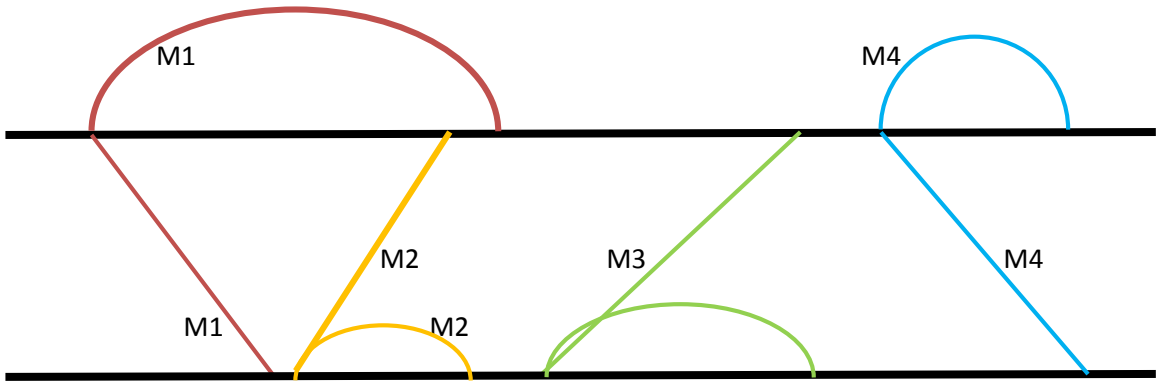
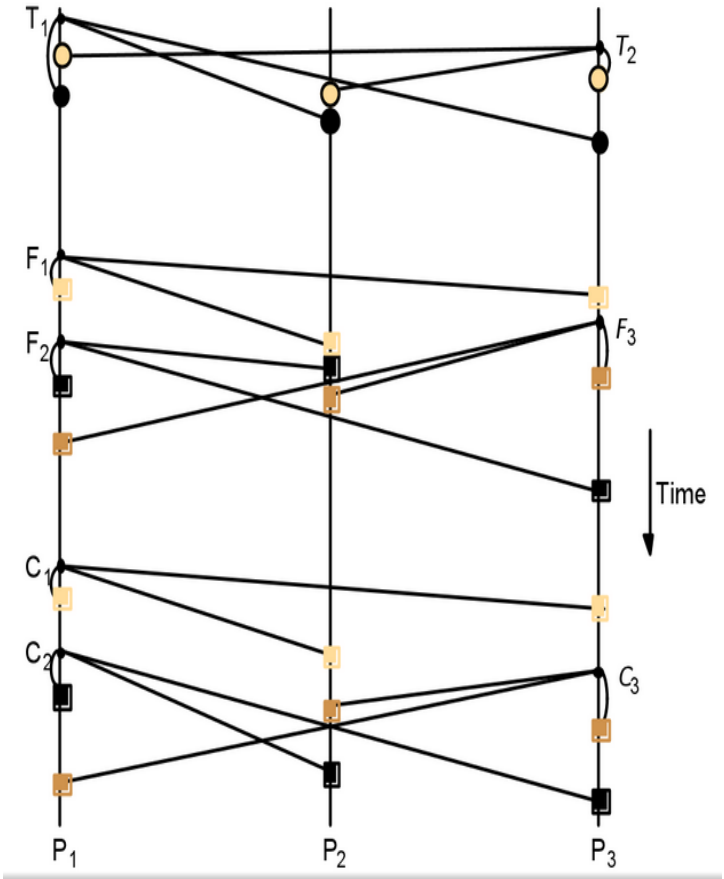
1.



2.



T1 and T2 – totally ordered messages.

F1 and F2 – FIFO related questions.

C1 and C3 – Causally related messages.

Causal-ordering implies FIFO.

Causal ordering does not imply total ordering.

Thus, Causal-ordering and FIFO together does not imply total-ordering.

3. (a)

$$\begin{bmatrix} X \\ Y \end{bmatrix} = \begin{bmatrix} (1/3)(2/3) \\ (2/3)(1/3) \end{bmatrix}^2 \begin{bmatrix} X \\ Y \end{bmatrix}$$

The square because there is one iteration.
Thus on solving we get

$$\begin{bmatrix} X \\ Y \end{bmatrix} = \begin{bmatrix} (1/3)(2/3) & (1/3)(2/3) \\ (2/3)(1/3) & (2/3)(1/3) \end{bmatrix} \begin{bmatrix} X \\ Y \end{bmatrix}$$

$$\begin{bmatrix} X \\ Y \end{bmatrix} = \begin{bmatrix} (5/9) & (4/9) \\ (4/9) & (5/9) \end{bmatrix} \begin{bmatrix} X \\ Y \end{bmatrix}$$

$X = (5X/9) + (4Y/9)$
$Y = (4X/9) + (5Y/9)$

3. (b)

$$\begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} (1/6) & (1/3) & (1/3) \\ (1/3) & (1/6) & (1/3) \\ (1/3) & (1/3) & (1/6) \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix}$$