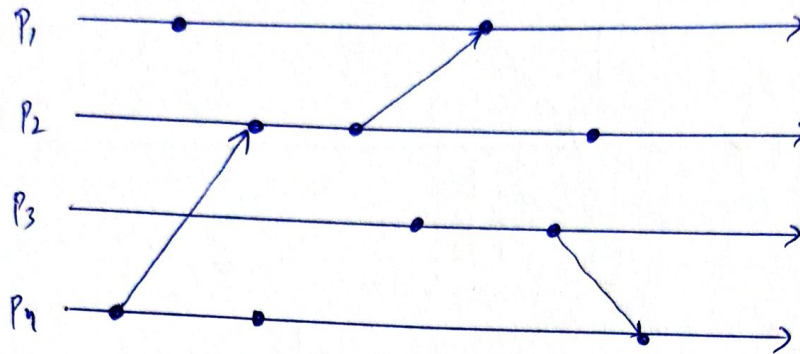


Shruti Sharma

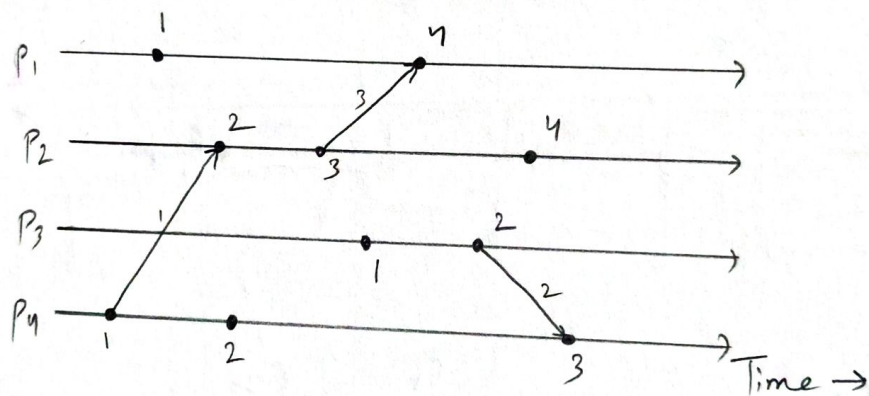
MD5202435

DCBD Assignment 1.

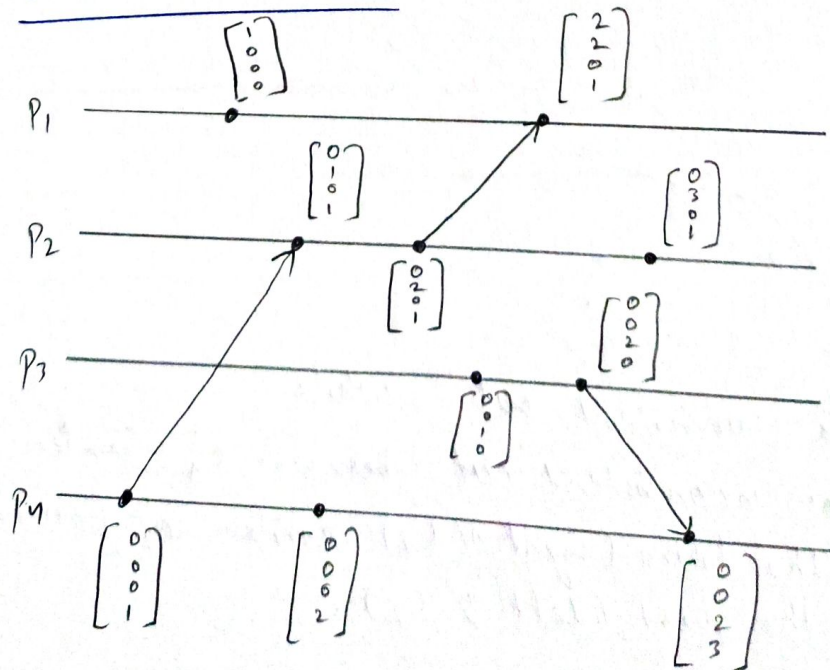
Part 1



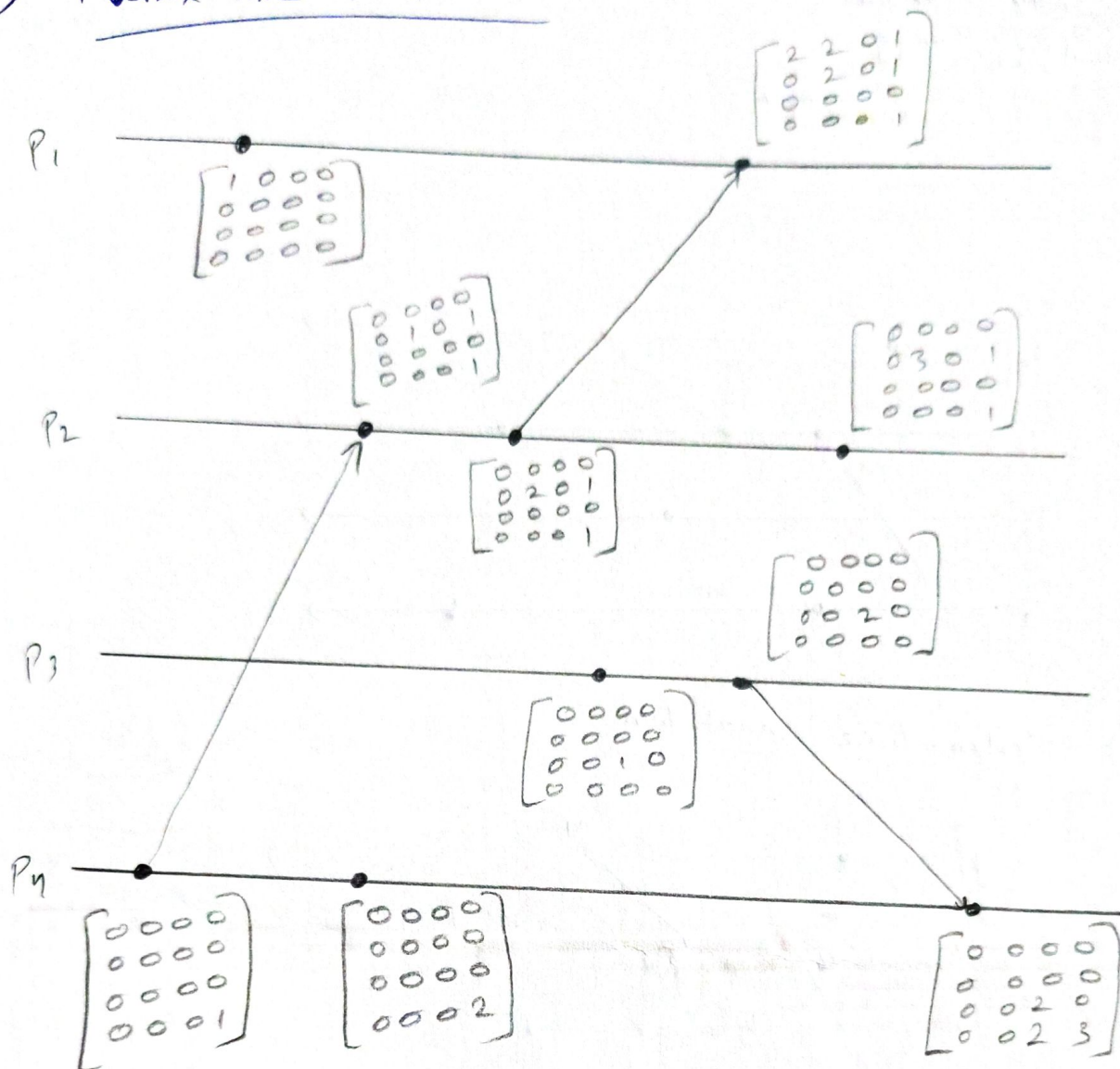
(1) Scalar-Time annotation



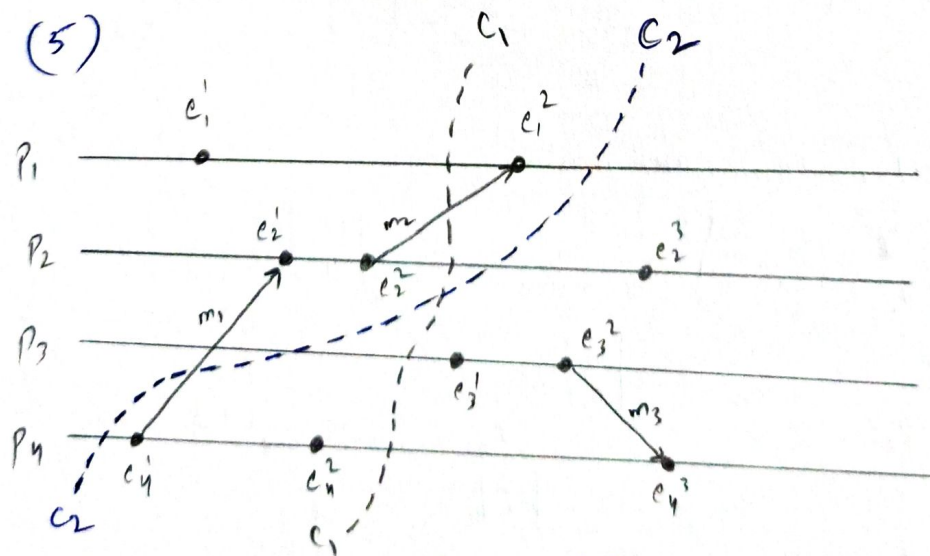
(2) Vector-Time annotation



(3) Matrix time annotation



(4) & (5)



C_1 is a consistent cut, while C_2 is an inconsistent cut because e_4^1 (sender of m_1) is in the future (right of C_2) while e_2^1 (receiver of m_1) is in the past (left of C_2).

$$(6) \quad (0, 0, 2, 0) \rightarrow (0, 0, 2, 3)$$

$$\text{ie. } e_3^2 \rightarrow e_4^3$$

is an example of a happens before relation between the events e_3^2 & e_4^3 .

(7) For our cut C_1 in answer (4) & (5), the latest events at each process past of the cut C_1 are:

$$e_1^1, e_2^2 \text{ and } e_4^2$$

$$\text{ie. } \bigcup_i LS_i^{\text{max-past}_i(C_1)} = \{LS_1^1, LS_2^2, LS_4^2\}$$

(local state)

~~Similarly, the channel state $SC_{jk}^{x,y}$ i.e. the messages that a process p_i sent up to event~~

Similarly, the channel state

$$SC_{ij}^{x,y} = \{m_{ij} \mid \text{send}(m_{ij}) \leq e_i^x \wedge \text{rec}(m_{ij}) \not\leq e_j^y\}$$

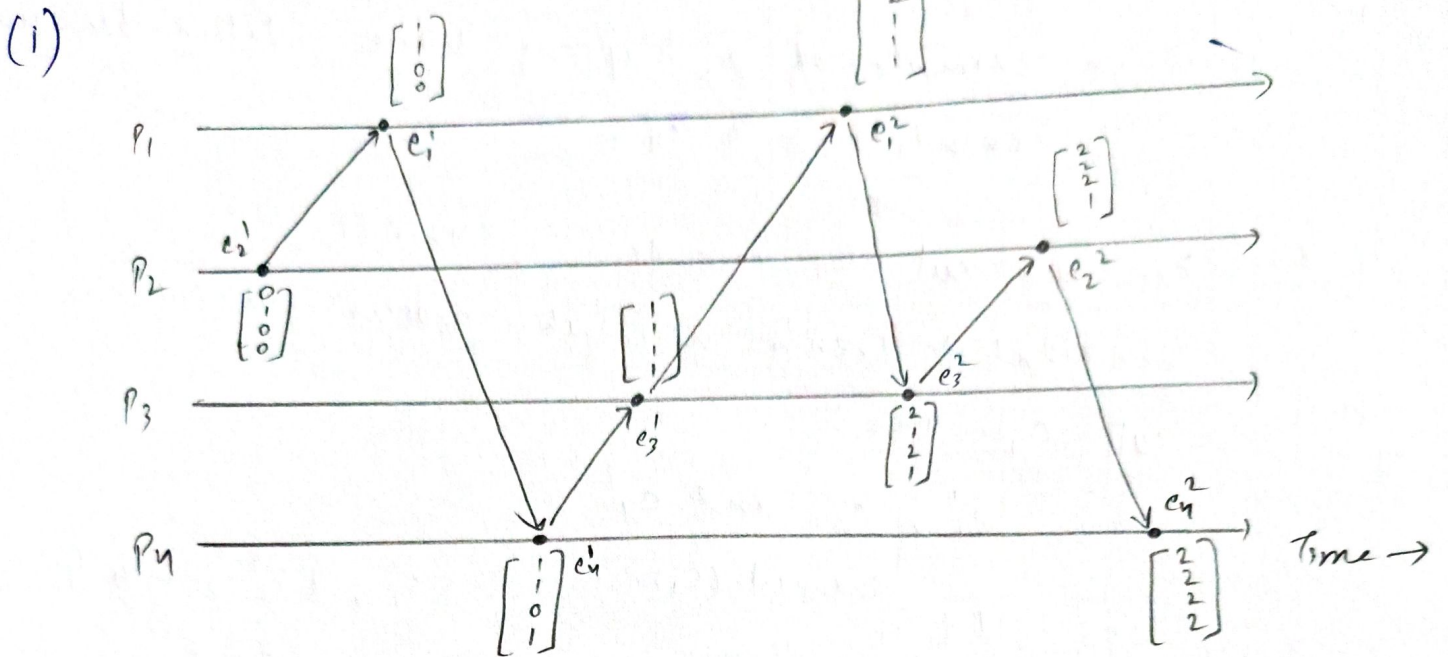
ie. all messages that p_i sent up to event e_i^x and process p_j had not received until event e_j^y are:

$$\{m_2\}$$

By definition, our global state becomes.

$$G_1 = \{\{LS_1^1, LS_2^2, LS_4^2\}, \{m_2\}\}$$

Part 2



(1) $(1, 1, 1, 1) \rightarrow (2, 1, 1, 1)$ happens from $e_3^1 \rightarrow e_1^2$

(2) Exactly two events occur in each process

$$P_1: \{e_1^1, e_1^2\}$$

$$P_2: \{e_2^1, e_2^2\}$$

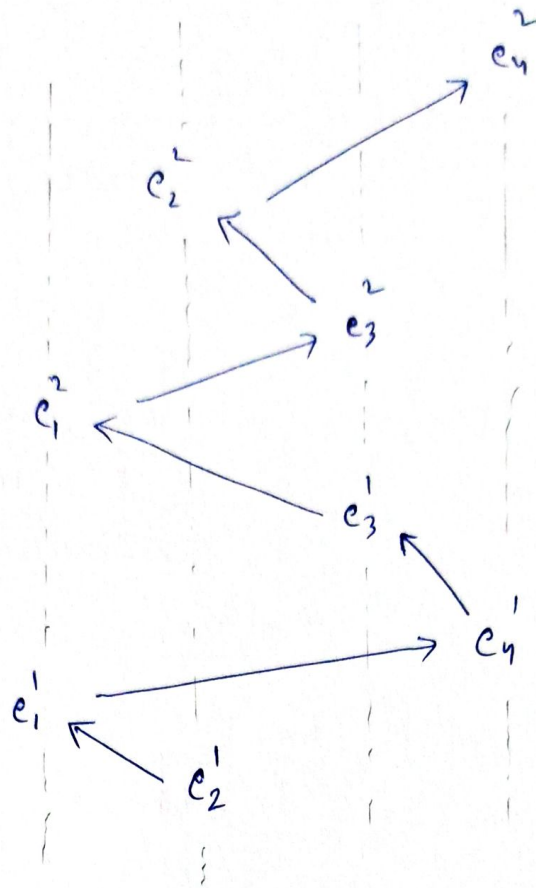
$$P_3: \{e_3^1, e_3^2\}$$

$$P_4: \{e_4^1, e_4^2\}$$

(3) B/w two events of every process, atleast one event occurred in another process.

(4) The first event occurred in $P_2 (e_2^1)$.

(2)



(3) Matrix time annotation:

