BASE ALGORITHM:

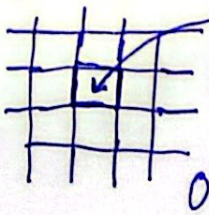
I. INITIALISE THE STARTING STATE ($t=0$)

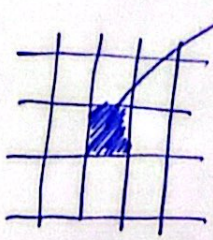
↳ $\frac{\alpha}{N}$ portion of the traders are active => placed randomly on the grid.

↳ Set parameters p_e, p_d, p_h, A, a, b

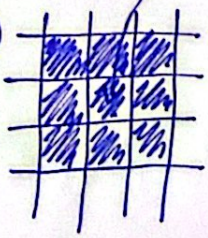
II. APPLY PERCOLATION RULES

- 3 options:

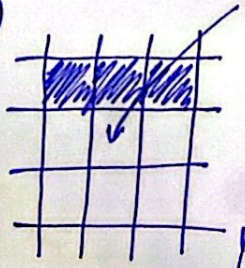
1. 

=> 

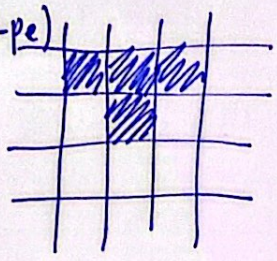
(GOES ACTIVE)

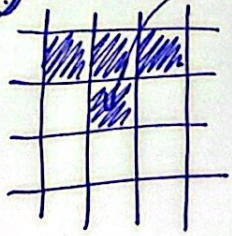
2. 

with $p=1$
=> STAYS ± 1 (ACTIVE)

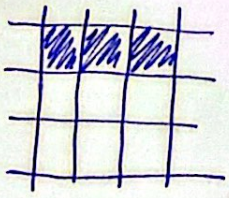
3. 

Let $N_{\pm 1}$ denote the number of $\pm 1_s$ in the V.N. neighborhood cycle

$1-(1-p_h)^{N_{\pm 1}}(1-p_e)$
=> 
GOES ACTIVE

4. 

Let N_0 denote the number of 0_s in the V.N. neighborhood cycle

$1-(1-p_d)^{N_0}$
=> 
GOES INACTIVE

III. APPLY STOCHASTIC RULES

EVERY ACTIVE TRADER AFTER THE PERCOLATION PROCESS WILL GET A NEW VALUE FROM THE SET $\{\pm 1\}$.

$$p_i^k(t) = \frac{1}{1 + e^{-2I_i^k(t)}}$$

$$I_i^k(t) = \frac{1}{N^k(t)} \sum_{j=1}^{N^k(t)} A_{ij}^k(t) G_j^k(t) + h_i^k$$

← we assume that every trader is connected in a cluster $\Rightarrow$ full graph.

$$A_{ij}^k(t) = A\,\xi^k(t) + a\,\eta_{ij}(t)$$

ξ^k: cluster specific; η_{ij}: trader pair specific

$$h_i^k(t) = h\,\varphi_i^k(t) \leftarrow \text{trader specific}$$

$\xi^k, \eta_{ij}, \varphi_i^k \sim U(-1, 1)$

IV. CALCULATE THE NEW PRICE

$$x(t) = \sum_{k=1}^{N_{cl}(t)} \sum_{i=1}^{N^k(t)} N^k(t) G_i^k(t)$$

↳ overweight big clusters

$$\boxed{P(t+1) = P(t) \cdot e^{x(t+1)}}$$

V. REPEAT FROM II. UNTIL THE MODEL IS IN STABLE STATE

~~$R(t+1) = \ln P(t+1)$~~

$$e^{r(t)} = \frac{P(t+1)}{P(t)}$$

$$r(t) = \ln P(t+1) - \ln P(t)$$

$$\frac{dP}{dt} = \beta \times P$$

$$\Downarrow$$

if ~~dt~~ $dt \Rightarrow \Delta t = 1$

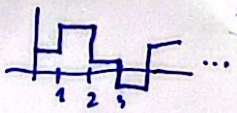
$$\frac{1}{P} dP = \beta x(t) dt$$

$$\ln P = \beta \int x(t) dt$$

$$P = e^{\beta \int x(t) dt}$$

↳ $\beta = 1$ (PAPER REFERENCE)

$$P = e^{\int x(t) dt}$$

$x \Rightarrow$ 

↳ $P(t) = e^{\int_0^t x(\tau) d\tau}$

$$P(t) = e^{\sum_{i=0}^{t} x(i)}$$

$$e^{r(t)} = \frac{P(t+1)}{P(t)} = \frac{e^{\sum_{i=0}^{t+1} x(i)}}{e^{\sum_{i=0}^{t} x(i)}} = e^{\sum_{i=0}^{t+1} x(i) - \sum_{i=0}^{t} x(i)} = e^{x(t+1)}$$

$$e^{r(t)} = e^{x(t+1)}$$

$$\boxed{r(t) = x(t+1)}$$