Deadlock detection

Three Strategies

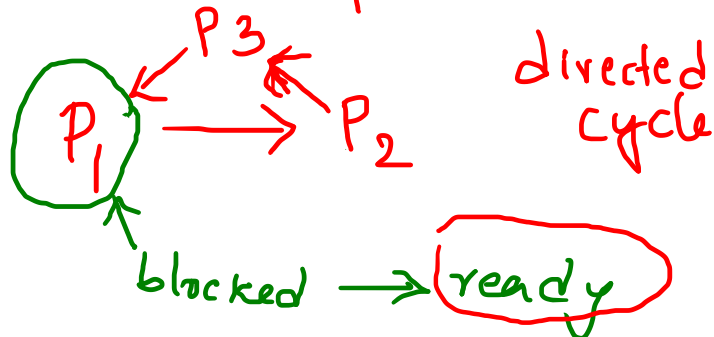**Detection**

↓

Interaction

b/w { process — resource }

↓

WFG nodes → process

P3 ← P1 → P2

directed cycle

blocked → ready

Prevention

↓

Avoidance

↓

global safe

RAG

Reso =

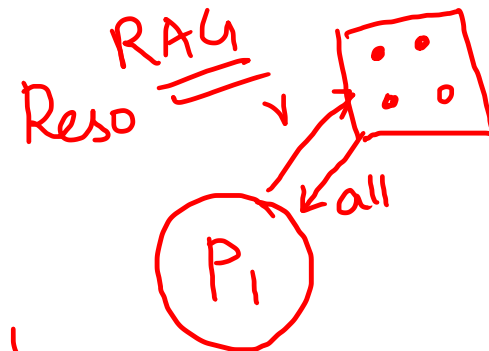P1 → all

System Model / Assumption

- Reusable resources
- exclusive acess to resource
- Single unit of resource

Models of deadlock.

1. Single - resource model (one unit resource)

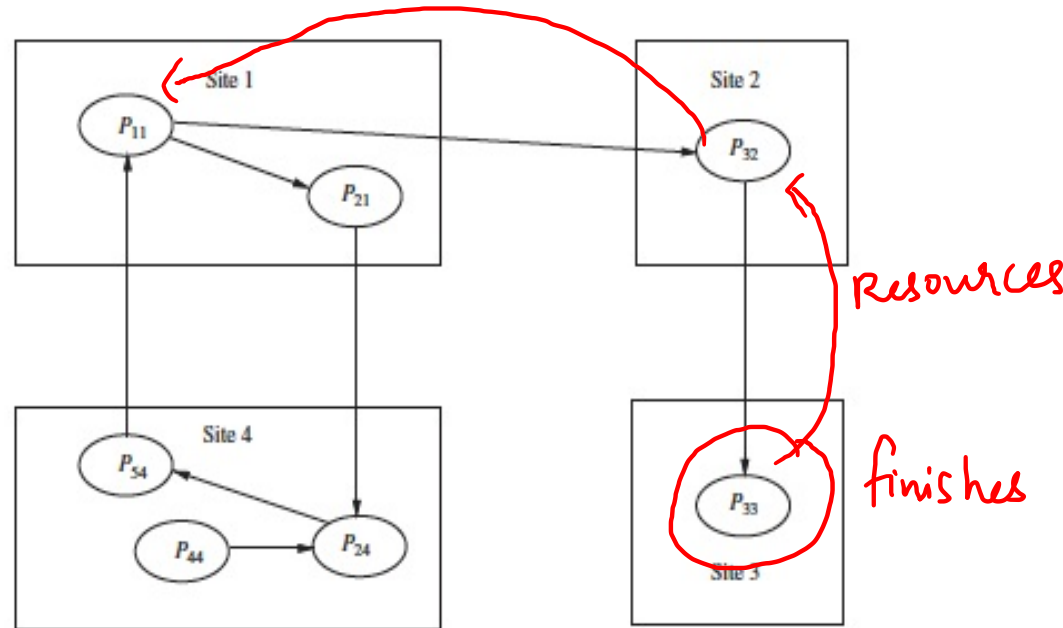2. AND - model
   ↳ cycle.

3. OR model
   ↳ "knot"

   v   u

4. AND – OR model

5. $\binom{p}{q}$ model

6. Unrestricted

Site 1 — P_{11}, P_{21}
Site 2 — P_{32}
Site 4 — P_{54}, P_{44}, P_{24}
Site 3 — P_{33}

Resources
finishes

1. Path-pushing Algm. (Building a global WFG)

2. (Edge-chasing Algm) (probe message)
   ↳ probe(i , j , k)
     ↓   ↓   ↘ node
     node   node   in
     which   in the   different
     initiated home   site
     deadlock site
     detection of "i"

3. Diffusing computation-
   based Algm.

4. Global State detection-based
   algm

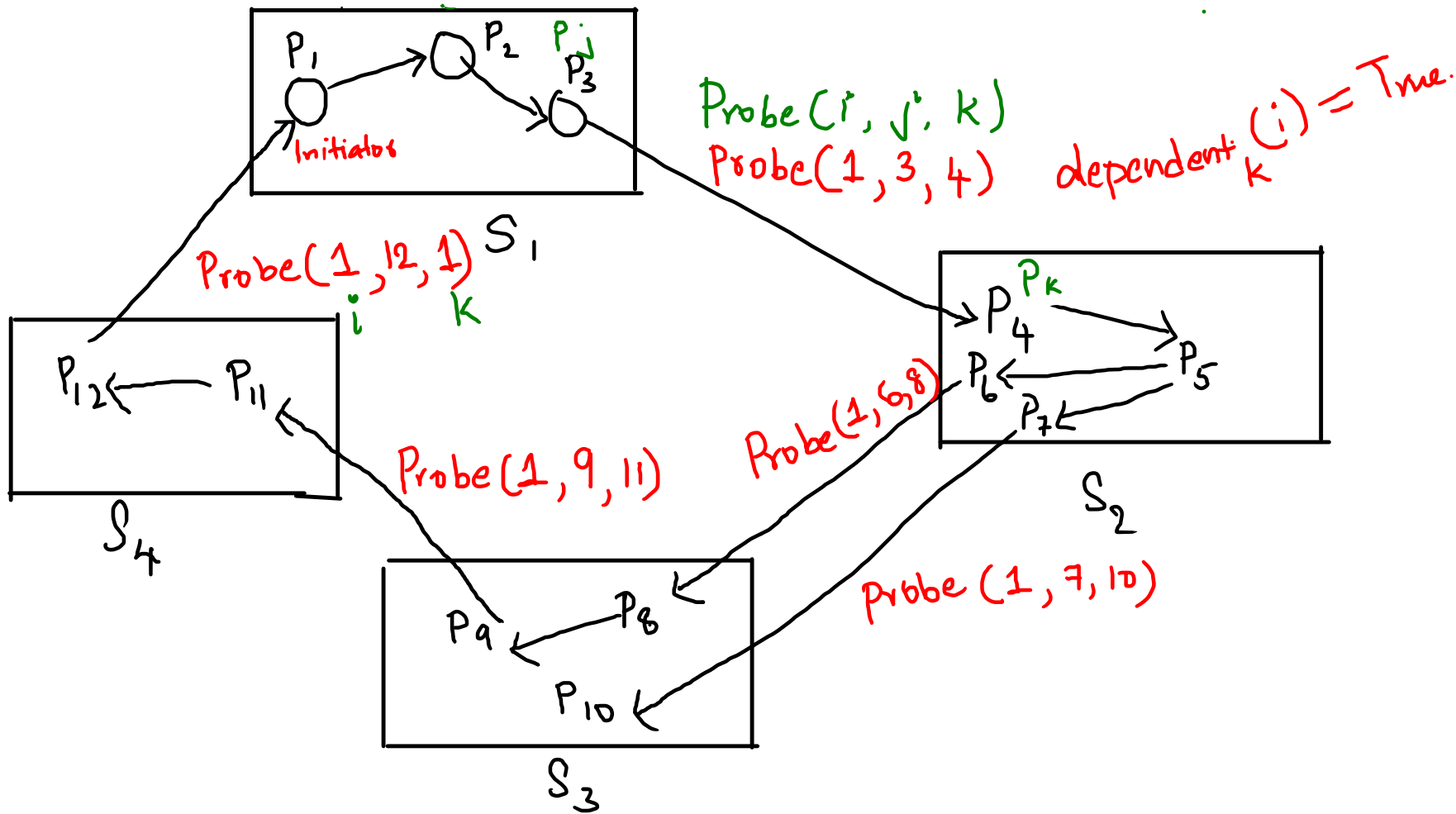## Chandy - Misra - Haas Algm — AND model

Edge chasing approach

Probe triplet (i, j, k)

dependent$_i$

$P_j \xrightarrow{} P_1 \quad P_2 \cdots P_m \quad P_m$

P_1 P_2 P_3

Initiator

S_1

Probe(i, j, k)

Probe(1, 3, 4)

dependent$_k$(i) = True.

Probe(1, 12, 1)
i k

P_{12} P_{11}

S_4

Probe(1, 9, 11)

P_k

P_4 P_5

P_6

P_7

S_2

Probe(1, 6, 8)

Probe(1, 7, 10)

P_9 P_8

P_{10}

S_3

$\text{Write}(x, a)$

$\downarrow \qquad \downarrow$

Var   value

$\text{read}(x, \underline{a})$

$\downarrow \qquad$

variable   value

$\text{read}_{(i)}(x, a)$

$\rightarrow$ process id

1. Strict Consistency/atomic Consistency/ Linearizability

No divisibility

Process (invocation   response)   operation

local
mfy
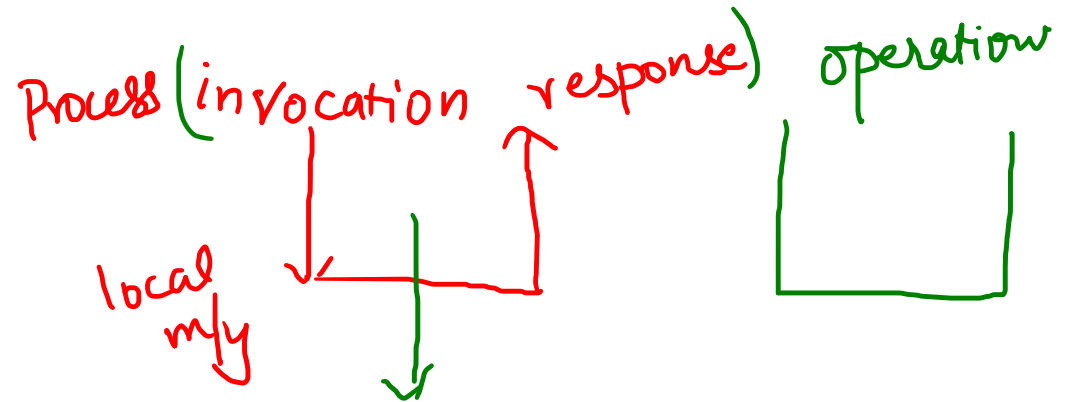
- Common global time axis is implicitly available.
- Write is immediately visible.

$Write_i(x, a)_{ts} \longrightarrow$ read operation

Overlap

P_i Write(x)

P_j read(x)   read(x)