# Synchronous Network model.

$G = (V, E)$  Connected network of Processes.

Set of Process        set of point-to-point edges
(vertices)

In most Cases,  $G$ is  undirected  graph
( all  links  are  bidirectional)

shortest_dist $(i, j)$ = shortest distance (in
# of links)  between  $i$ & $j$
diam of $G$  (diameter  of  graph $G$)
$$= \max_{i,j} \text{shortest\_dist}(i,j)$$

For  each  Process  $i \in V$ :
states$_i$ : set  of states  of  $i$
start$_i \subseteq$ states$_i$   start states) of $i$
msgs$_i$  is  message  generation  function

*to who?*
*what do*
*I send?* { : states$_i$ × Outnbrs$_i$ ⟶ $M \cup \{null\}$

trans$_i$ is  state  transition

*What do*
*I do*
*with the*  { states$_i$ × Vectors of elements of $M \cup \{null\}$
*received*            ⟶ states$_i$
*message?* $M$ = set  of  all  messages

②

$i \longrightarrow j$ is a link?

$i \in$ in-neighbors$_j$ and

$j \in$ out-neighbors$_i$

"Round" or "execution of a step"

initialization $\{$

① Each process $i \in V$ is in one
state of start.

② All channels are ~~empty~~ empty

one round.

③ in lock-step repeatedly do following

(a) (i) apply message genation function to
current state
(ii) Put the generated messages in
out going channel (appropriate)

(b) (i) ~~~~ apply state transition function
to current state and the incoming
messages & go to new state
(ii) remove all received messages
from incoming channels.

(a) & (b) is when a message is
received, no limit
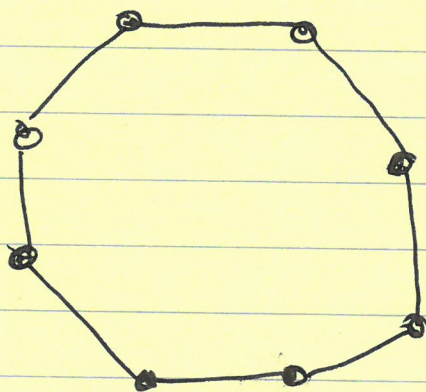one ~~step~~.      on how long to
round.      process it.

Deterministic Model.

Why Synchronous model? (hard to
implement in
real-life)
(a) easier to develop synchronous distributed
algorithm
(b) if a problem is impossible to solve
in Synchronous model, it is impossible
in asynchronous model also.

Chapter 3. Leader Election in
Synchronous rings.



Example

8 Processes

All processes {execute the same "code"}
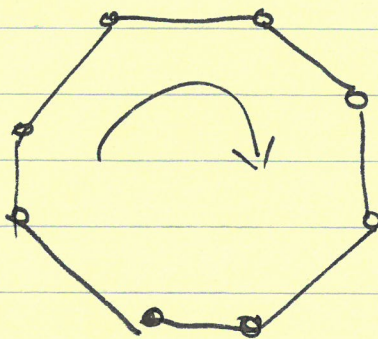run same distributed algorithm

All Processes are identical?

Impossible to elect a leader

Symmetry breaking?

Each process has a unique i'd.



example of
8—process ring.

Leader = process with largest id
Unidirectional ring