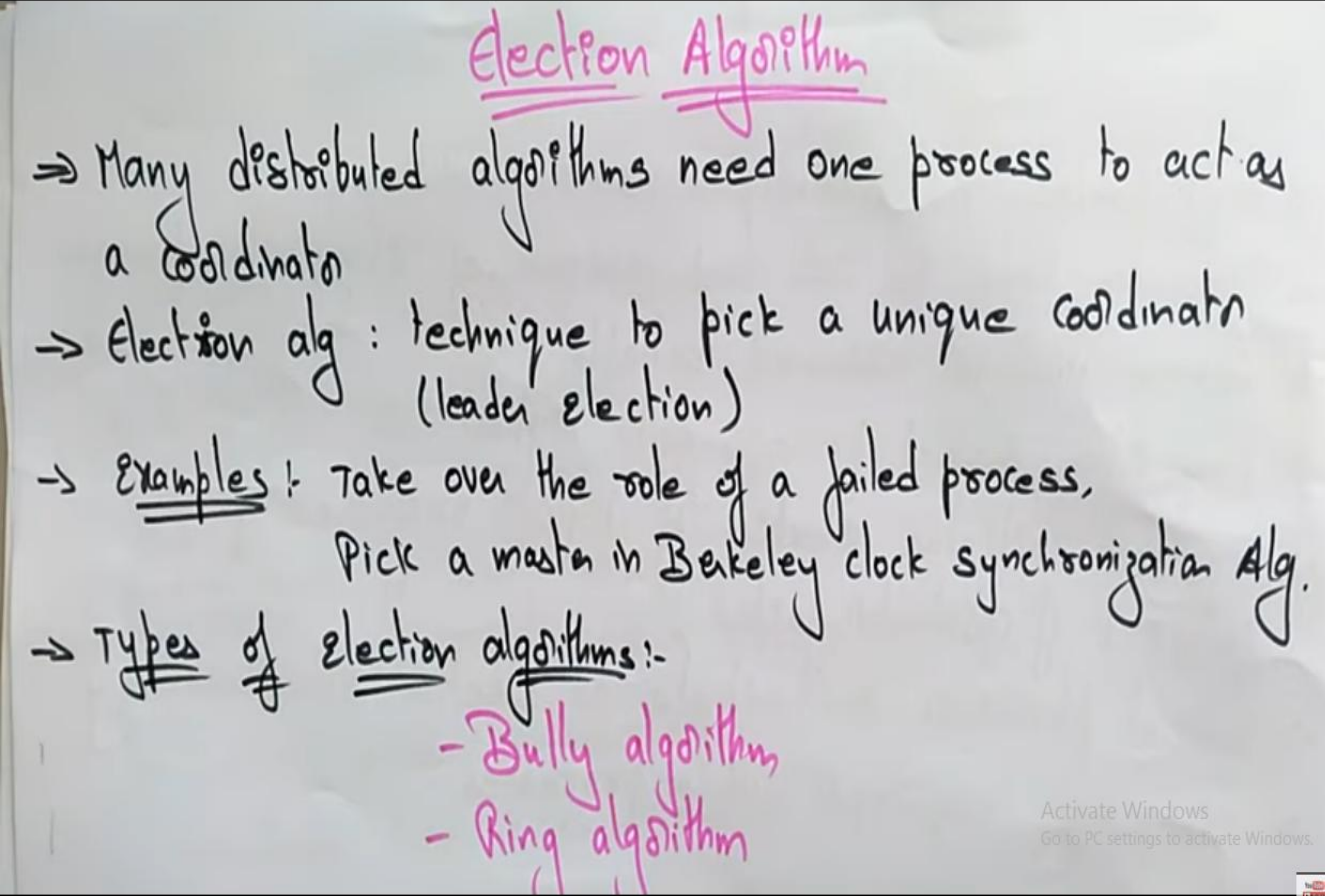

Election Algorithm

⇒ Many distributed algorithms need one process to act as a coordinator

-> Election alg : technique to pick a unique coordinator (leader election)

-> Examples :- Take over the role of a failed process,
Pick a master in Berkeley clock synchronization Alg.

-> Types of election algorithms :-

- Bully algorithm
- Ring algorithm

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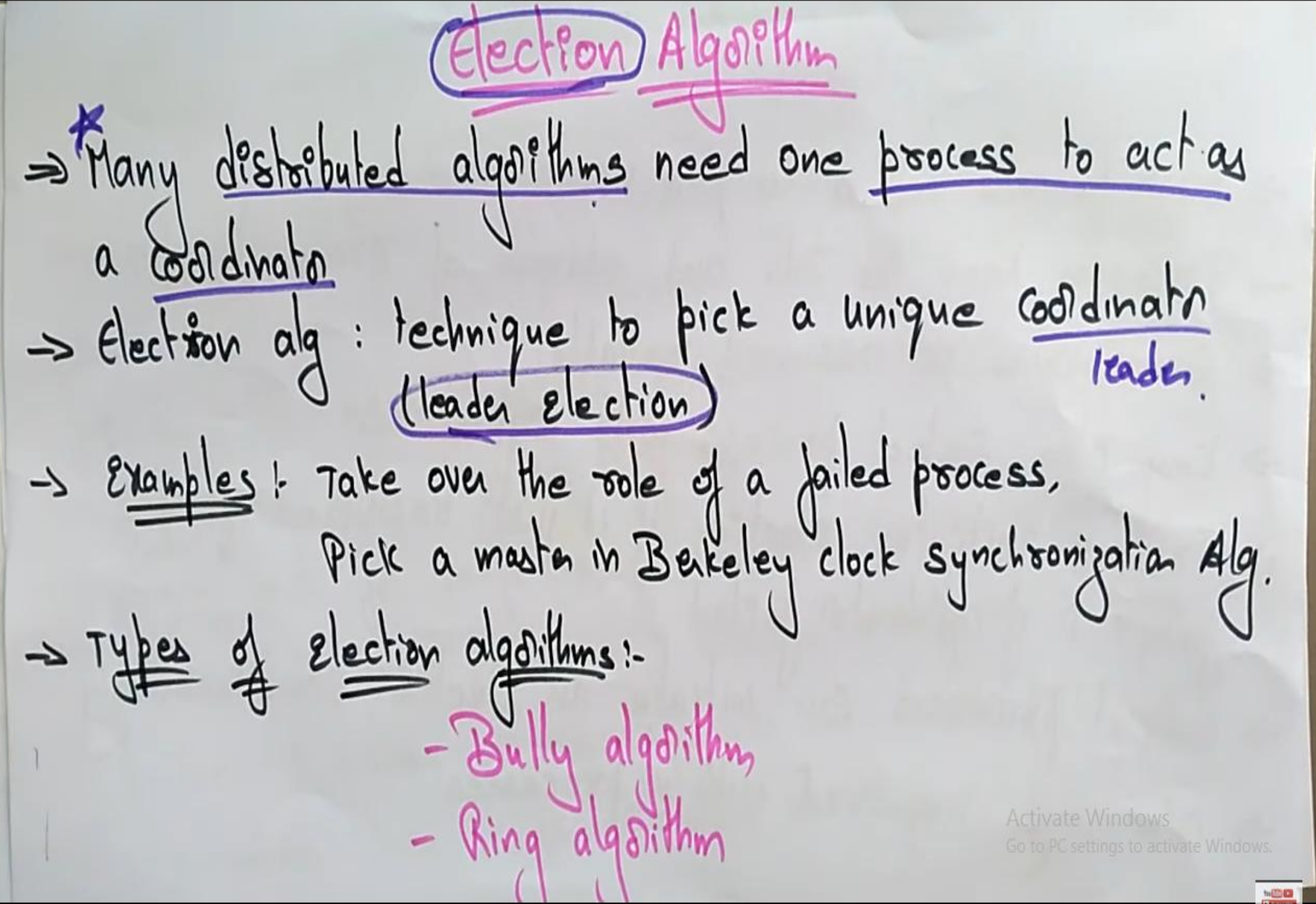

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Bully Algorithm

- -> Each process has a unique numerical ID
- -> Processes know the Id's and address of every other process
- -> Communication is assumed reliable.
- -> Key idea: select process with highest ID
- -> Process initiates election if it just recovered from failure or if coordinator failed
- -> Several processes can initiate an election simultaneously
- -> $O(n^2)$ msg required with n processes

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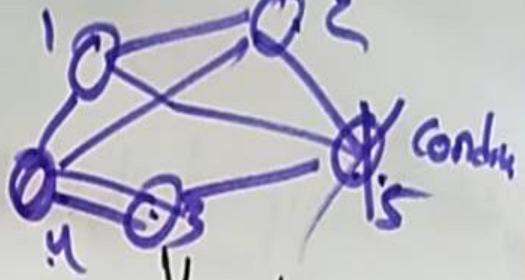

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Algorithm:- Suppose Process P Sends a message to the coordinator.

1. If coordinator does not respond to it within a time interval T, then it is assumed that coordinator has failed.
2. Now Process P Sends Election message to Every process with high priority number.
3. It waits for response, if no one responds for time interval T then process P Elects itself as a coordinator
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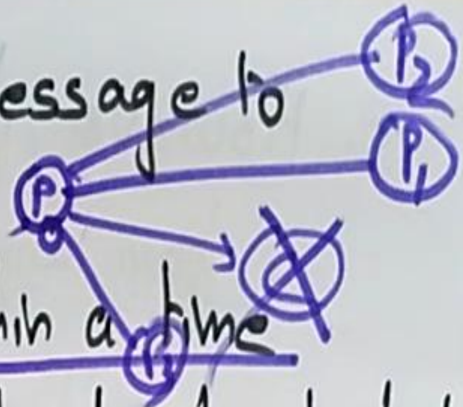

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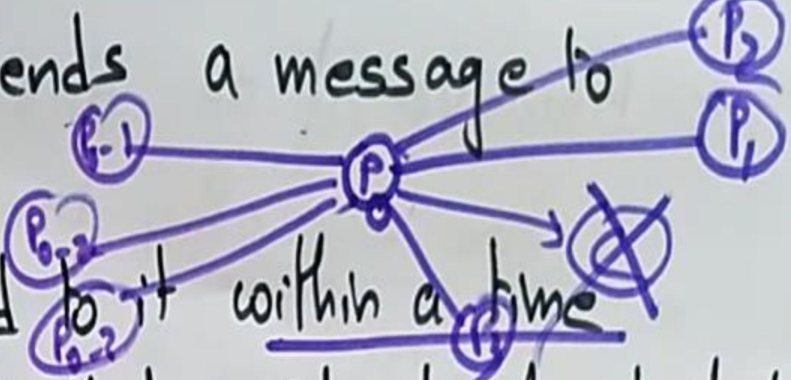

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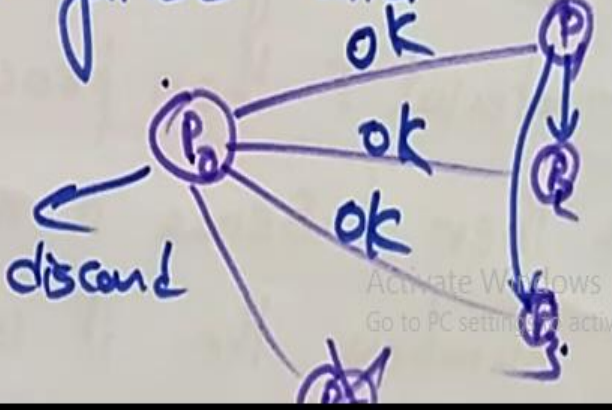
5. However, if an answer is received within time T from any other process Q,

- -> Process P again waits for time interval T to receive another message from Q that it has been elected as coordinator.
- -> If Q doesn't respond within time interval T, then it is assumed to have failed and algorithm is restarted.



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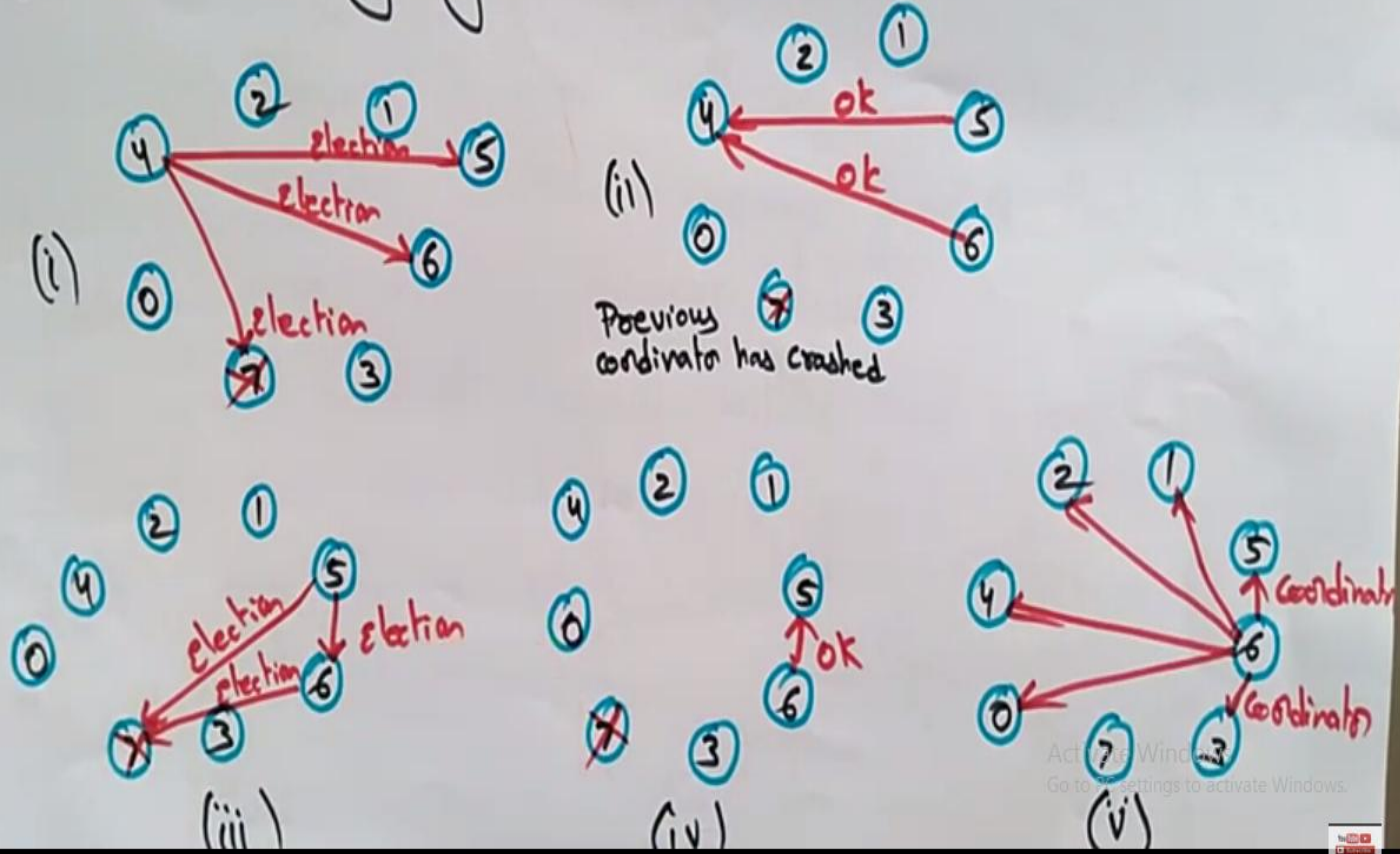
Example: "Bully algorithm"



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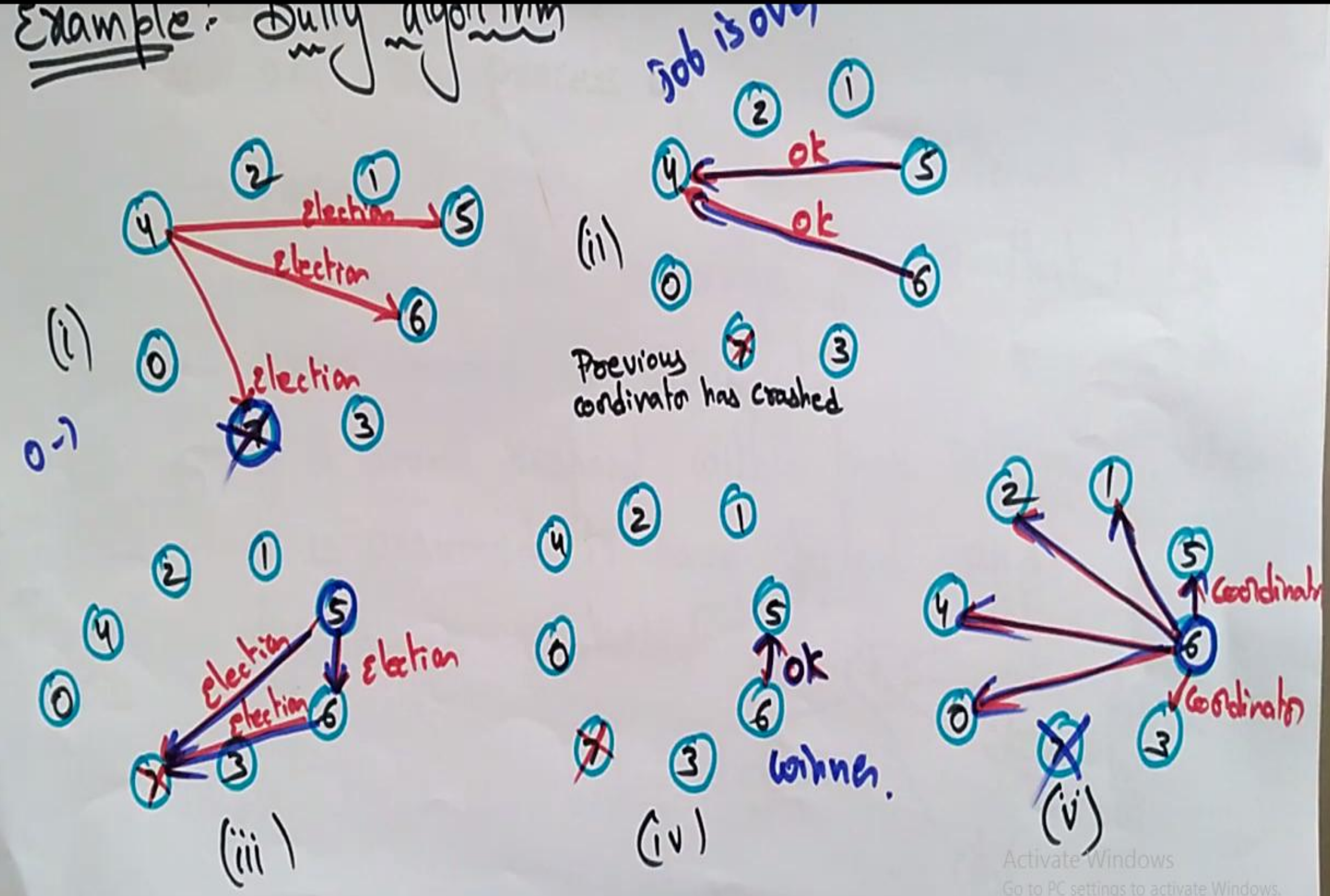

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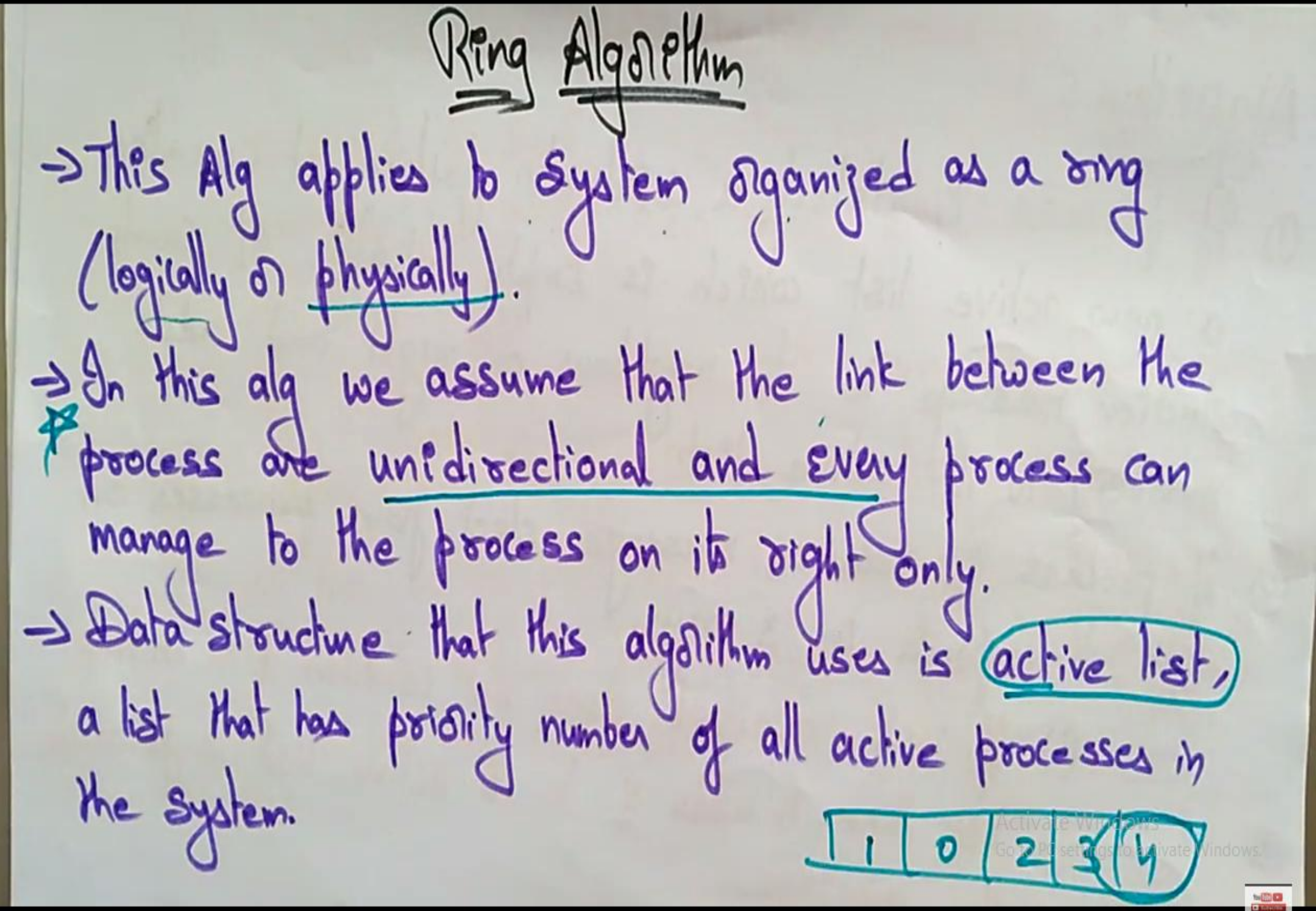

Ring Algorithm

- This Alg applies to system organized as a ring (logically or physically).
- In this alg we assume that the link between the process are unidirectional and every process can manage to the process on its right only.
- Data structure that this algorithm uses is active list, a list that has priority number of all active processes in the system.

1	0	2	3	4

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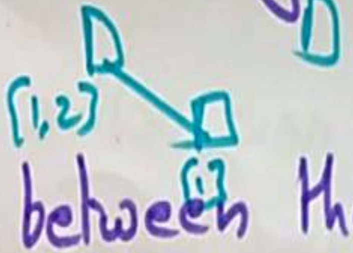

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Algorithm :-

① If process P_1 detects a coordinator failure, it creates a new active list which is Empty initially. It sends election message to its neighbour on right and adds number 1 to its active list.

② If process P_2 receives message elect from processes on left, it responds in 3 ways.

(i) If msg received does not contain 1 in active list then P_1 adds 2 to its active list & forwards the message.

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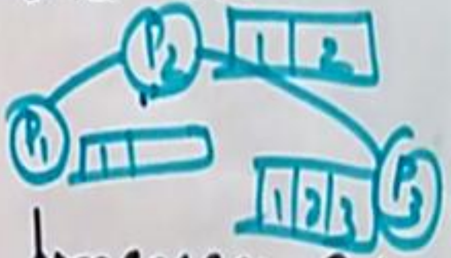

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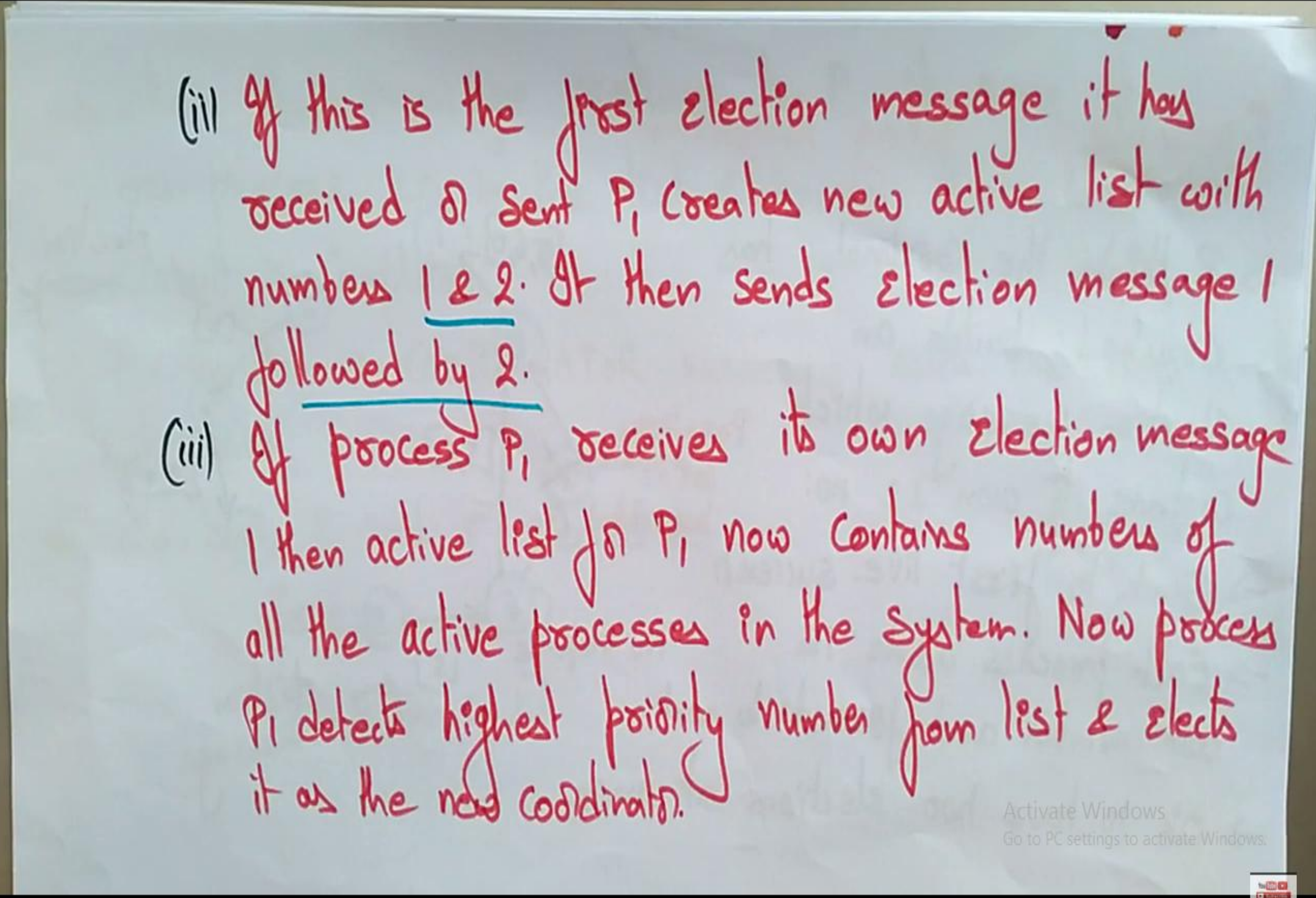

(ii) If this is the first election message it has received or sent P_1 creates new active list with numbers 1 & 2. It then sends election message 1 followed by 2.

(iii) If process P_1 receives its own election message 1 then active list for P_1 now contains numbers of all the active processes in the system. Now process P_1 detects highest priority number from list & elects it as the new coordinator.

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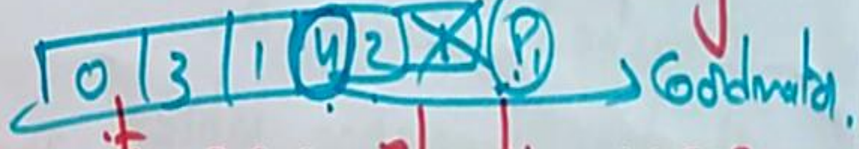

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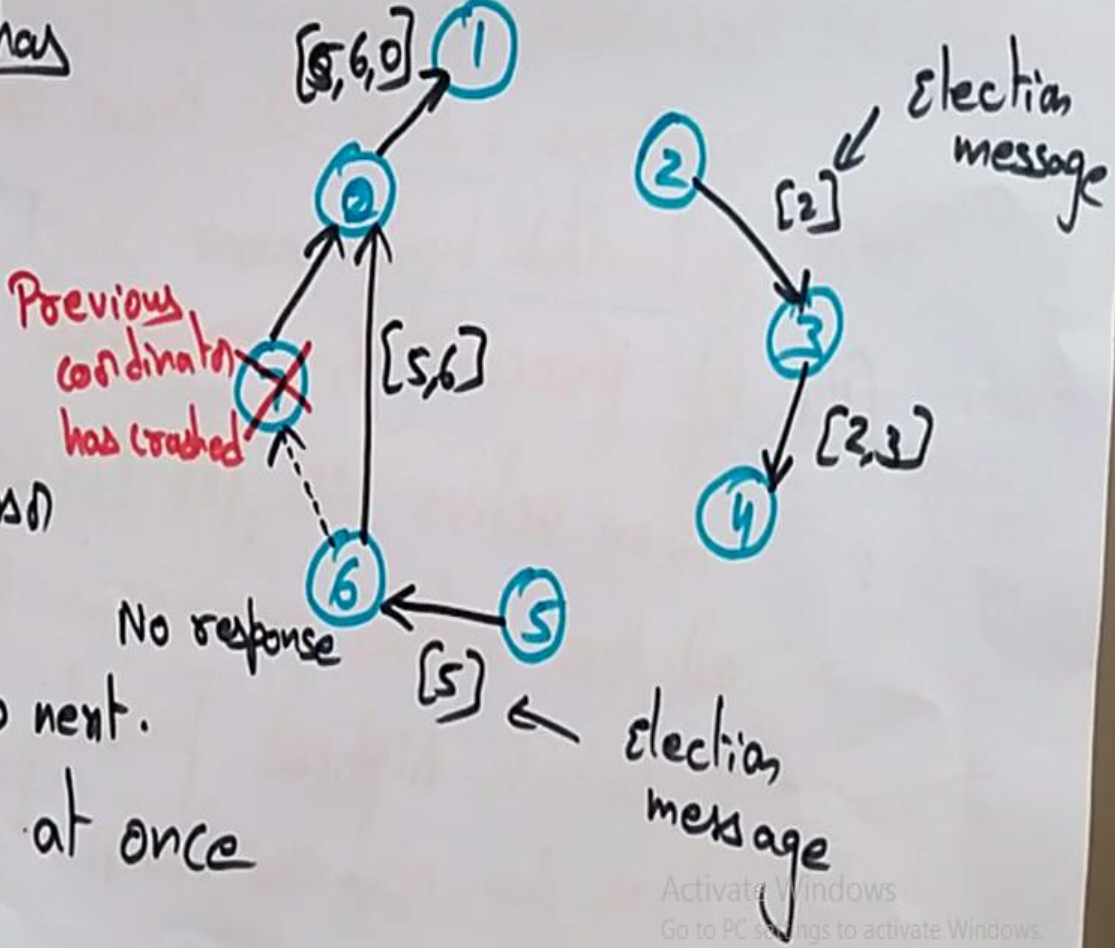
Example : "Reng Algorithm"

- P thinks the coordinator has crashed; builds an Election message which contains its own ID no:
- Sends to first live successor
- Each process adds its own number and forwards to next.
- Ok to have two elections at once



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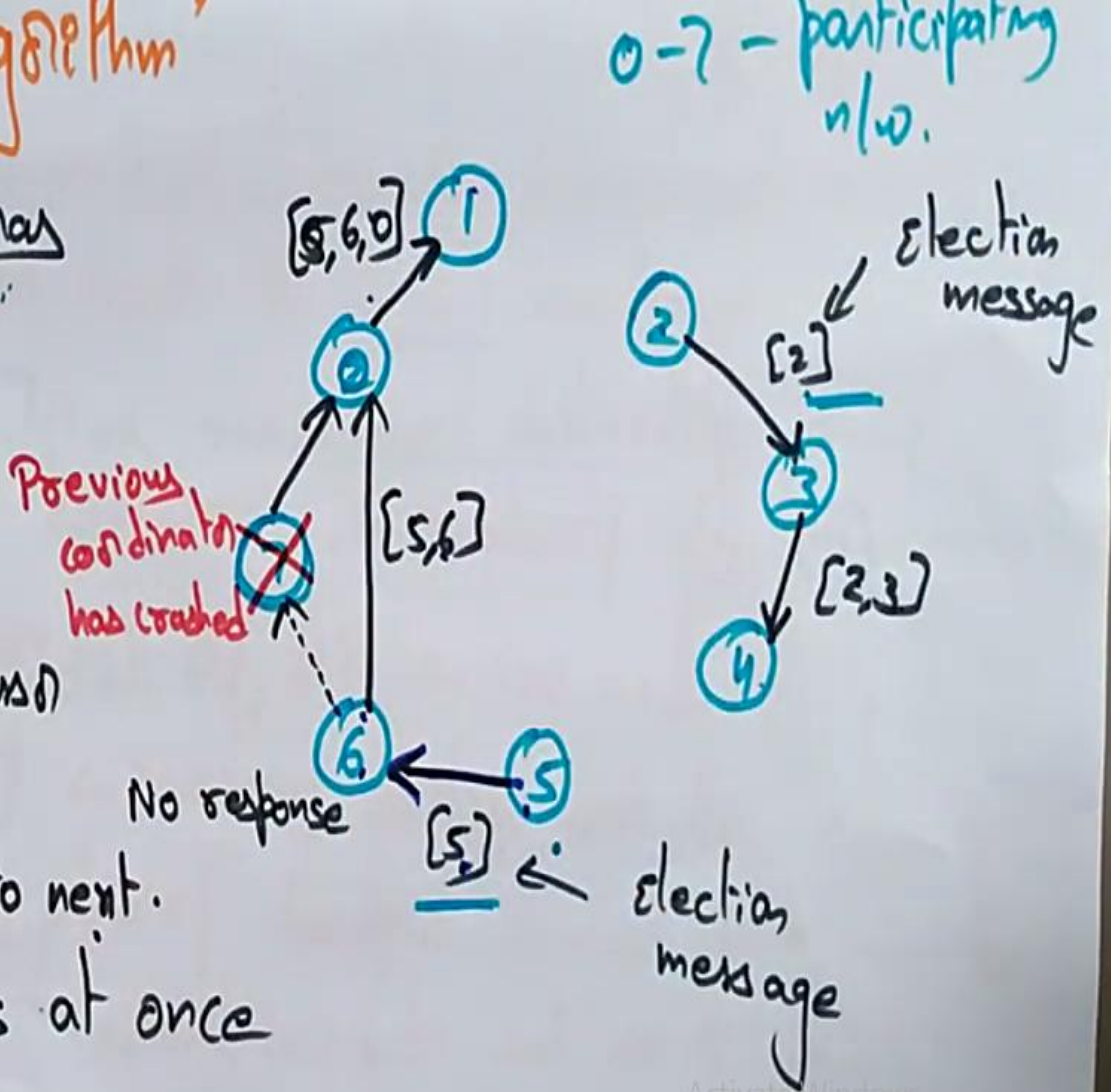

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→ when the message returns to P, it sees its own process ID in the list & knows that the circuit is Complete.

→ P circulates a COORDINATOR message with the new high number.

→ Here, both 2 and 5 Elected &:

[5, 6, 0, 1, 2, 3, 4]

[2, 3, 4, 5, 6, 0, 1]

6 - coordinator.

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