MYE017 Distributed Systems

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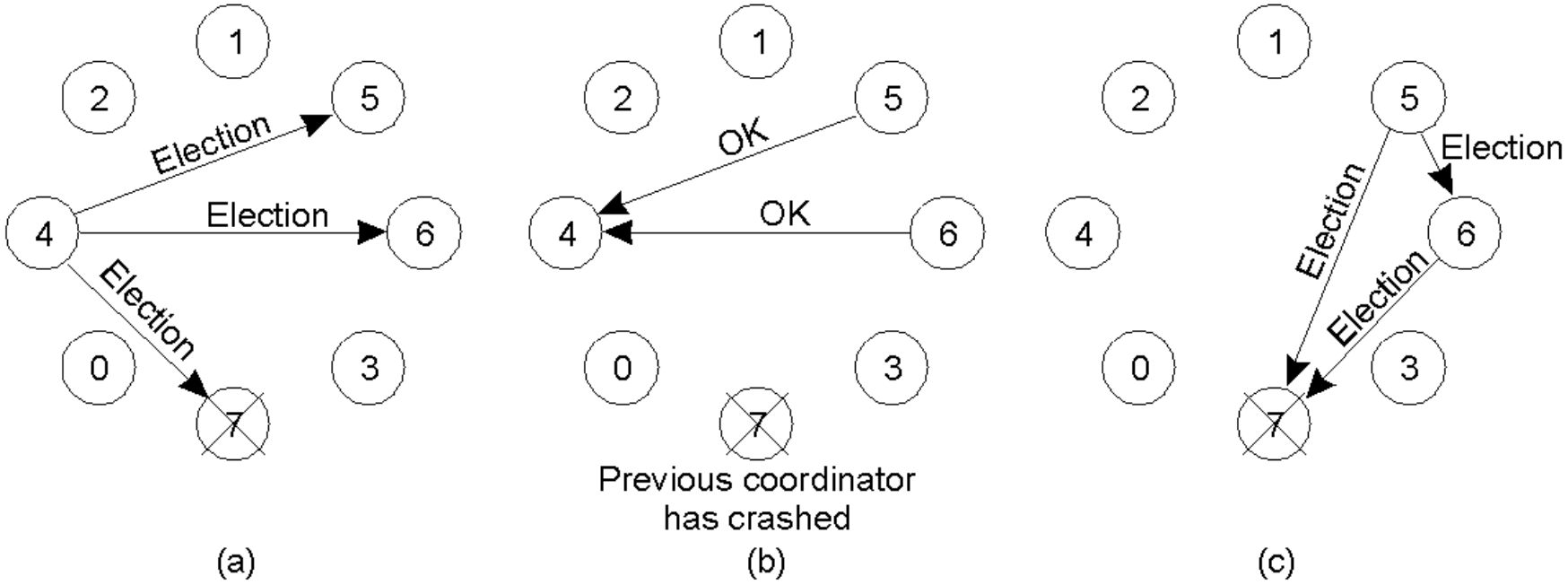
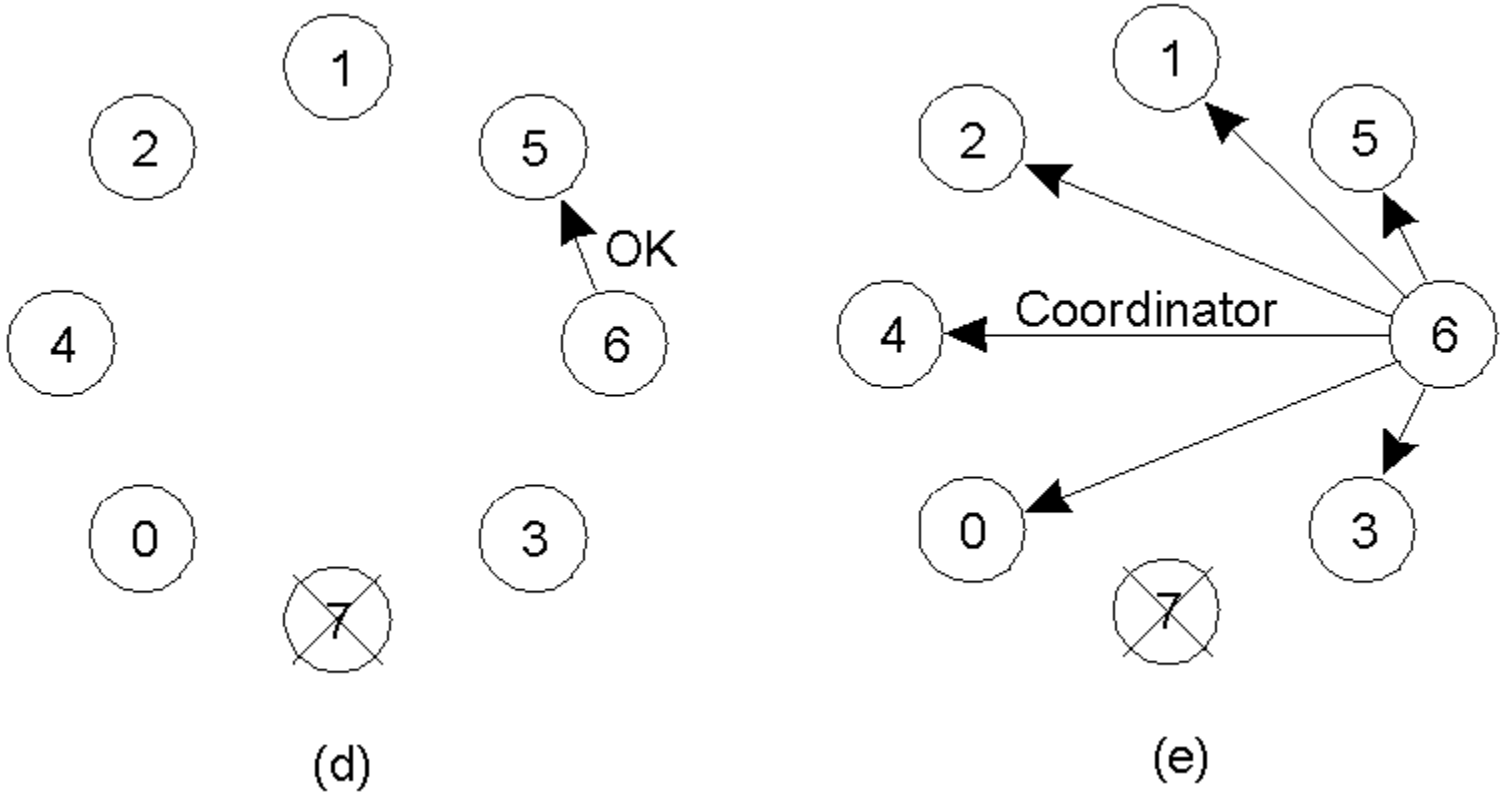
The Bully Algorithm (1)



(a) Process 4 holds an election
(b) Process 5 and 6 respond, telling 4 to stop
(c) Now 5 and 6 each hold an election

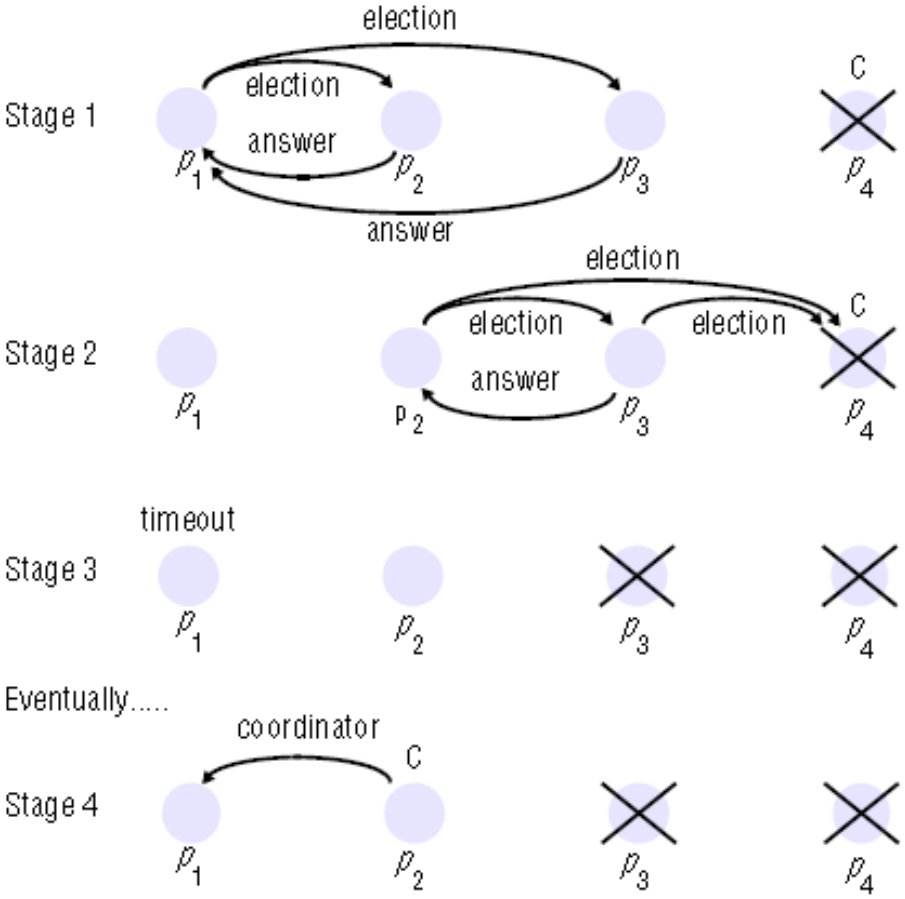
The Bully Algorithm (2)



d) Process 6 tells 5 to stop

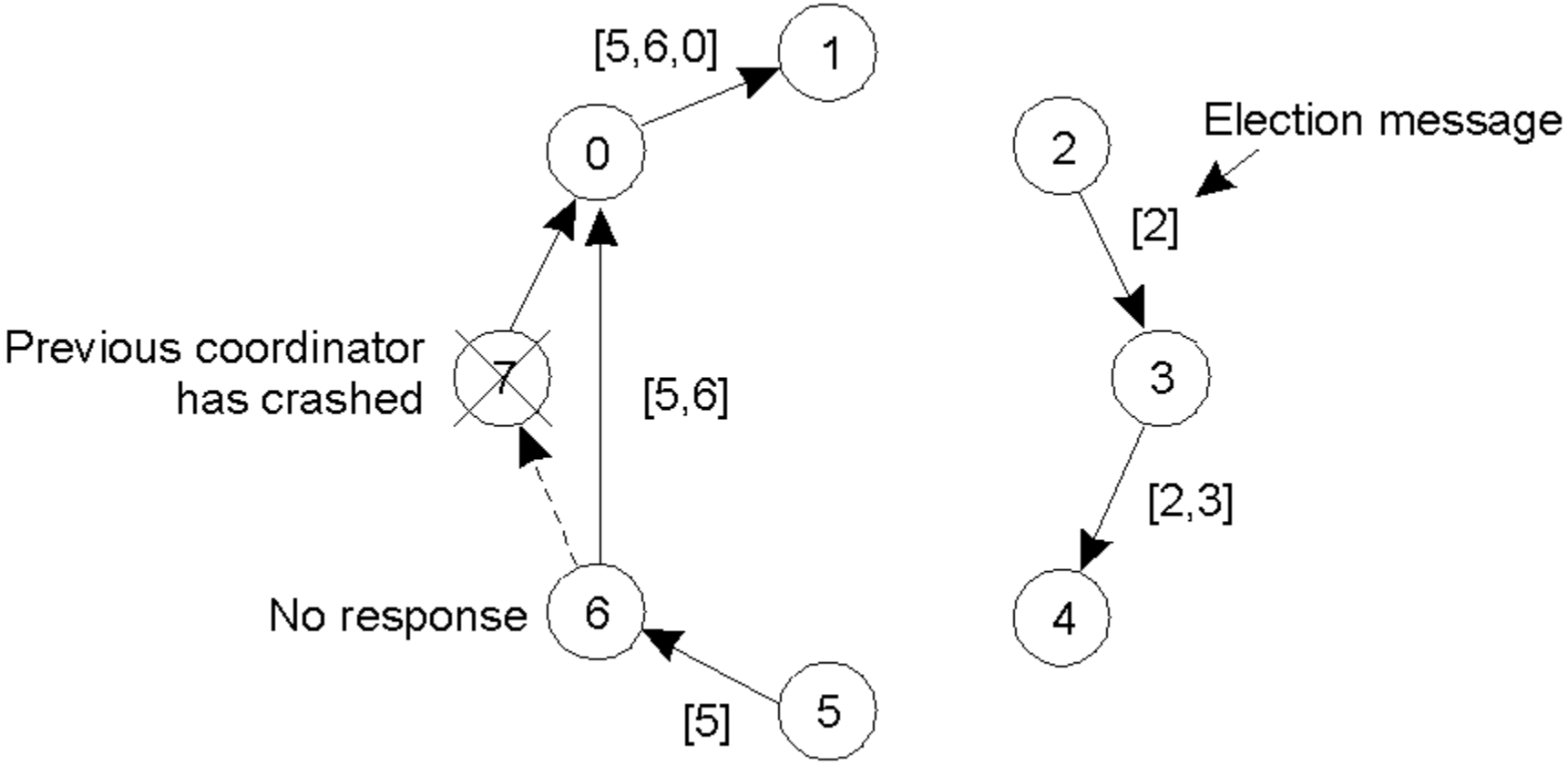
e) Process 6 wins and tells everyone

Another example

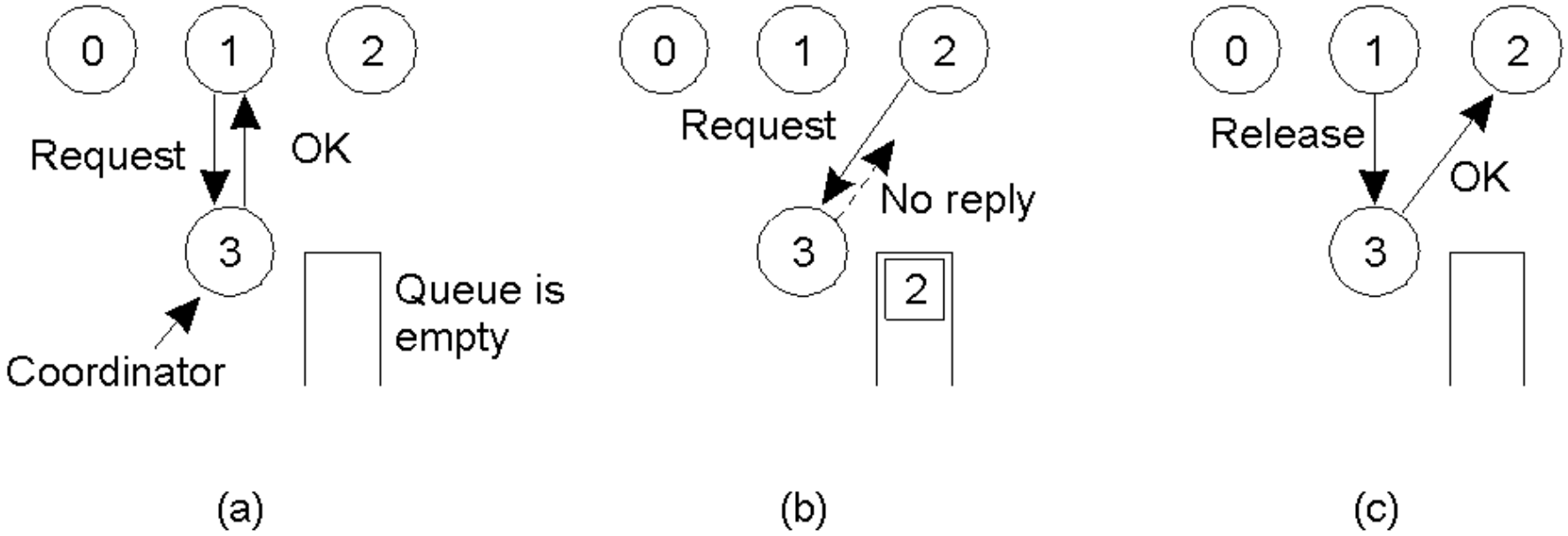


The election of coordinator p_2, after the failure of p_4 and then p_3

A Ring Algorithm

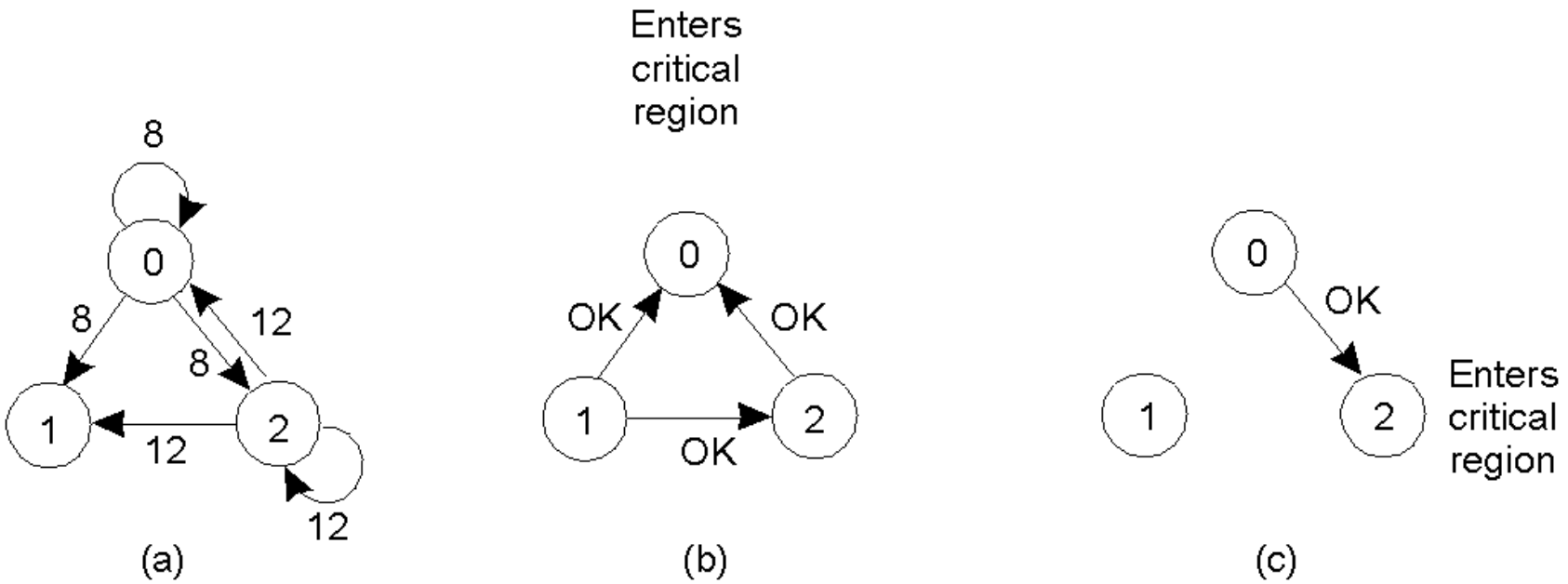


Mutual Exclusion: A Centralized Algorithm



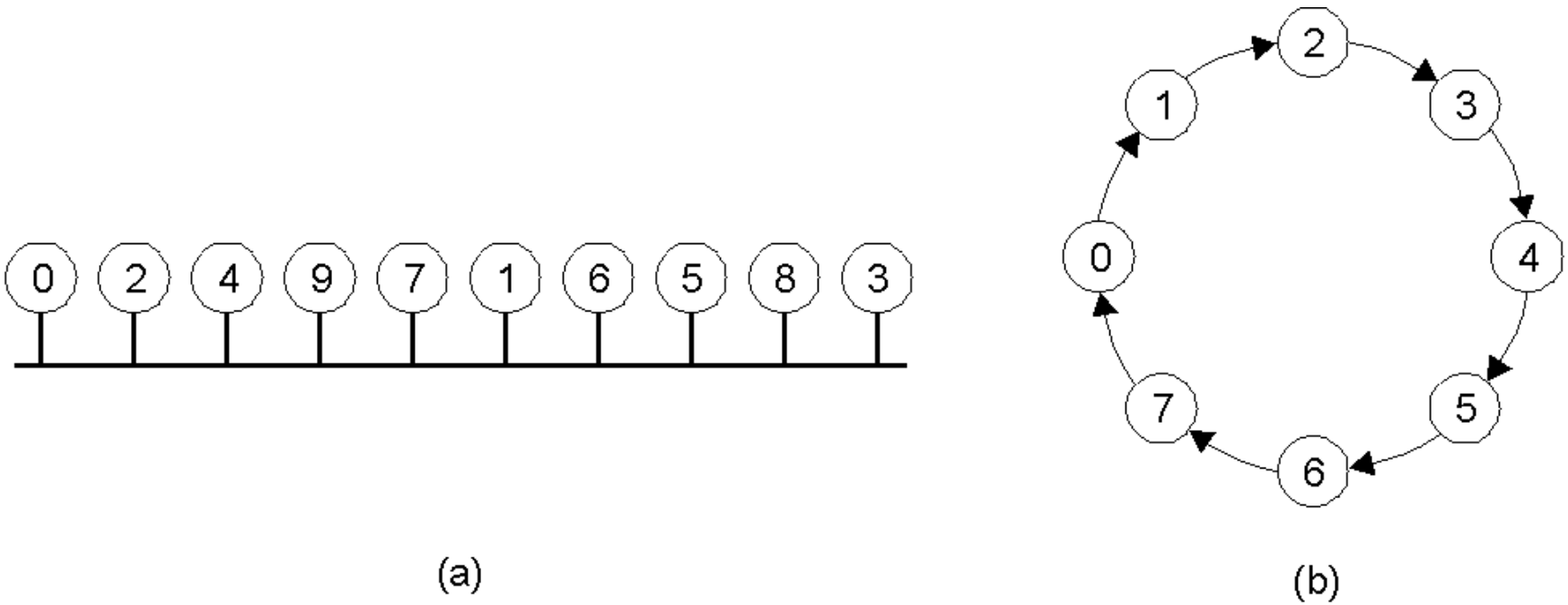
a) Proc 1 asks coordinator for permission to enter critical region (granted)
b) Proc 2 asks permission to enter same CR, coordinator does not reply
c) When proc 1 exits CR, it tells the coordinator, which then replies to 2

A Distributed Algorithm



a) Procs 0, 2 want to enter critical region at the same time
b) Proc 0 has the lowest timestamp, so it wins
c) When process 0 done, it sends an OK, so 2 can now enter the CR

A Token Ring Algorithm



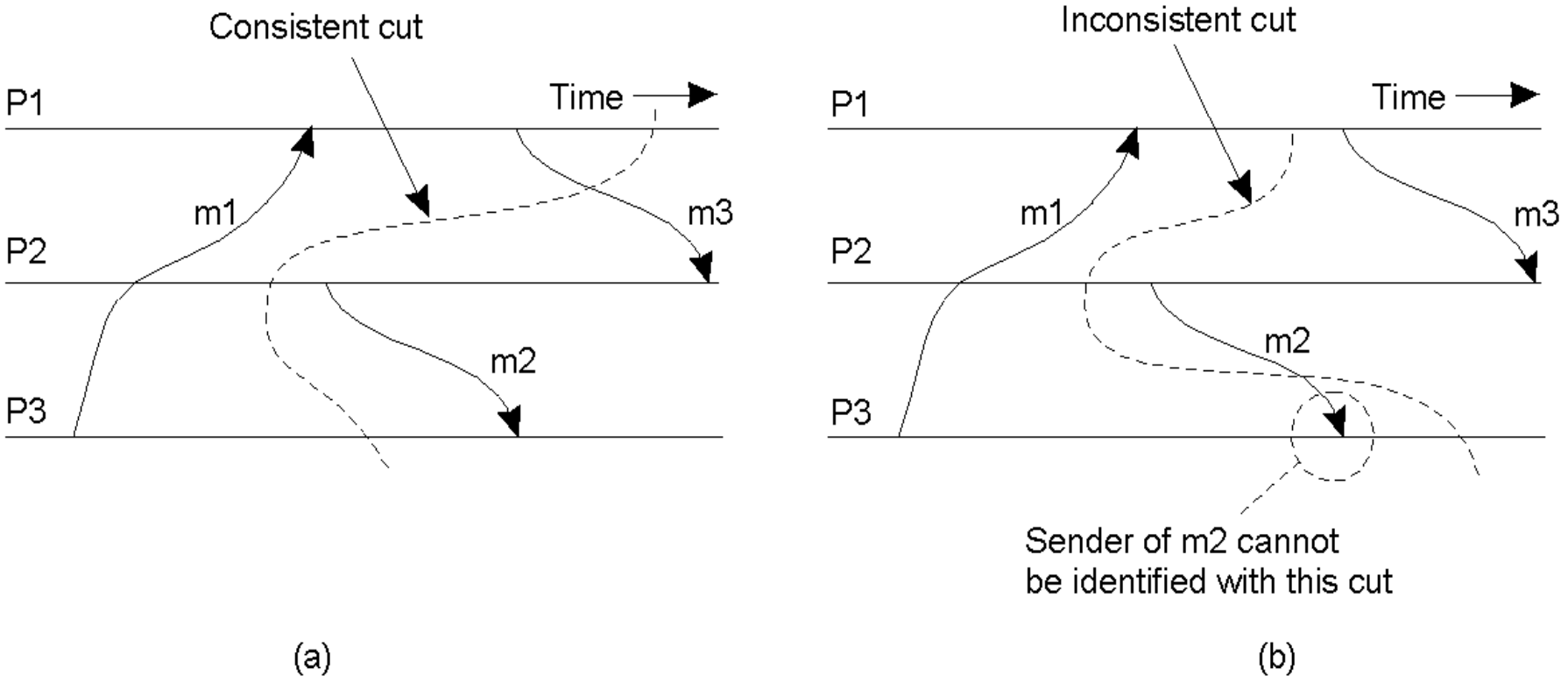
a) An unordered group of processes on a network
b) A logical ring constructed in software

Comparison

Algorithm	Messages per entry/exit	Delay before entry (in message times)	Problems
Centralized	3	2	Coordinator crash
Distributed	2 (n – 1)	2 (n – 1)	Crash of any process
Token ring	1 to ∞	0 to n – 1	Lost token, process crash

A comparison of three mutual exclusion algorithms

Global State (1)



a) A consistent cut
b) An inconsistent cut