

# SIMULATED ANNEALING

## Algorithm 2: Simulated Annealing Optimizer

$T \leftarrow T_{max}$

$x \leftarrow$  generate the initial candidate solution  $\rightarrow x = (x_1, x_2 \dots x_m) \rightarrow$  the weights of the  $m$  replicas

$E \leftarrow E(x)$  compute the energy of the initial solution

while  $(T > T_{min})$  and  $(E > E_{th})$  do

$x_{new} \leftarrow$  generate a new candidate solution

$E_{new} \leftarrow$  compute the energy of the new candidate  $x_{new}$

$\Delta E \leftarrow E_{new} - E$

    if Accept  $(\Delta E, T)$  then

$x \leftarrow x_{new}$

$E \leftarrow E_{new}$

    end

$T \leftarrow \frac{T}{\alpha}$  cool the temperature

end

return  $x$

predict latency of algorithm

1. + weak the xed configuration  
2. verify AVAILABILITY and CONSISTENCY

$\forall$ -disseminating quorum system

A) CONSISTENCY  $\rightarrow \forall Q_1, Q_2$  quorum systems  $|Q_1 \cap Q_2| \geq f+1$

B) AVAILABILITY  $\rightarrow$  for any set of  $f$  nodes  $F$ ,  $\exists Q$  quorum system such that  $Q \cap F \neq \emptyset \rightarrow$  prevents the Byzantine process from stopping

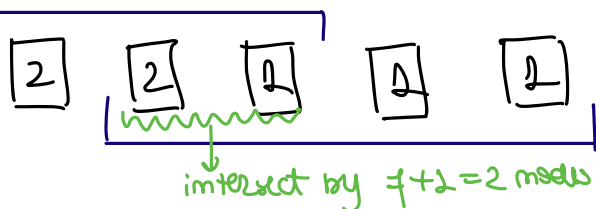
## SETUP FOR BFT-OKE SYSTEMS

$$m = 3f + 1 + \Delta$$

$\forall$  faulty nodes can be tolerated

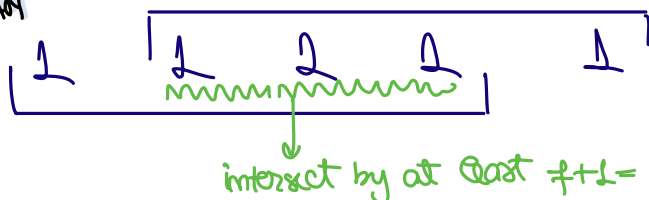
for  $f=1, \Delta=1$

AWARE



$$\rightarrow Q_v = 2f + 1$$

EGALITARIAN



$$\rightarrow Q_v = \left\lceil \frac{m+f+1}{2} \right\rceil \text{ (egalitarian)}$$

## Generalised weighting scheme

$x_1$   $x_2$   $x_3$   $x_4$   $x_5$

A) AVAILABILITY  $\rightarrow$  whatever  $f$  nodes are failing  $\Rightarrow$  consensus is still possible

1. fail the  $f$  nodes having the highest weights (worst-case scenario)
2. quorum weight = sum of the remaining live replicas

B) CONSISTENCY  $\rightarrow$  all possible 2 quorums intersect by at least  $(f+1)$  nodes

1. generate all subsets of replicas out of the  $n$  present in the system
2. keep only the subsets which have cumulated weight  $\geq$  quorum weight (quorum found)
3. get any 2 pairs  $(Q_1, Q_2)$  out of the remaining subsets and check if  $|Q_1 \cap Q_2| \geq f+1$
4. if all combinations of 2 quorums hold the condition  $\Rightarrow$  we have a viable weighting scheme.