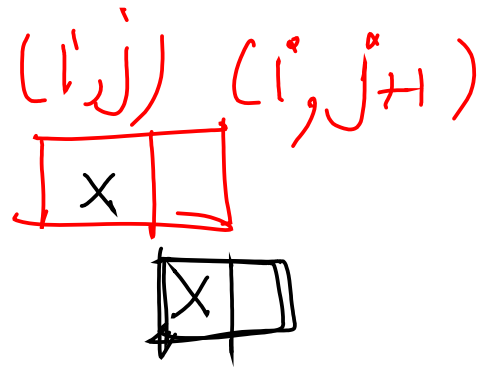
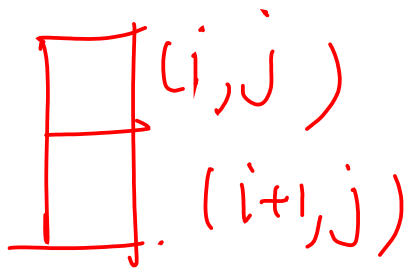
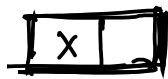
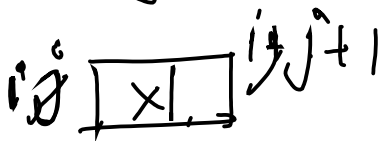


- ① move
- ② position
- ③ by min and
- ④

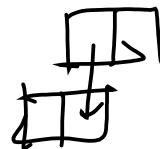


H2 right

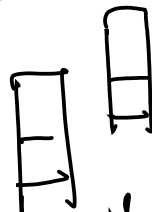


$i, j+1$
 $i, j+2$
tail

let



head



up-head

var-tail

(3,5) ✓

(4,5) ✓

(3,3) ✓

(3,4) ✓

(2,3) ✓

(3,3) ✓

(2,2) ✓

(2,3) ✓

(2,4) ✓

(i, j)

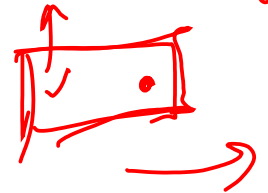
$m_{ijt} = 1$

m_{351}

m_{452}

m_{333}

must $p_{i,j-1,h}$ → right



Boolean

1) Moves

m_{ijt}

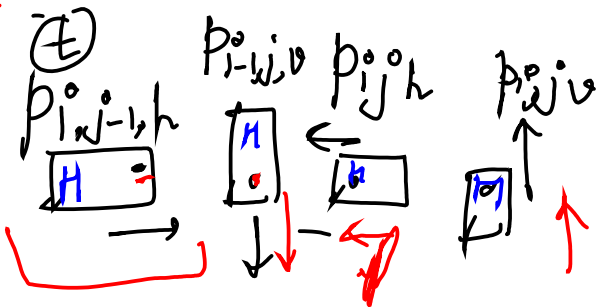
2) pos.

p_{ijh}

p_{ijv}

i, j

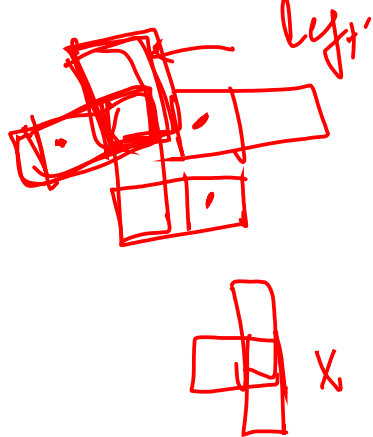
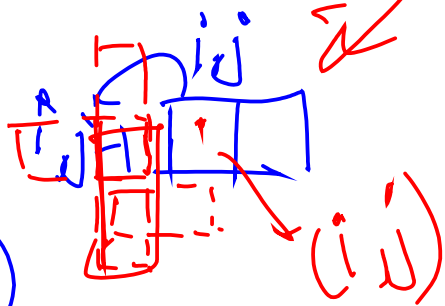
x_{ij}



if move done $(m_{ijt} \wedge p_{ijh}) \rightarrow (\sim p_{ijh} \wedge p_{i,j-1,h})$

Check (?)

①



Move

Car orientation

Checks

m_{ijt}

p_{ijh}

$\sim x_{ij-1}$

$\sim p_{i, j-2, h}$

$\sim p_{i-1, j-1, h}$

$\sim p_{i, j+1, h}$

$\sim p_{ijh}$

$p_{i, j-1, h}$

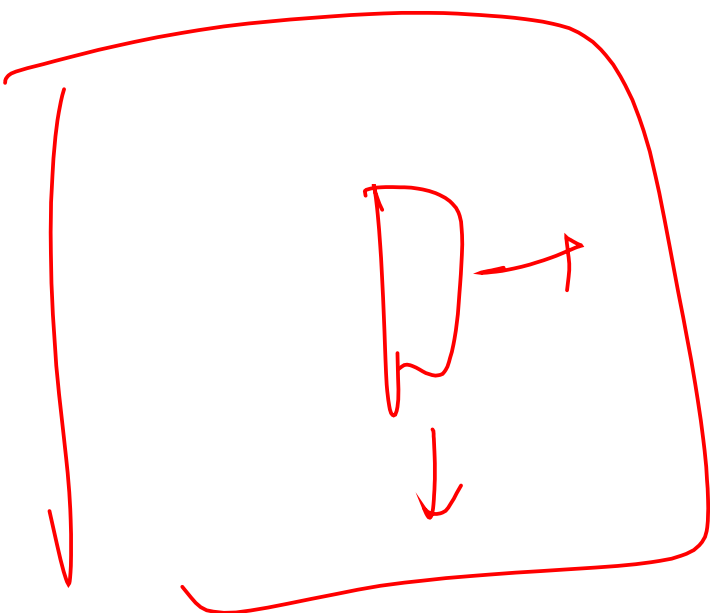
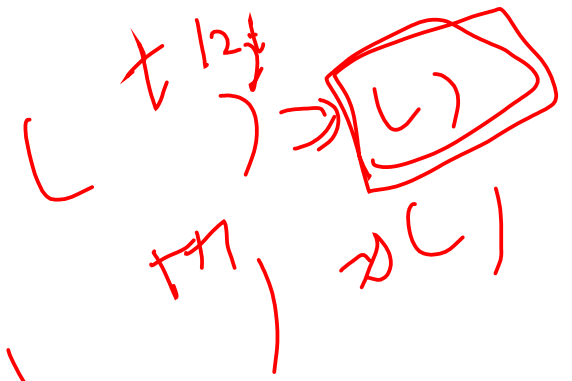
② one & only one move

$\forall i, j, h, t \quad m_{ijt} = 1$

unique
 $\sum p_i = 1$

δ_i (?)

③



④



#

mit \rightarrow punkt \rightarrow punkt(t+1)

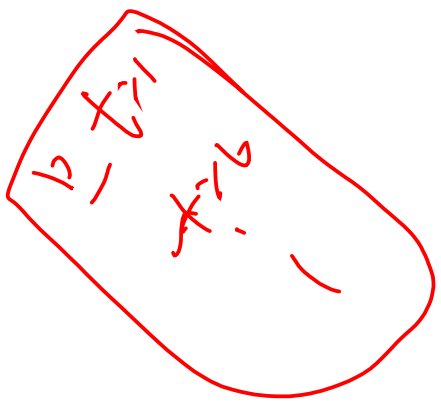
#



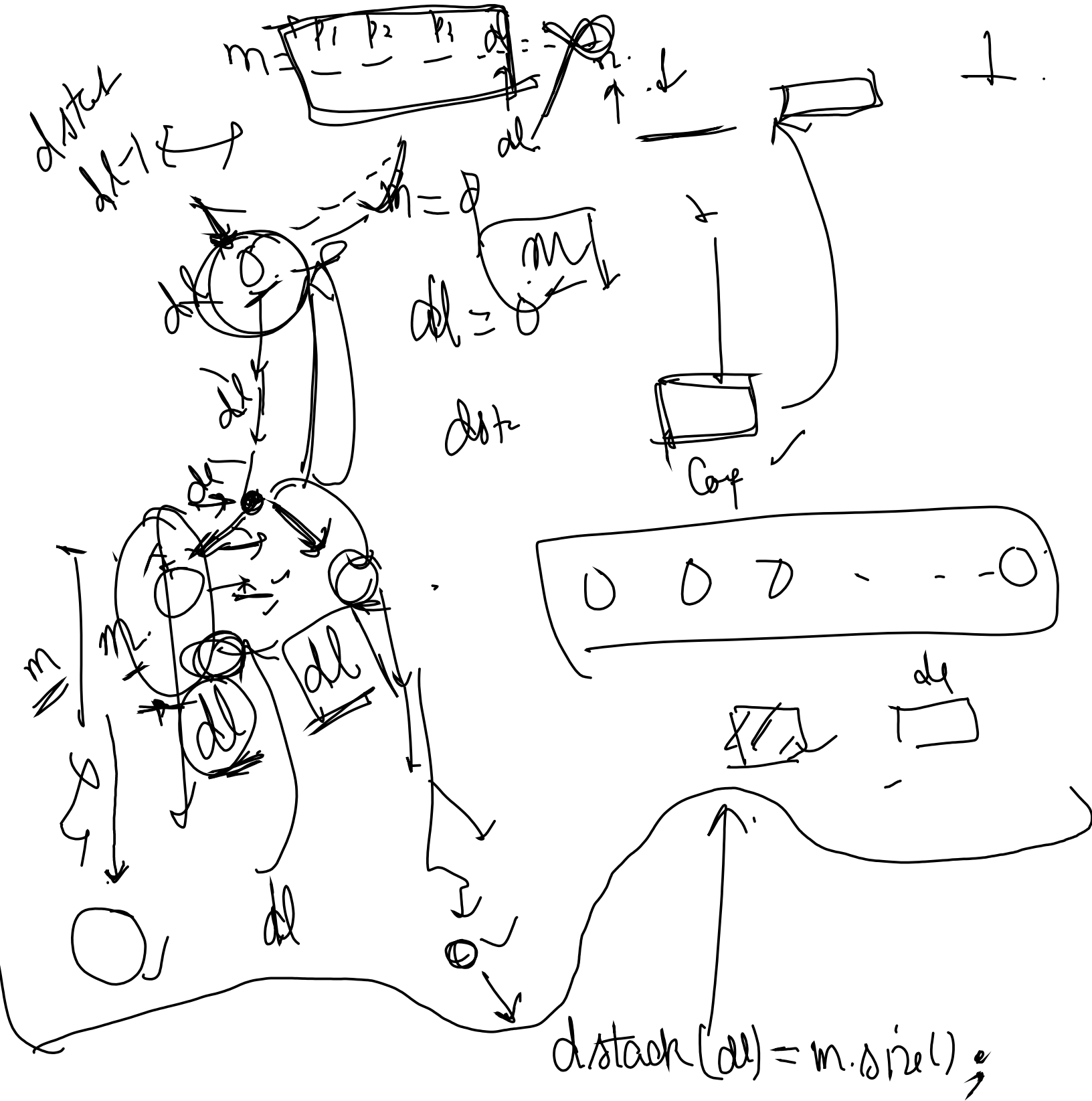
n^4

n^2

mit



(ii) $n^2 \times n \times$
 $n \sim 100$
 $= 10^2 \times 10 \times 100$
 $= 10^5$



①

| | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|----------|--------------|---|---|---|
| 1 | | | X | v | | |
| 2 | | γ | γ | v | | v |
| 3 | | X | h | h | | v |
| 4 | | | | | | |
| 5 | | | | | | |

$(3,5) \downarrow$

~~$(4,5)$~~ \downarrow

$$m_{35} = 1$$

$$m_{352} = 0$$

$$m_{451} = 0$$

$$m_{452} = 1$$

\downarrow

\downarrow

\downarrow

~~005, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100~~

~~152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200~~

~~152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200~~

x_j

(ρ, ν)

$hijt$

$t < l$

~~sin~~
0.15x

~~hijt~~

h_{11}, h_{12}, \dots

u

m_{12}, m_{12}, \dots

m_{23}, \dots

r_{11}, r_{12}, \dots

x_{11}, x_{12}, \dots

t_{11}, t_{12}, \dots

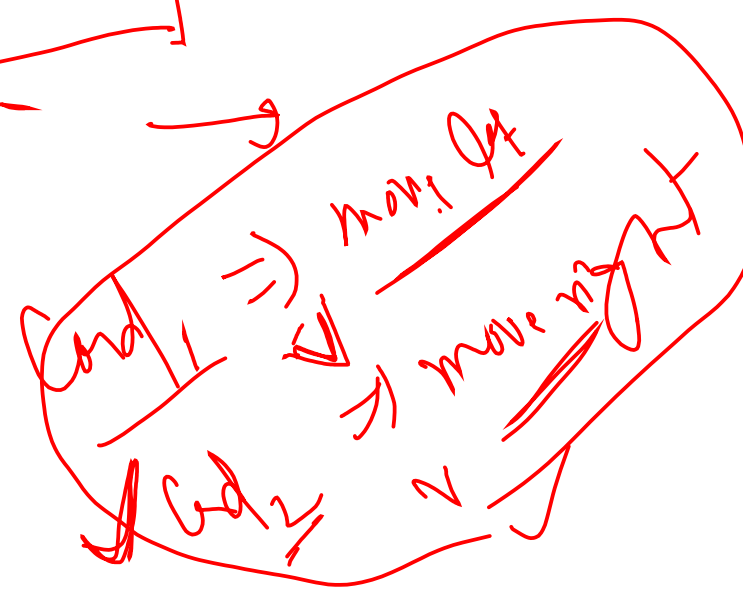
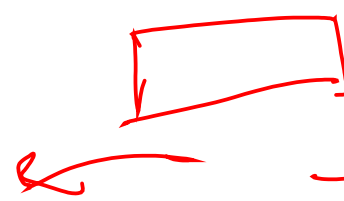
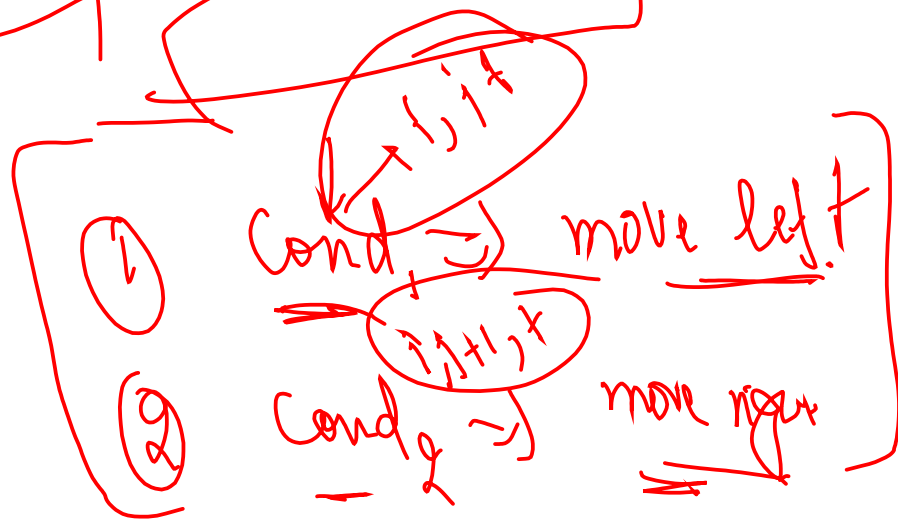
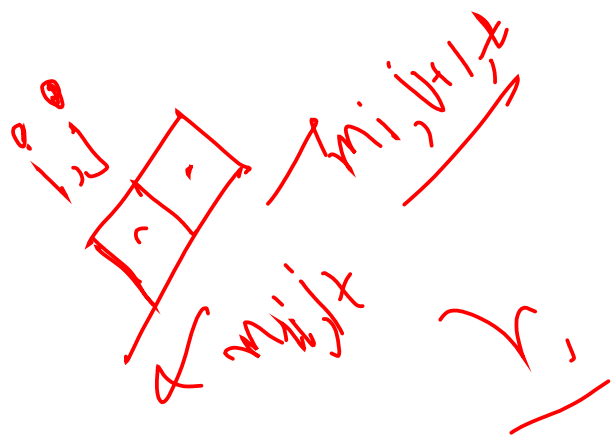
~~sin~~

~~set~~

Cond \rightarrow move



mid



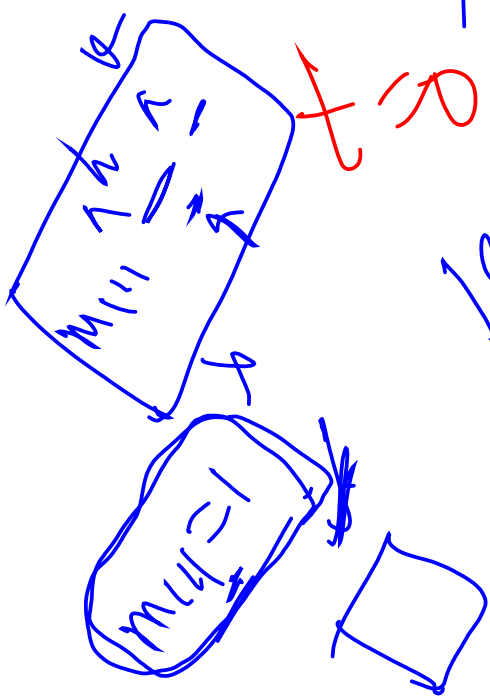
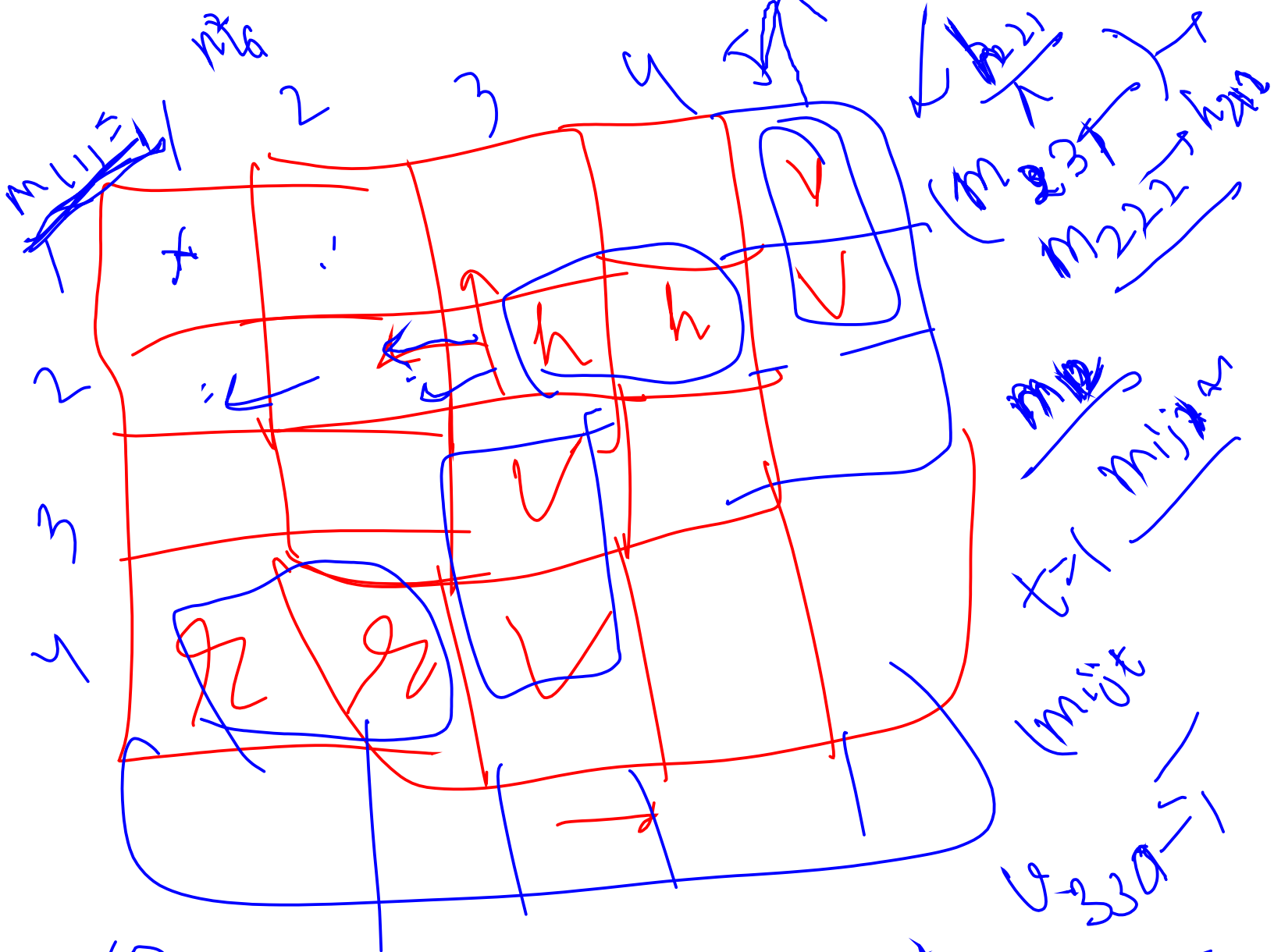
n^2

n

100

104

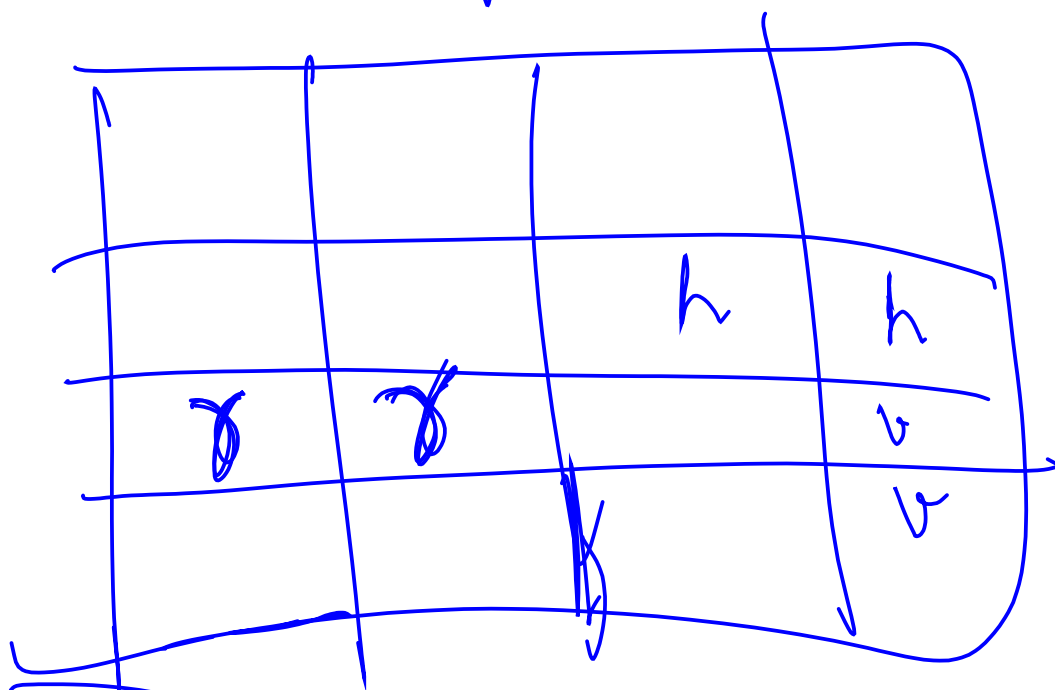
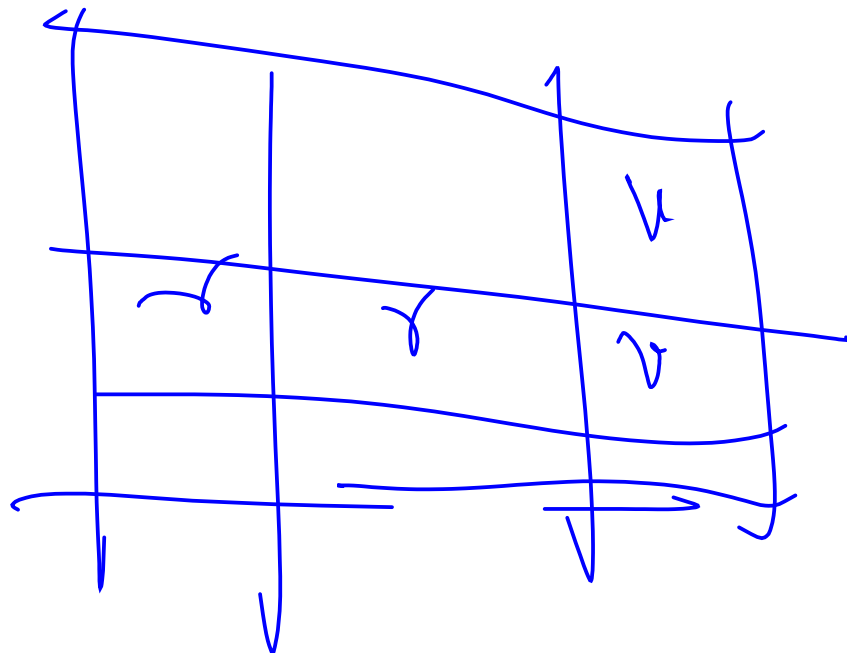
105-106



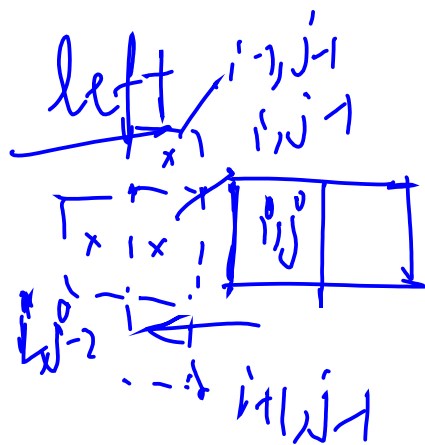
$h_{150} = 1$
 $h_{230} = 1$

$h_{4110} = 1$

$m_{111} \rightarrow h_{111}$
 $m_{112} \rightarrow h_{112}$
 $m_{113} \rightarrow h_{113}$
 $m_{114} \rightarrow h_{114}$
 $m_{115} \rightarrow h_{115}$
 $m_{116} \rightarrow h_{116}$
 $m_{117} \rightarrow h_{117}$
 $m_{118} \rightarrow h_{118}$
 $m_{119} \rightarrow h_{119}$
 $m_{120} \rightarrow h_{120}$
 $m_{121} \rightarrow h_{121}$
 $m_{122} \rightarrow h_{122}$
 $m_{123} \rightarrow h_{123}$
 $m_{124} \rightarrow h_{124}$
 $m_{125} \rightarrow h_{125}$
 $m_{126} \rightarrow h_{126}$
 $m_{127} \rightarrow h_{127}$
 $m_{128} \rightarrow h_{128}$
 $m_{129} \rightarrow h_{129}$
 $m_{130} \rightarrow h_{130}$
 $m_{131} \rightarrow h_{131}$
 $m_{132} \rightarrow h_{132}$
 $m_{133} \rightarrow h_{133}$
 $m_{134} \rightarrow h_{134}$
 $m_{135} \rightarrow h_{135}$
 $m_{136} \rightarrow h_{136}$
 $m_{137} \rightarrow h_{137}$
 $m_{138} \rightarrow h_{138}$
 $m_{139} \rightarrow h_{139}$
 $m_{140} \rightarrow h_{140}$
 $m_{141} \rightarrow h_{141}$
 $m_{142} \rightarrow h_{142}$
 $m_{143} \rightarrow h_{143}$
 $m_{144} \rightarrow h_{144}$
 $m_{145} \rightarrow h_{145}$
 $m_{146} \rightarrow h_{146}$
 $m_{147} \rightarrow h_{147}$
 $m_{148} \rightarrow h_{148}$
 $m_{149} \rightarrow h_{149}$
 $m_{150} \rightarrow h_{150}$

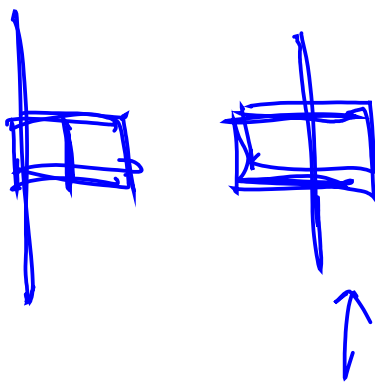


$l=5$



$\forall i, j$

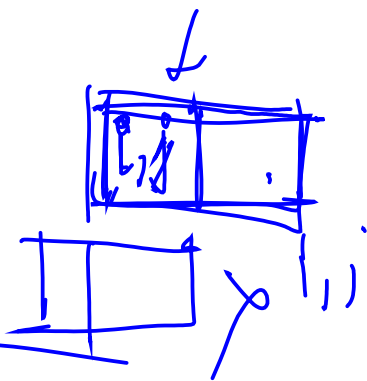
$$\left(m_{ij,t} \wedge h_{ij,t} \wedge h_{i,j-2,t} \wedge v_{i-1,j-1,t} \wedge v_{i,j-1,t} \right)$$



$$\begin{matrix} \downarrow \downarrow \\ (h_{i,j-1,t+1}) \end{matrix}$$

$$h_{ij}$$

W \rightarrow no eye.



$$\begin{aligned} & (\sim m_{ij,t} \wedge h_{ij,t} \wedge h_{ij,t}) \\ & (m_{i,j+1,t} \wedge h_{i,j+1,t}) \end{aligned}$$

h_{ij}
h_{ij}

$h_{ijt} \rightarrow 3 \times 3$

$\checkmark \Leftrightarrow \checkmark$

mijk

$a \stackrel{\star}{=} b$
 $a \wedge c \Leftrightarrow b$

| a | b | c |
|---|---|-----|
| 1 | 1 | 1 |
| 0 | 0 | 0/1 |
| - | - | - |

2 moves

9, 18

| | | | |
|---|---|---|---|
| | 0 | 3 | 2 |
| 3 | h | h | |
| | | | v |
| 2 | x | x | v |

$h_{ijt} \wedge m_{ijt} \Leftrightarrow h_{i,j-1,t+1}$
 m_{131}

Soln
 $m_{231} = 1$
 h_{111}
 v_{131}
 x_{311}
 m_{322}
 x_{322}
 m_{111}

m_{211}

m_{221}

m_{231}

m_{311}

m_{321}

m_{331}

True

h_{110}

v_{230}

x_{310}

$m_{211} = 1$
 $h_{i,j-1,t+1}$
 $t-1$
 m_{ij}
 v_{23}
 m_{23}

m_{111} wall x, m_{121} ,

$$m[i][j][t]$$

$$m_{i,j,t}$$

$$m_{123}$$

$$h \sim m \xrightarrow{nc} p$$

$$m \xrightarrow{h} b$$

$$m(\Rightarrow) p$$

$$b \oplus \downarrow$$

$$m \Rightarrow \underbrace{c^n}_{\neq} \text{ pos.}$$

$$\perp$$

$$\perp$$

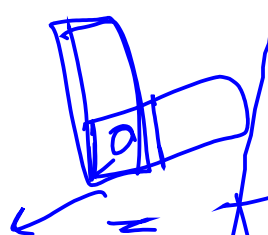
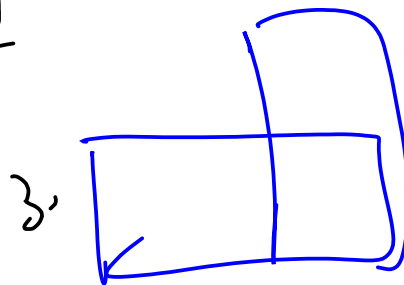
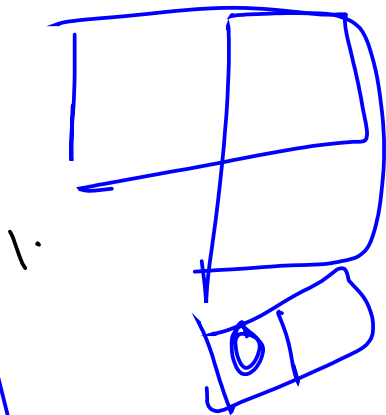
$$m=1 \quad c=1 \quad p=1$$

$$m=0$$

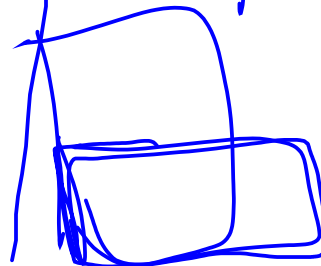
$$\text{pos} =$$

$$a \Leftrightarrow b \quad (a \Rightarrow b)^{\wedge} (b \Rightarrow a)$$

$H_2, v_2 - y$

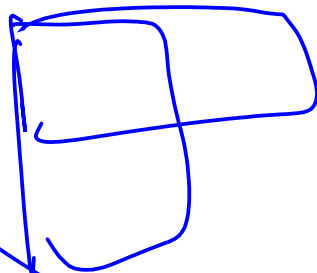


4.



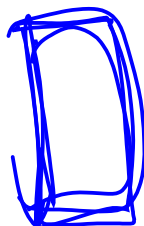
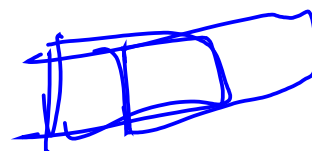
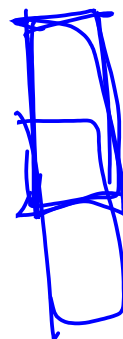
Walls

2.

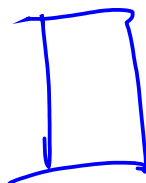


v_1, v_2

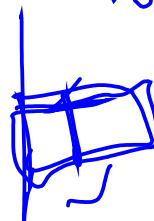
H_2/m



(new area)



$M_{ij} \Rightarrow \text{per-yr}$



~~per-yr~~
Colliding

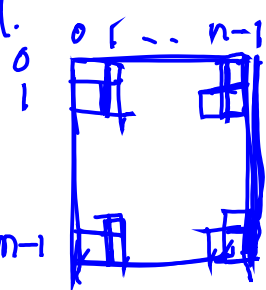
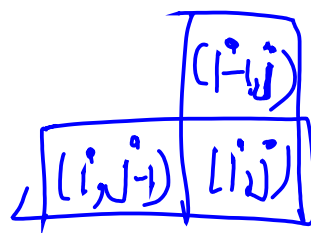
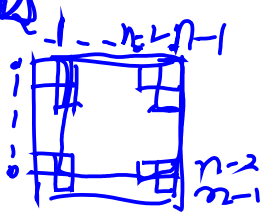
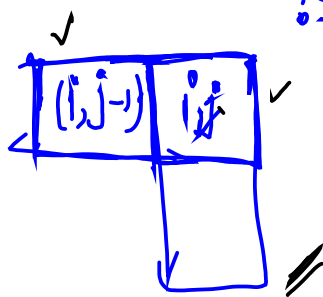
$M \geq 0$

pos

~~$M^1 C \Rightarrow 1$~~

Collisions

$t = 0$ to 1 included.

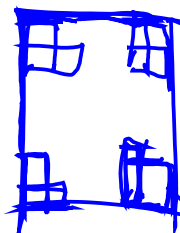
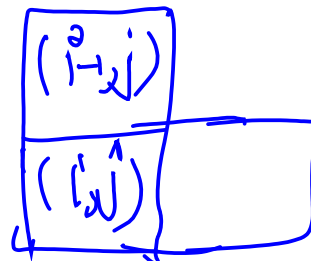
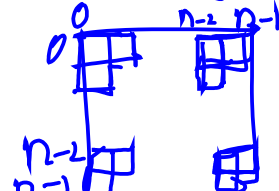
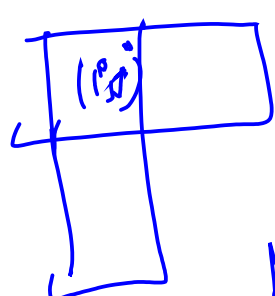


$$h_{i,j-1,t} \wedge v_{i,j,t}$$

$$i = 1 \text{ to } n-1 \quad j = 1 \text{ to } n-1$$

$$h_{i,j-1,t} \wedge v_{i,j,t}$$

$$i = 0 \text{ to } n-2, j = 0 \text{ to } n-1$$

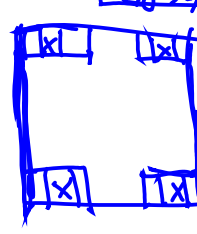
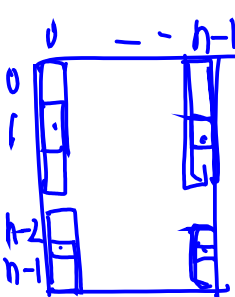
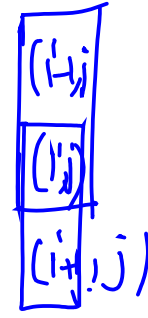


$$h_{i,j,t} \wedge v_{i,j,t}$$

$$i = 0 \text{ to } n-2, j = 0 \text{ to } n-2$$

$$h_{i,j,t} \wedge v_{i+1,j,t}$$

$$i = 1 \text{ to } n-1, j = 0 \text{ to } n-2$$



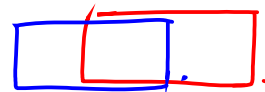
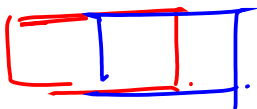
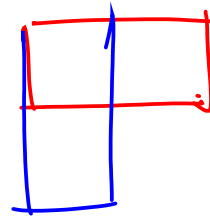
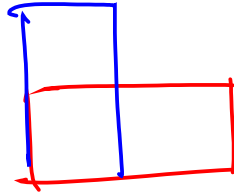
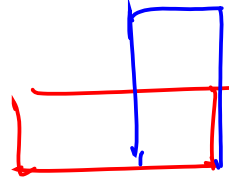
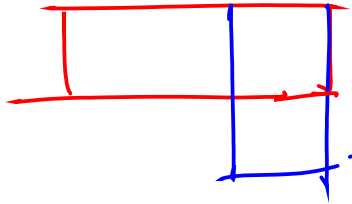
$$v_{i,j,t} \wedge v_{i+1,j,t}$$

$$i = 1 \text{ to } n-2, j = 0 \text{ to } n-1$$

$$h_{i,j-1,t} \wedge h_{i,j,t}$$

$$j = 1 \text{ to } n-2, i = 0 \text{ to } n-1$$

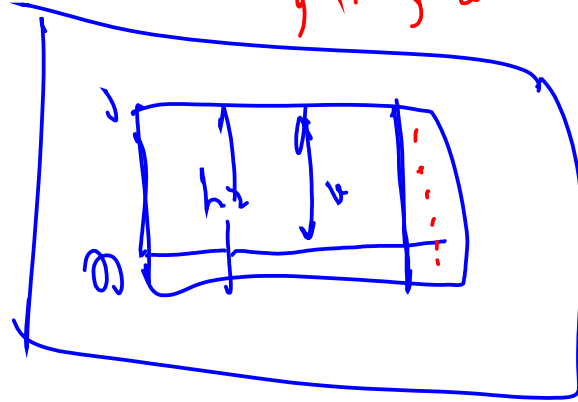
Red collisions



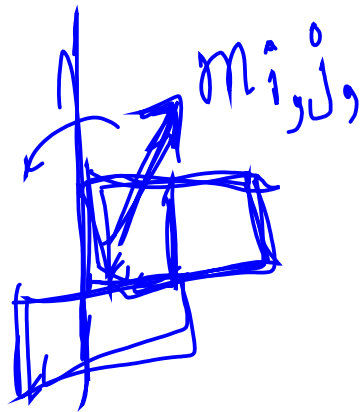
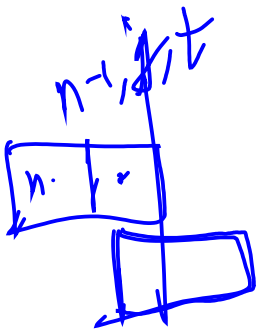
* Just put $h=r$ above!*

forbidden position $\rightarrow h_{i,n-1,t} \quad v_{n-1,j,t}$

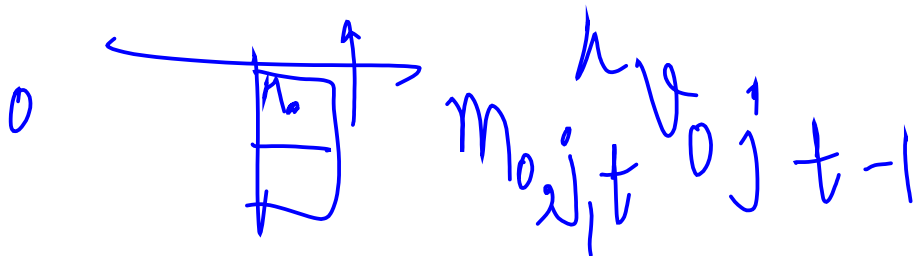
Walls

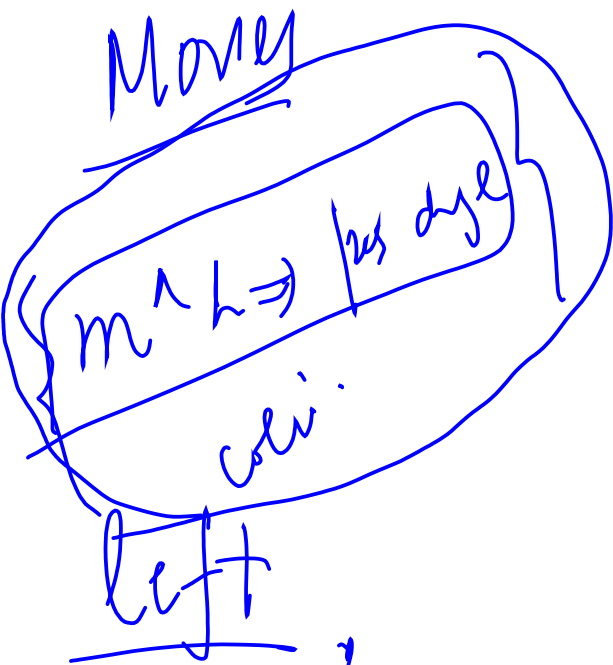


forbidden moves $\rightarrow m_{i,t} \wedge h_{i,t-1}$



$m_{i,n,t} \wedge h_{i,n-2,t-1}$





$$m \wedge h \Rightarrow h_{t+1}$$

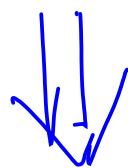
$$\sim m \wedge h$$



$$h_{t+n} \wedge \sim m \wedge h_t \Rightarrow h_{t+1}$$

$$\sim m \Rightarrow (h_t \Leftrightarrow h_{t+1})$$

$$(m_{i,j,t} \wedge h_{i,j,t-1})$$



$$(\sim h_{i,j,t}) \wedge h_{i,j-1,t} \wedge \sim h_{i,i,t}$$

drop $j=0$ clause

$j = 1$ to $n-2$
 $i = 0$ to $n-1$

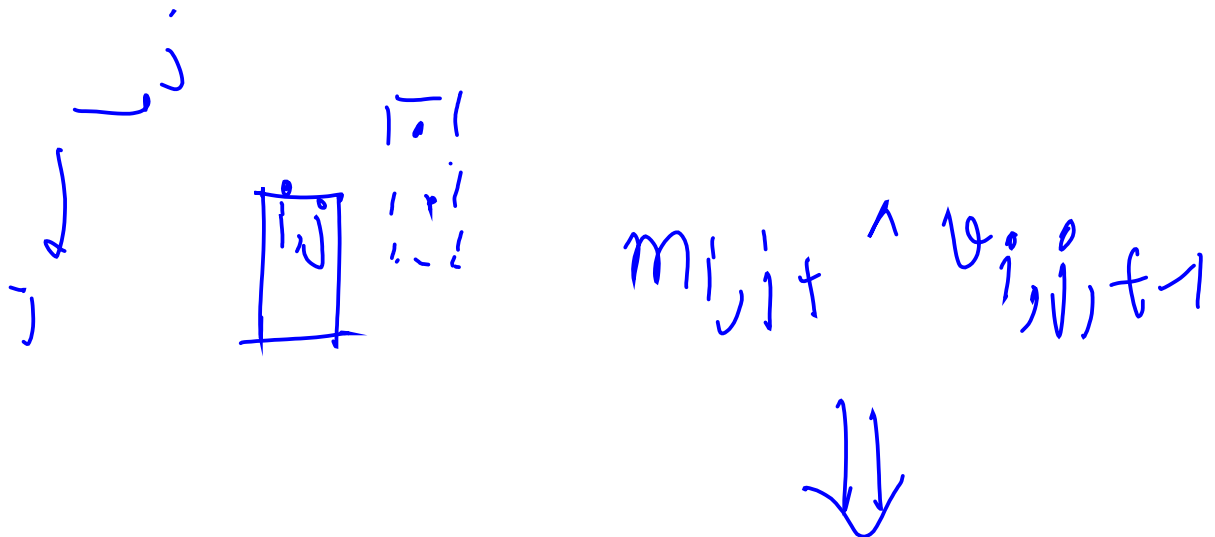
Right move



$$\forall j = 1 \text{ to } n-2$$

$$i = 0 \text{ to } n-1$$

up



$$\forall i = 1 \text{ to } n-2 \quad \forall j = 0 \text{ to } n-1$$

down



$$m_{i,j,t} \sim v_{i-1,j,t-1}$$

\Downarrow

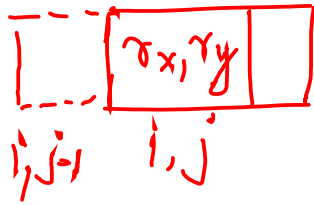
$$v_{i,j,t} \sim v_{i-1,j,t} \sim v_{H,j,t}$$

$$i = 1 \text{ to } n-2$$

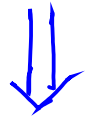
$$j = 0 \text{ to } n-1$$

Red car movement

left



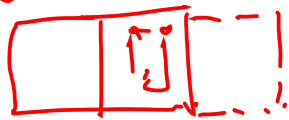
$$m[i][j][t] \wedge \gamma_{i,j,t-1}$$



$$\sim \gamma_{i,j,t} \wedge \gamma_{i,j-1,t} \wedge \sim \gamma_{i,j+1,t}$$

for all else $\gamma_{i,j,t} = 0$

Right



for all else
 $\gamma_{i,j,t} = 0$

$$m_{i,j,t} \wedge \gamma_{i,j-1,t-1}$$



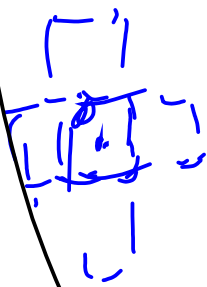
$$\gamma_{i,j,t} \wedge \sim \gamma_{i,j-1,t} \wedge \sim \gamma_{i,j+1,t}$$

ensure that more is perfect only when there is a can

fact $m \geq 0$

$$(m_{i,j,t} \wedge h_{i,j,t-1}) \vee (m_{i,j,t} \wedge h_{i,j-1,t})$$

$m \rightarrow$



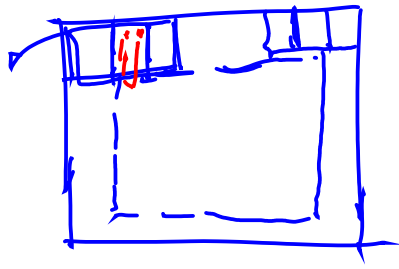
$$\vee (m_{i,j,t} \wedge v_{i,j,t-1})$$

$$\vee (m_{i,j,t} \wedge v_{i-1,j,t-1})$$

$$\vee (m_{i,j,t} \wedge r_{i,j,t-1}) \vee (m_{i,j,t} \wedge r_{i,j-1,t-1})$$

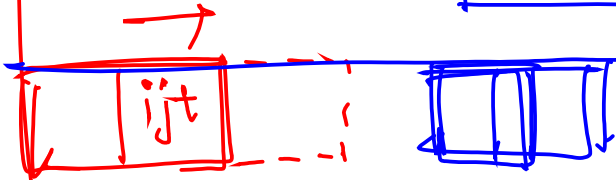
$$\forall i,j \in \underline{[1,n-2]} \times \underline{[1,n-2]}$$

works rule abhyan nahi



$$i = 0, n-1$$

$$j = 0, n-1$$

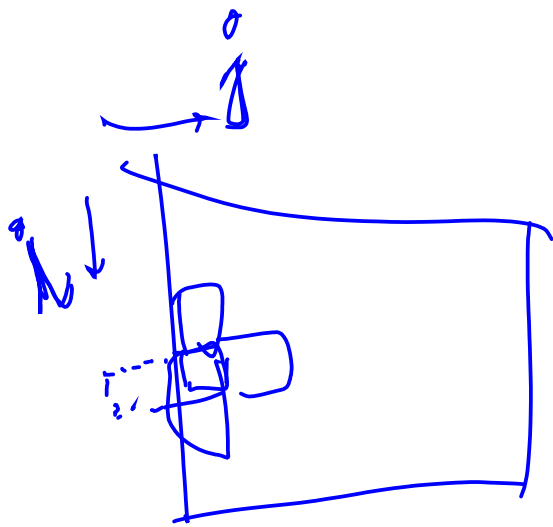


right
0

$$i = 0$$

$$j = 0 \Rightarrow m \Rightarrow m_{ijt}^{\wedge}$$

for near wall case



$$(m_{i,j,t} \wedge h_{i,j,t-1})^v \quad \cancel{(m_{i,j,t} \wedge h_{i,j,t})}$$

$$m \Rightarrow \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \wedge (m_{i,j,t} \wedge v_{3,j,t-1})$$

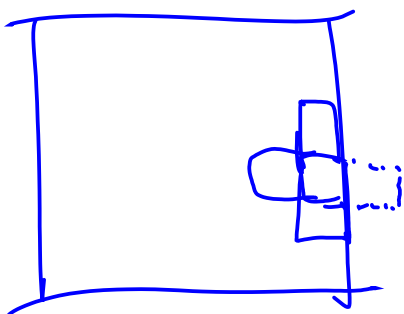
$$\wedge (m_{i,j,t} \wedge v_{i-1,j,t-1})$$

$$\wedge (m_{i,j,t} \wedge \gamma_{i,j,t-1})$$

$$j = 0$$

$$i = 1 \text{ to } n-2, + n-1 \text{ to } \infty$$

$$t = 1 \text{ to } l$$



$$j = n-1, i = 1 \text{ to } n-2$$

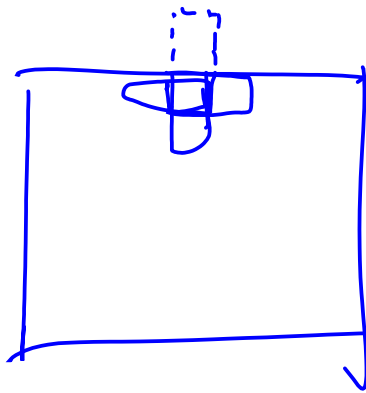
forget m=0

m =>

$$\cancel{(m_{i,j,t} \wedge h_{i,j,t-1})^v} \quad \cancel{(m_{i,j,t} \wedge h_{i,j,t})}$$

$$\wedge (m_{i,j,t} \wedge v_{3,j,t-1})$$

$$\wedge (m_{i,j,t} \wedge v_{i-1,j,t-1})^v \text{ won}$$



for $m \geq 0$

$m \Rightarrow$

$$(m_{ijt} \wedge h_{ijt-1}) \vee (m_{ijt} \wedge h_{ij,t-1})$$

$$\vee (m_{ijt} \wedge v_{s,j,t-1})$$

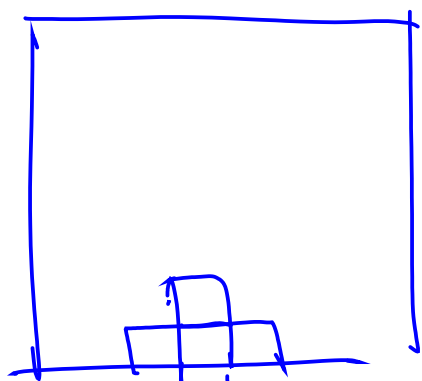
$$\vee (m_{ijt} \wedge v_{r,j,t-1})$$

$$\vee (m_{ijt} \wedge r_{ijt-1})$$

$$\vee (m_{ijt} \wedge r_{i,j+1,t-1})$$

$$i = 0$$

$$j = 1 \text{ to } n-2 + (n-1)$$



$$i = n-1$$

$$j = 1 \text{ to } n-2 + (n-1)$$

for $m \geq 0$

$m \Rightarrow$

$$(m_{ijt} \wedge h_{ijt-1}) \vee (m_{ijt} \wedge h_{ij,t-1})$$

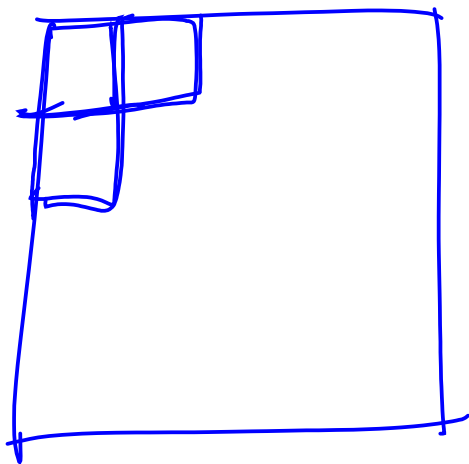
$$\vee (m_{ijt} \wedge v_{s,j,t-1})$$

$$\vee (m_{ijt} \wedge v_{r,j,t-1})$$

$$\vee (m_{ijt} \wedge r_{ijt-1})$$

$$\vee (m_{ijt} \wedge r_{i,j+1,t-1})$$

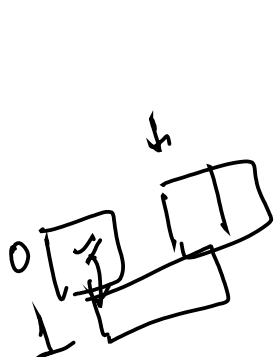
(0,0) left



forget $m \neq 0$

$m \Rightarrow$

$$\left(\begin{array}{l}
 (m_{ijt} \wedge h_{ijt-1}) \vee \cancel{(m_{ijt} \wedge h_{ijt})} \\
 \vee (m_{ijt} \wedge v_{ijt-1}) \\
 \vee \cancel{(m_{ijt} \wedge v_{ijt})} \\
 \vee (m_{ijt} \wedge \gamma_{ijt-1})
 \end{array} \right)$$

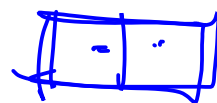


$$\left(\begin{array}{l}
 h_0 \wedge \hat{h}_2 \\
 h_0 \wedge \hat{h}_1
 \end{array} \right) \times \quad m \Rightarrow (\square \wedge \text{unaged})$$

$\sim m \Rightarrow (h_{ijt+1} \Leftrightarrow h_{ijt}) \times$

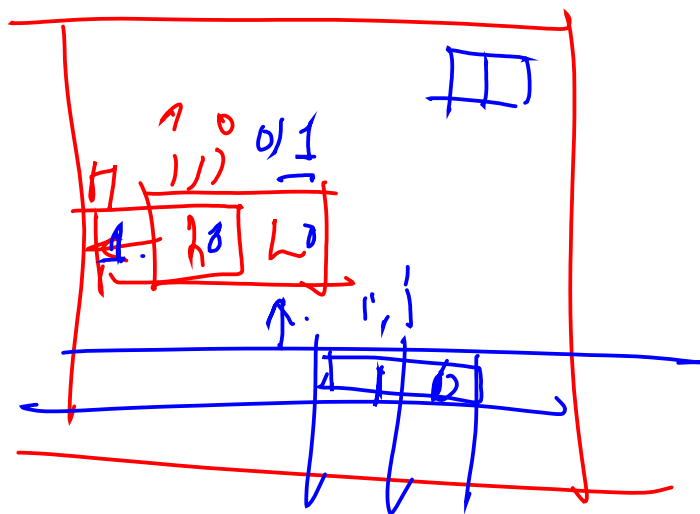
if no move, pgs remain same

$\sim m$

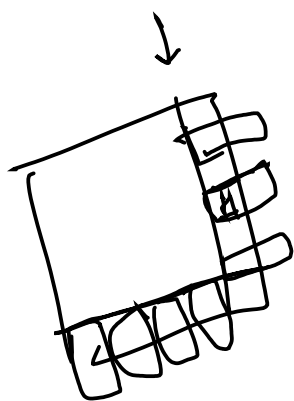


t

$$\sim m_{i,j,t} \sim \underline{h} \Rightarrow \underline{h_i}$$



$\underline{v_1} \quad \underline{h_1}$



$\underline{t+1}$

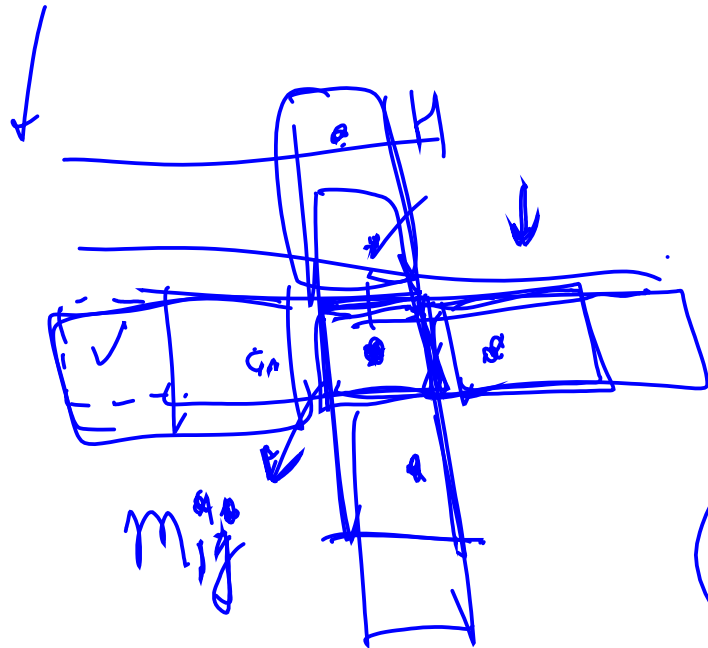
$$\underline{h_{i,j,t-1} = 1 \sim}$$

$$m_{i,j,t} \sim \underline{h_{i,j,t-1}} \Rightarrow \underline{h_{i,j,t-1}}$$

$t=1 \text{ to } k$

$$\sim m_t \Rightarrow (h_{t-1} \Rightarrow k_t)$$

$$\forall i,j \ 0 \text{ to } n-1$$



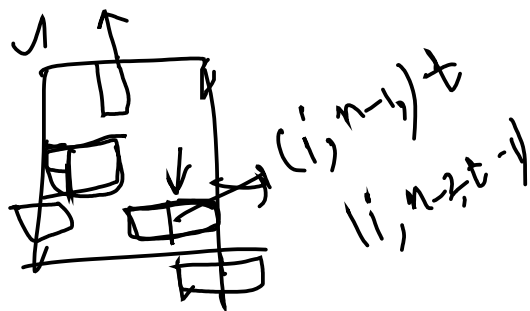
$$\sim m_{ij}^t \sim m_{i,j+1}^t$$

$$(\sim m_{ij}^t \sim m_{i,j+1}^t \sim m_{i,j+2}^t)$$

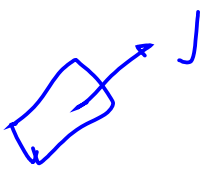
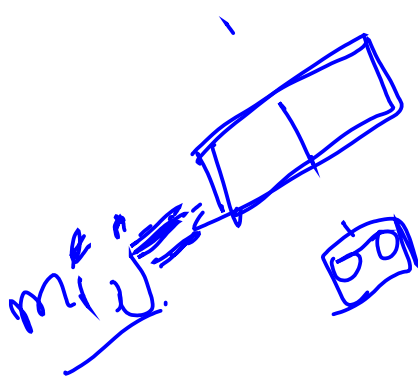
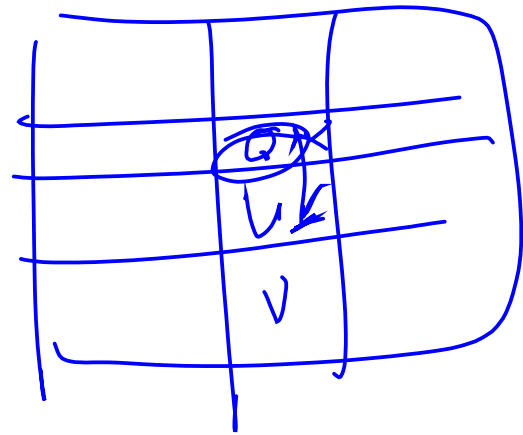
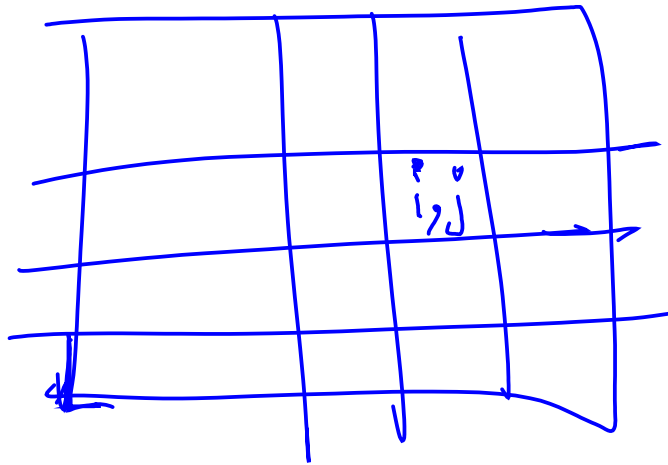
$$\sim (m_{ij}^t m_{i,j+1}^t m_{i,j+2}^t)$$

$$\sim m_{ij,t}^t \sim \left[\begin{array}{c} (m_{i,j-1,t}^t h_{i,j-2,t}^t)^v \\ ()^v \end{array} \right] \left(\begin{array}{c} () \\ () \end{array} \right)$$

✓ \Downarrow
pij change



$$\sim m_{ij,t}^t \sim [] \Rightarrow \underline{\text{Unchange}}$$



$m_{ij} \Rightarrow (p_{ord} e_{ij})^{\wedge} (else \text{ remain same})$



$t=0$

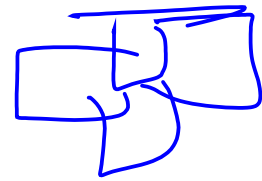
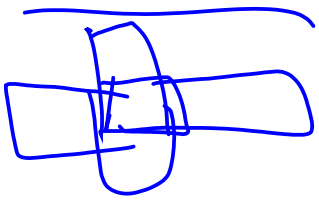
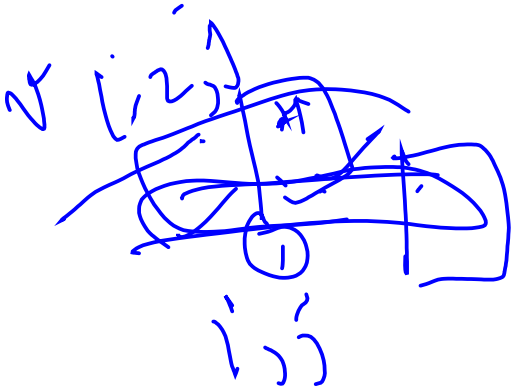
$t=1$

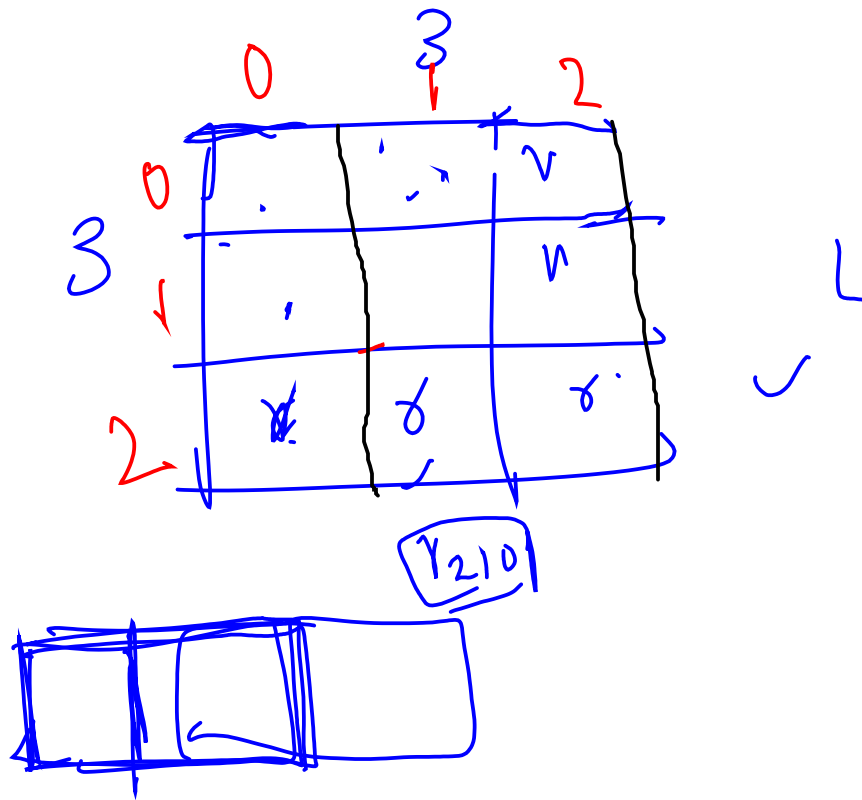
$$v_{i,j,t} \Rightarrow v_{i,j,t+1}$$

(+)

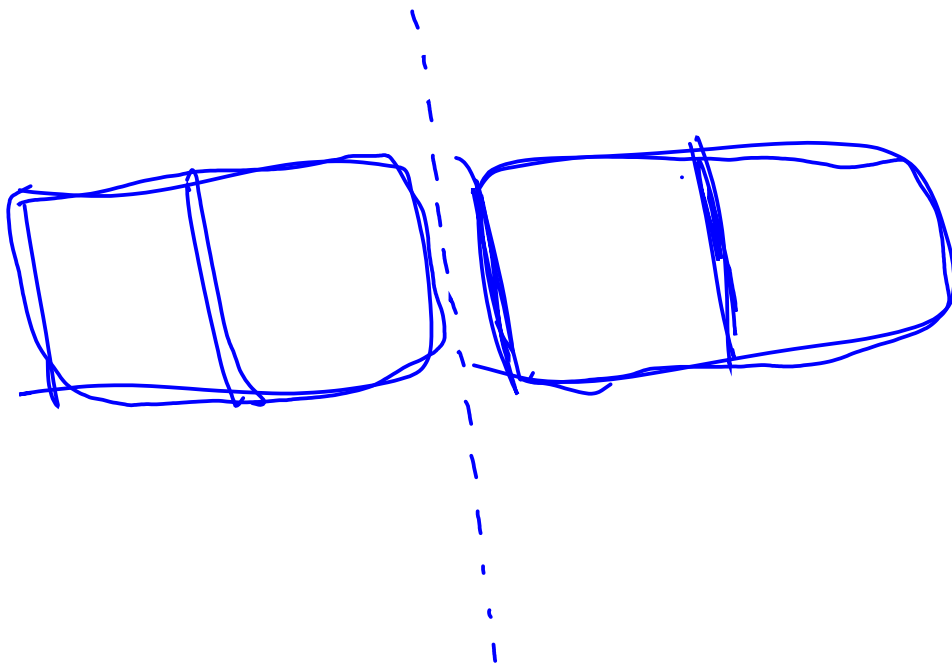
ma

ANDP(vert)





rest cell same h, v both
 eh 3 cell 3 st v same.



[illegible]

| | 0 | 1 | 2 | 3 |
|---|---|---|----------|----------|
| 0 | h | h | v | |
| 1 | | | v | |
| 2 | | | γ | γ |
| 3 | | | | |