DIJKSTRA'S MUTUAL EXCLUSION ALGORITHM (1)

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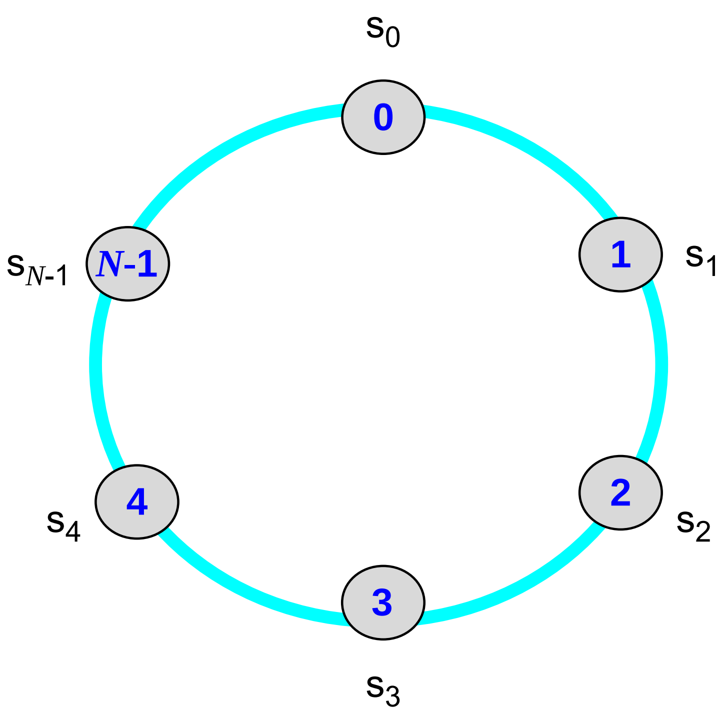


- N-processes ring
- one distinguished process $\boldsymbol{P}_0$
- $\boldsymbol{P}_1 \div \boldsymbol{P}_{N\text{-}1}$ processes are equal and behave uniformly
- s_i = current local state of a given process $\boldsymbol{P}_i$
- every process $\boldsymbol{P}_i$ knows the state of its left neighbor ($s_{i\text{-}1}$ for $1 \leqslant i \leqslant N$-1 and $s_{N\text{-}1}$ for $\boldsymbol{P}_0$) – instantaneous communication

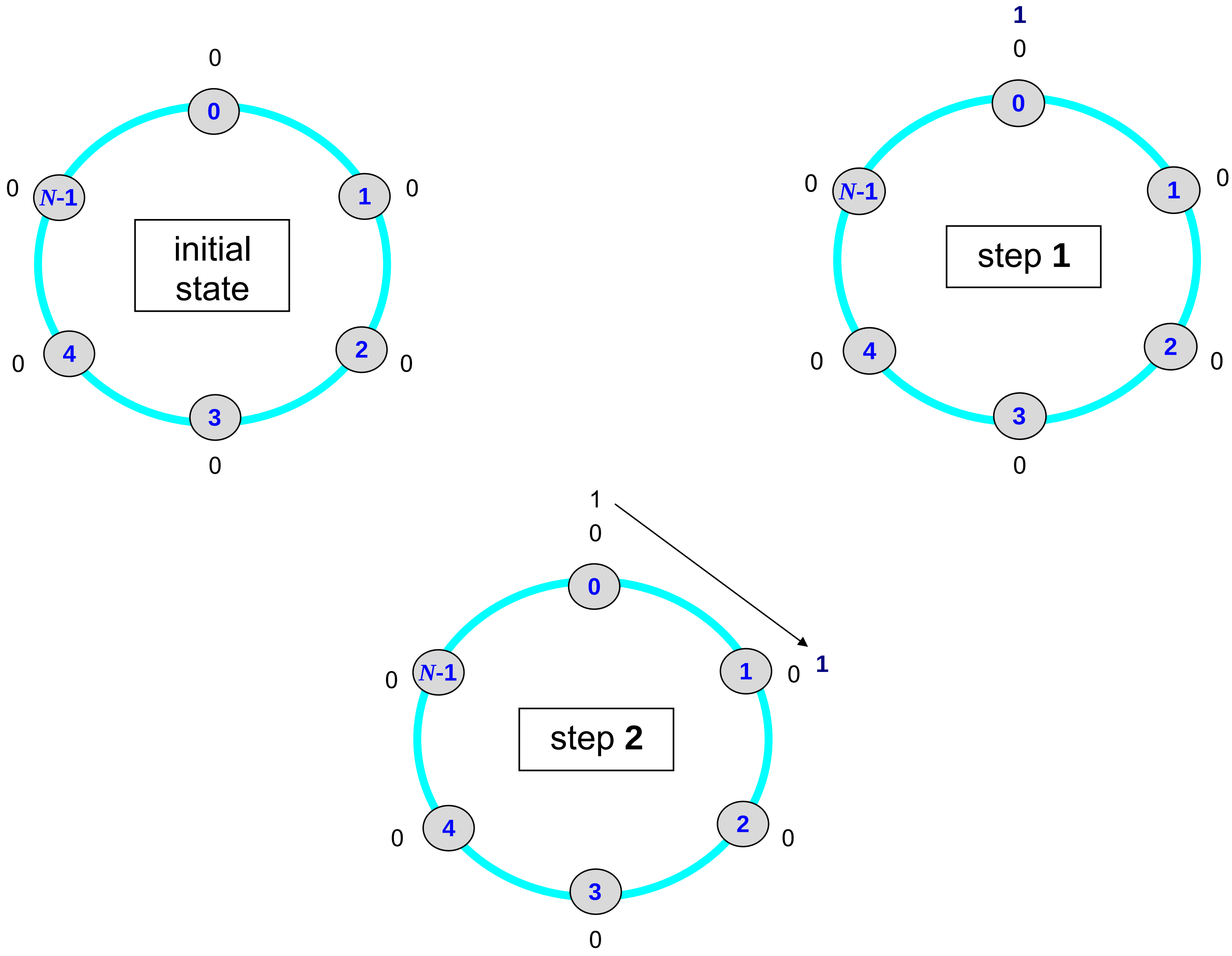
DIJKSTRA'S MUTUAL EXCLUSION ALGORITHM (2)

Notion of *privilege*.

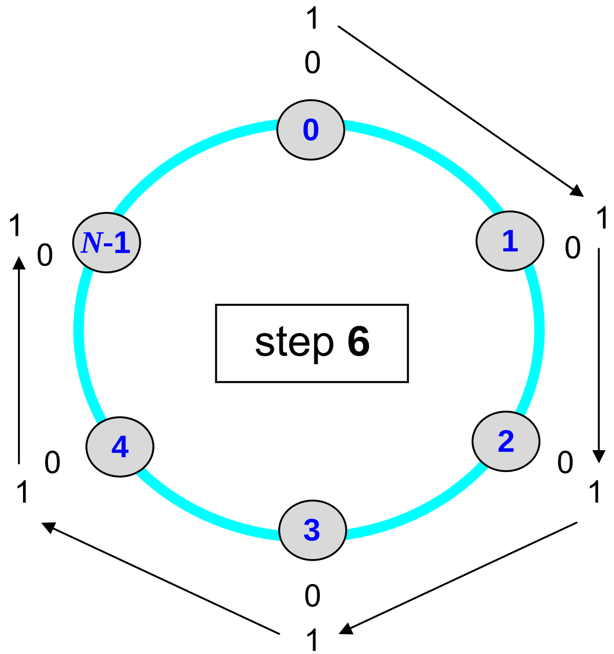
- when a process has the *privilege*, it is authorized to *make a move* (change its local state, enter the critical section)
- the system satisfies following properties:
  1. There must be at least one privilege in the system.
  2. During an infinite time every process should be able to receive a privilege infinitely many times.
- the legal (global) state must satisfy:
  3. There is only one privilege in the system.

for P_0:	if $s_0 = s_{N-1}$	then P_0 has the privilege and $s_0=(s_0+1)_{\mathrm{mod}\ K}$
for P_i:	if $s_i \neq s_{i-1}$	then P_i has the privilege and $s_i=s_{i-1}$; $1 \leqslant i \leqslant N-1$

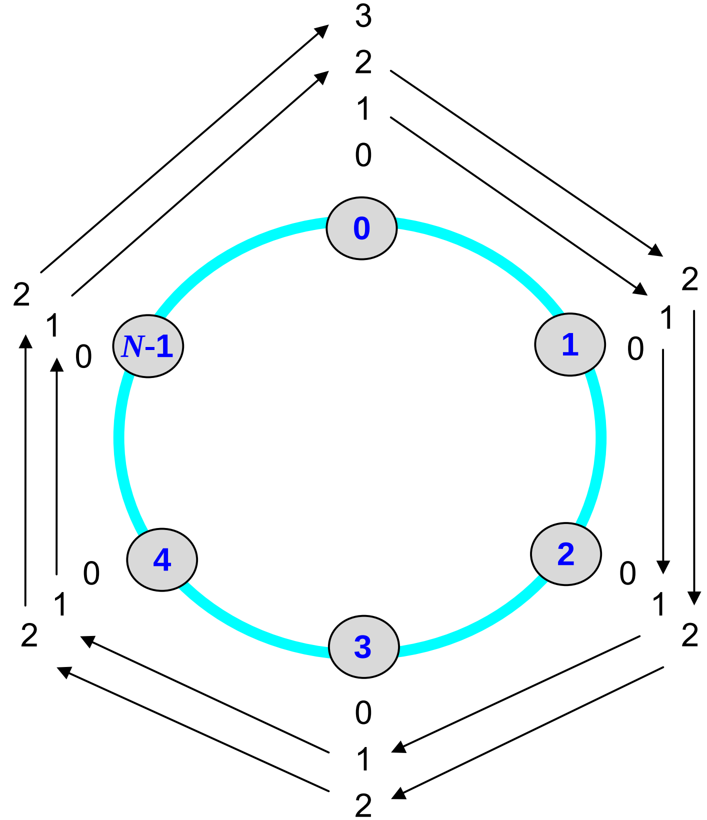
DIJKSTRA'S MUTUAL EXCLUSION ALGORITHM (3)



DIJKSTRA'S MUTUAL EXCLUSION ALGORITHM (4)



after 12 steps:



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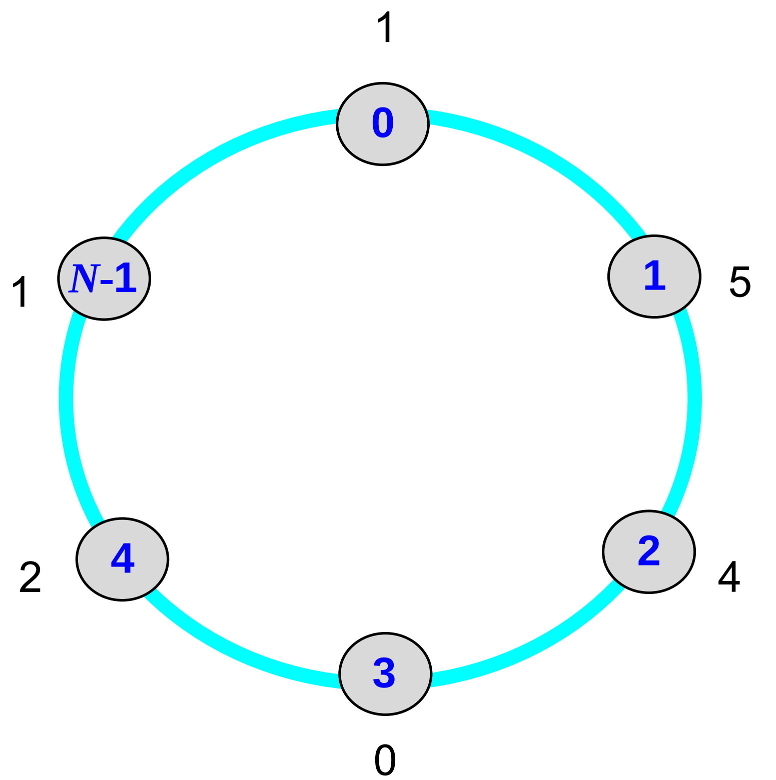
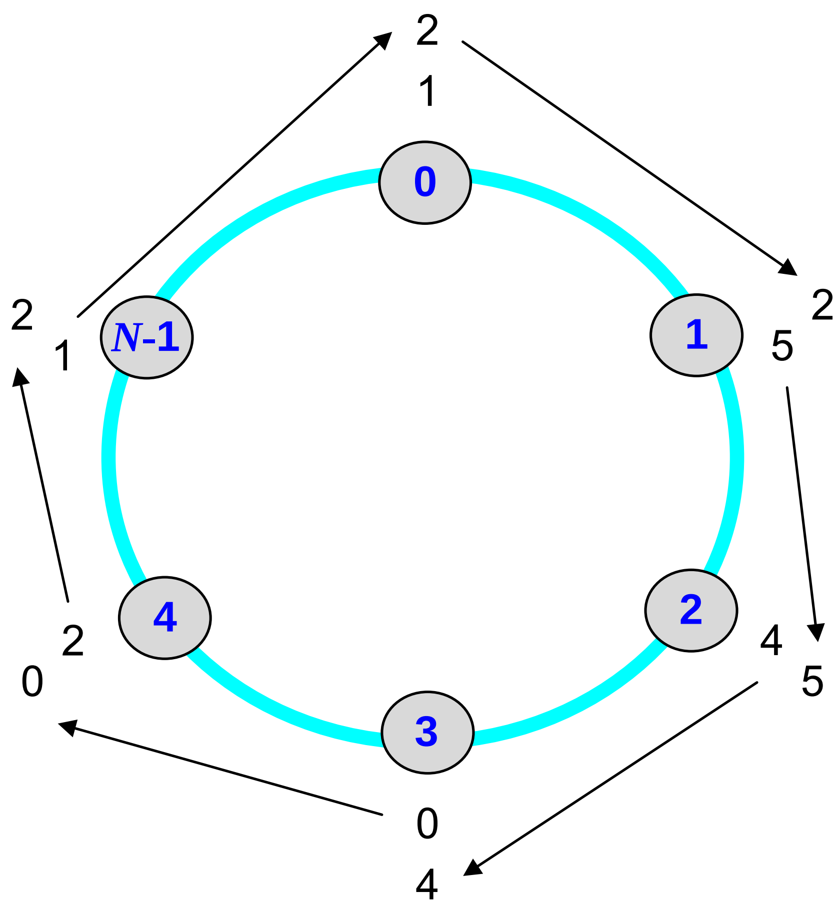
Possible failure scenario:

let's assume a transient failure has set the system into an illegal state:

n=6
K=6



DIJKSTRA'S MUTUAL EXCLUSION ALGORITHM (6)



DIJKSTRA'S MUTUAL EXCLUSION ALGORITHM (7)

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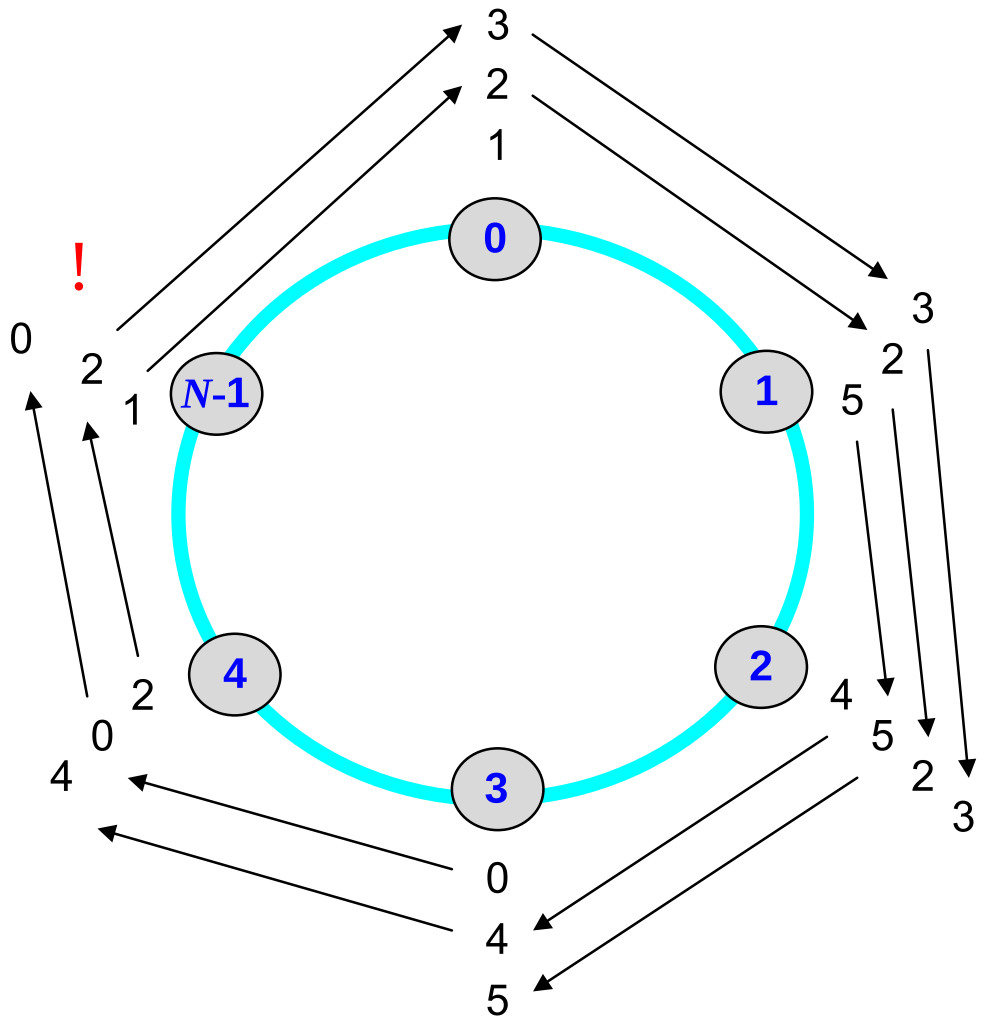

DIJKSTRA'S MUTUAL EXCLUSION ALGORITHM (8)

What is the stabilization time?

- This algorithm needs $O(N^2)$ system steps before reaching a legal global state.