

ALGORITHMIC APPROACH TO D.S.

2020/2021



20/09/21

LEADER ELECTION

COMPLETE
GRAPH LB

WORST CASE

- Process i receive IDs in increasing order
 - it receive $m-1$ msgs
 - it broadcast ($m-1$ msgs) for each one he receive
 - there are m processors
- $$\Rightarrow \# \text{MSGS} = (m-1)(m-1)m = O(m^3)$$

BEST CASE:

- Process i receives IDs in mon-increasing order
 - it receive $m-1$ msgs
 - there are m processors
- $$\Rightarrow \# \text{MSGS} = (m-1)m = O(m^2)$$

CHANG / ROBERTS

- ASSUME that exists a UNIDIRECTIONAL RING of non faulty processors
- PROCLAMATION is needed (<End> msg)

ALGO

I_p

$$\{M = \emptyset\}$$

$$\begin{array}{|l} M = p \\ \text{SEND } M \end{array}$$

M_p

$$\{ \text{RECEIVING } j \}$$

IF ($j > M$)

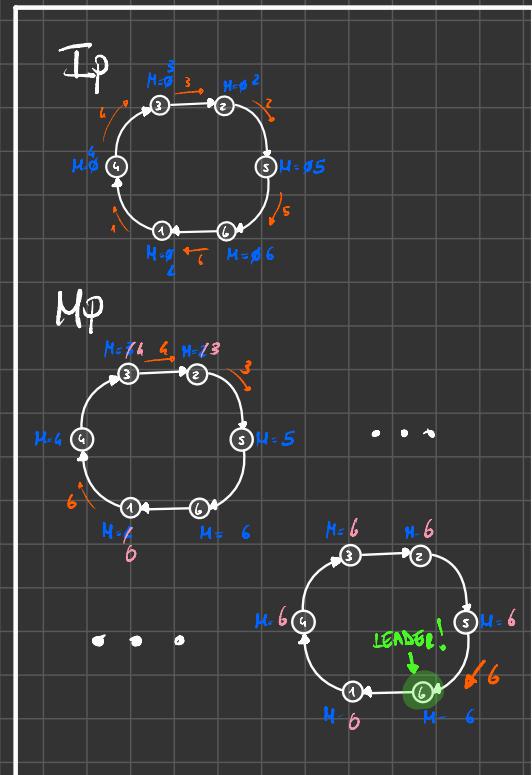
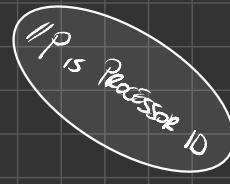
$$M = j$$

SEND M

IF ($M = p$)

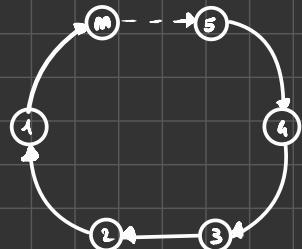
PROCLAMATION

STOP



NOTE IGNORE PROCLAMATION

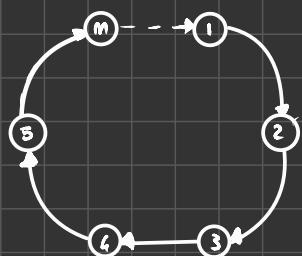
WORST CASE



MSGs of LEADER

$$\# \text{MSGs} = m + (m-1) + (m-2) + \dots + 1 = \sum_{i=1}^m i = \frac{m(m+1)}{2} = \Theta(m^2)$$

BEST CASE



MSGs of LEADER

$$\# \text{MSGs} = \underbrace{m + 1 + \dots + 1}_m = 2m = \Theta(m)$$

Avg Case

- The Prob. for a node to make one step is $\frac{1}{m}$, so to complete the circle is $\sum_{i=1}^m i \cdot P(\text{MAKING ONE STEP}) \leq \Theta(m \log m)$
 $\Rightarrow \Theta(m \log m)$

ROUND BASED LEADER ELECTION

- A mode become PASSIVE if its value P is less than the one it receive
- A passive mode only forwards messages

FRANKLIN (ON BIDIRECTED G)

- Processes send msgs in 2 directions
- At each round at least half Proc's become PASSIVE
 (Since every 2 near nodes one should win) $\Rightarrow \# \text{Rounds } O(\log m)$
- In each round ACTIVE send 2 msgs, PASSIVE forward 2 msgs $\Rightarrow \# \text{MSGs} = 2m \cdot O(\log m) = O(m \log m)$

