdot |$ — notation for 'norm'

'norm' is numeric characteristic of some object

$\forall x, y, |\cdot| \hookrightarrow$

$|x| + |y| \geqslant |x+y|$

Examples:

norm for numbers: module, absolute value

$|-2{,}8| = 2{,}8$

norm for vectors: length, Pythagoras theorem

$V = (1, 3, -2)$; $|V| = \sqrt{1^2 + 3^2 + (-2)^2}$

norm for sets: number of elements (in case set is finite)

$S = \{\text{"a"}, \text{"z"}, \text{"y"}\}$ $\quad |S| = 3$ $\quad S + P = \{\text{"a"}, \text{"b"}, \text{"z"}, \text{"y"}\}$

$P = \{\text{"b"}, \text{"a"}\}$ $\quad |P| = 2$ $\quad |S+P| = 4 \leqslant |S| + |P|$