# TK1 Exercise 9

**Team members:**

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**Task 1 : 'Snapshot'-Algorithm of Chandy and Lamport**

a. Illustration 1.i is the correct and 1.ii is wrong.

**Reason:**
Quoting the rule from lecture slides,
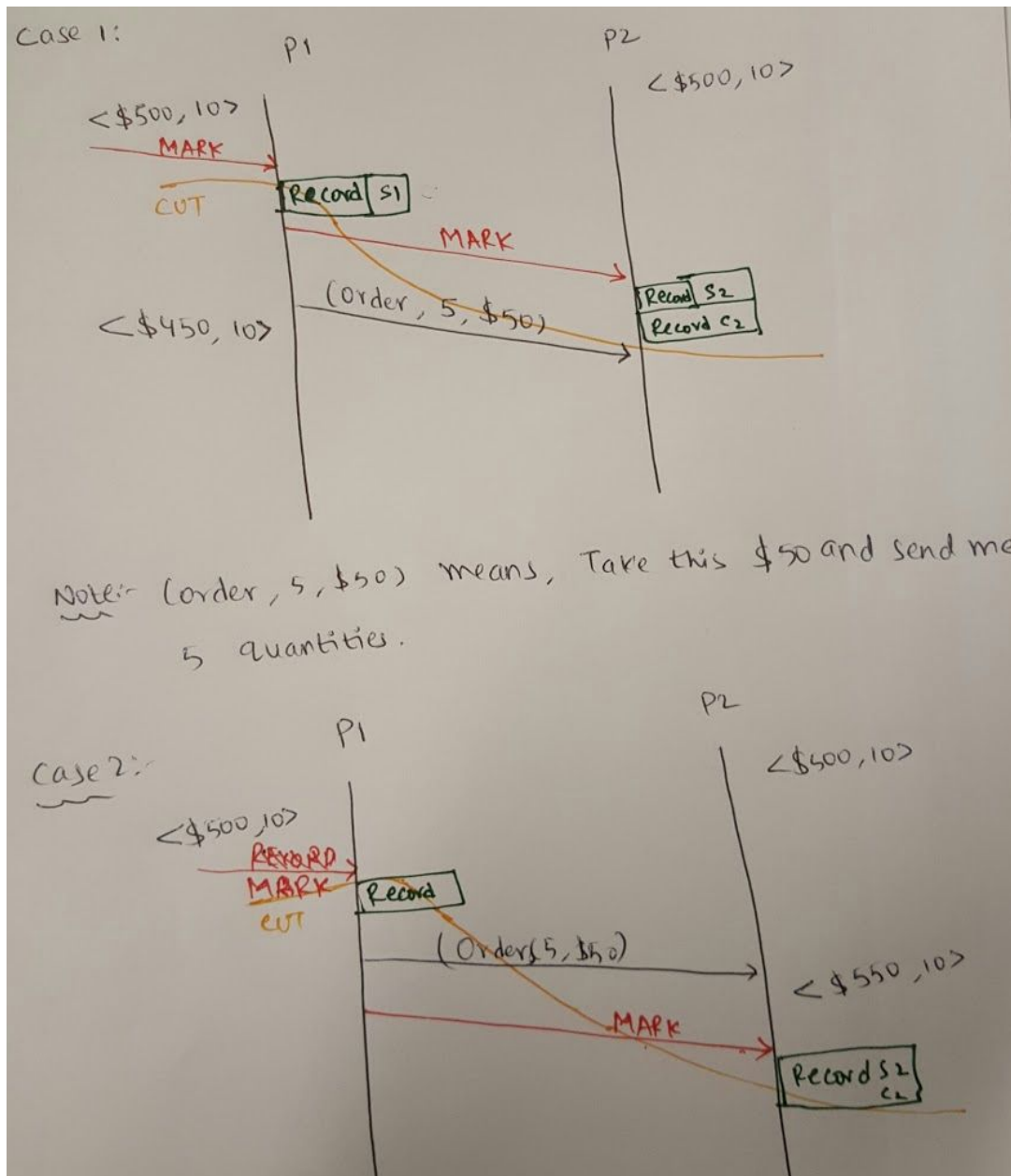
Marker sending rule for process $P_i$
- After $P_i$ has recorded its state, for each outgoing channel C
- $P_i$ sends one marker message over C **(before it sends any other message over C)**

   In 1.i marker message is the first message sent on channel after recording state. In 1.ii, P1 sends a different message after recording the state and before sending the marker message on channel

**Example:**
Consider a distributed system of 2 processors operating on 2 resources - money and quantities. The total resources at any recorded state must be constant.

Applying the above methods for a series of events in this system gives us:

Case 1:

P1          P2

<$500, 10>

<$500, 10>
MARK

CUT    Record S1

MARK

(Order, 5, $50)

<$450, 10>

Record S2
Record C2

Note:- (Order, 5, $50) means, Take this $50 and send me 5 quantities.

Case 2:

P1          P2

<$500, 10>

<$500, 10>
RECORD
MARK   Record
CUT

(Orders 5, $50)

<$550, 10>

MARK

Record S2
C2

**Recorded states:**

Case 1

    P1: <$500, 10>   C1: <>
    P2: <$500, 10>   C2: <>
    Total resources <$1000, 20> - consistent snapshot

Case 2

    P1: <$500, 10>   C1: <>
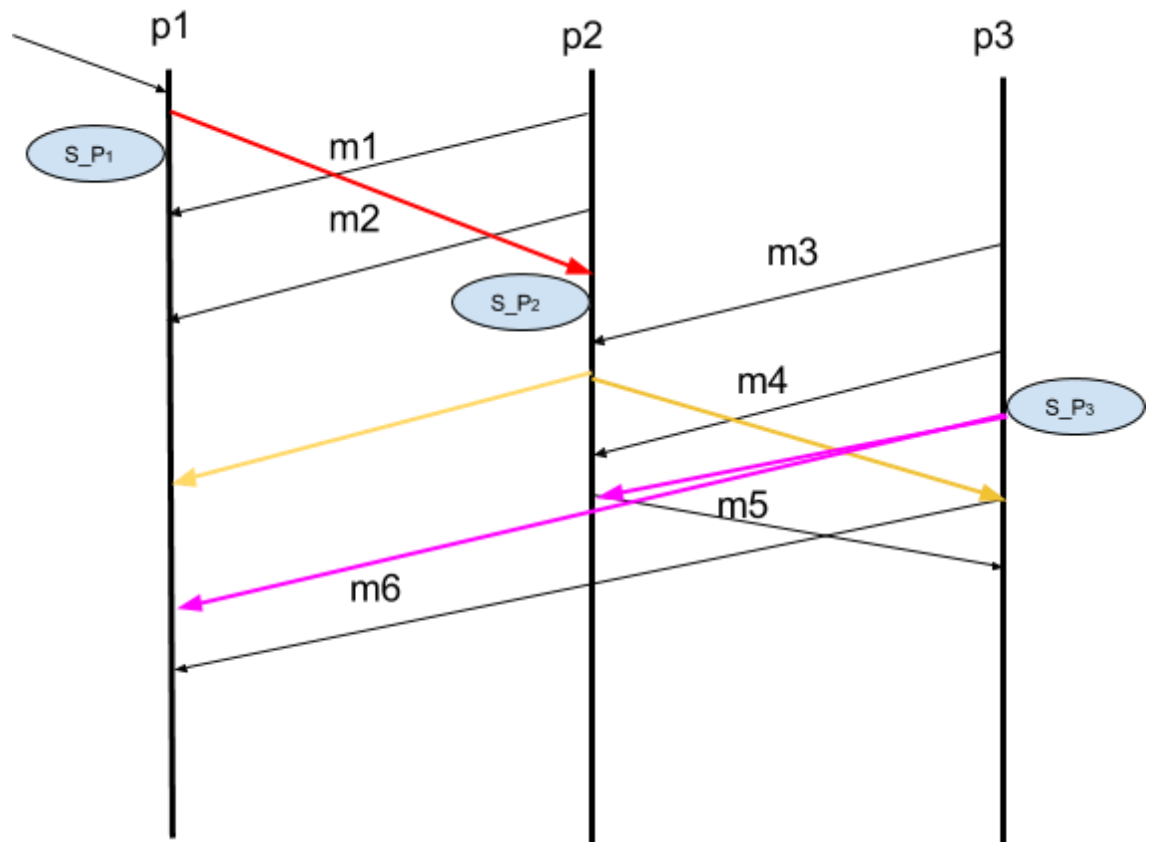    P2: <$550, 10>   C2: <>
    Total resources <$1050, 20> - inconsistent snapshot

Inconsistency in case 2 comes from the fact that we sent a message over the channel C1 before sending MARK MESSAGE after recording state.

b. 2 possible recording of states

Case 1:



S_P1
$C_{P2P1}$ : <M1,M2>
$C_{P3p1}$ : <>

S_P2
$C_{P1P2}$ : <>
$C_{P3P2}$ : <M3, M4>

S_P3
$C_{P1P3}$ : <>
$C_{P2P3}$ : <>

Case 2 :



S_P1
$C_{P2P1}$ : <M1,M2>
$C_{P3p1}$ : <M6>
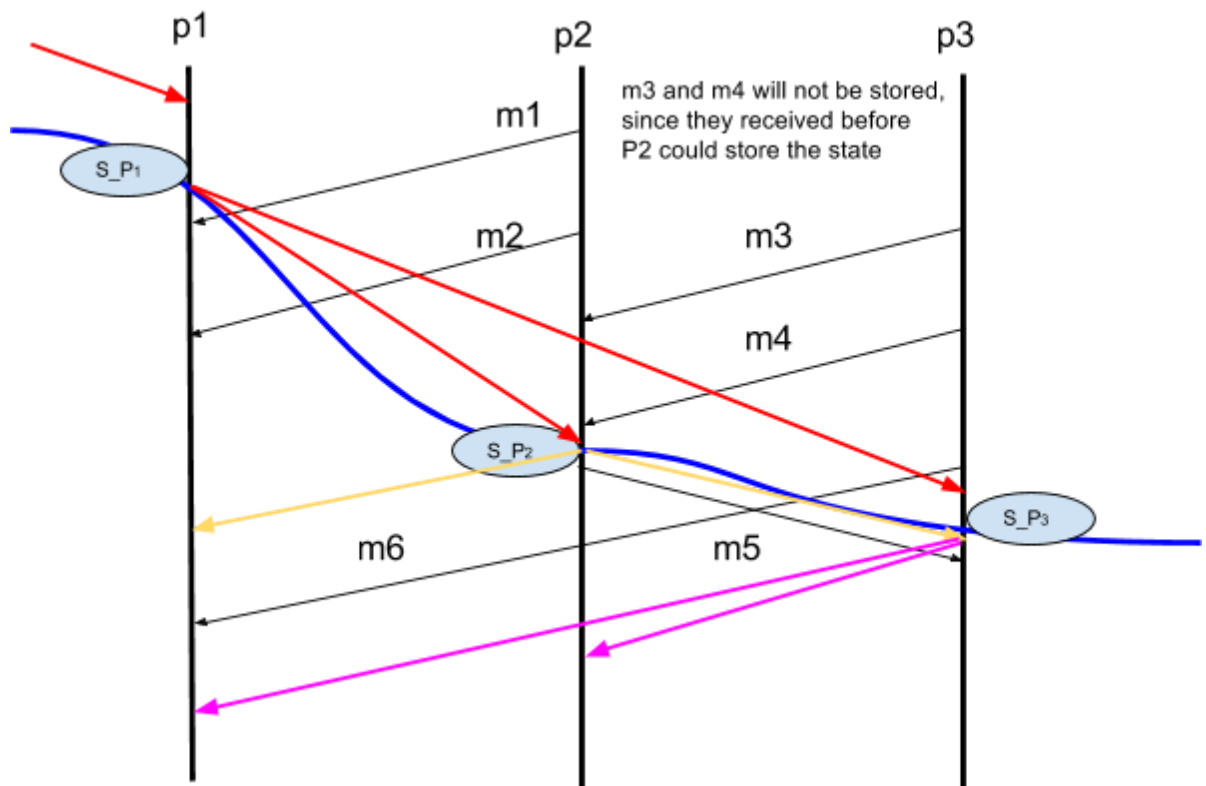
S_P2
$C_{P1P2}$ : <>
$C_{P3P2}$ : <>

S_P3
$C_{P1P3}$ : <>
$C_{P2P3}$ : <>

## Task 2: Snapshot vs. Actual Program Flow

**a)**
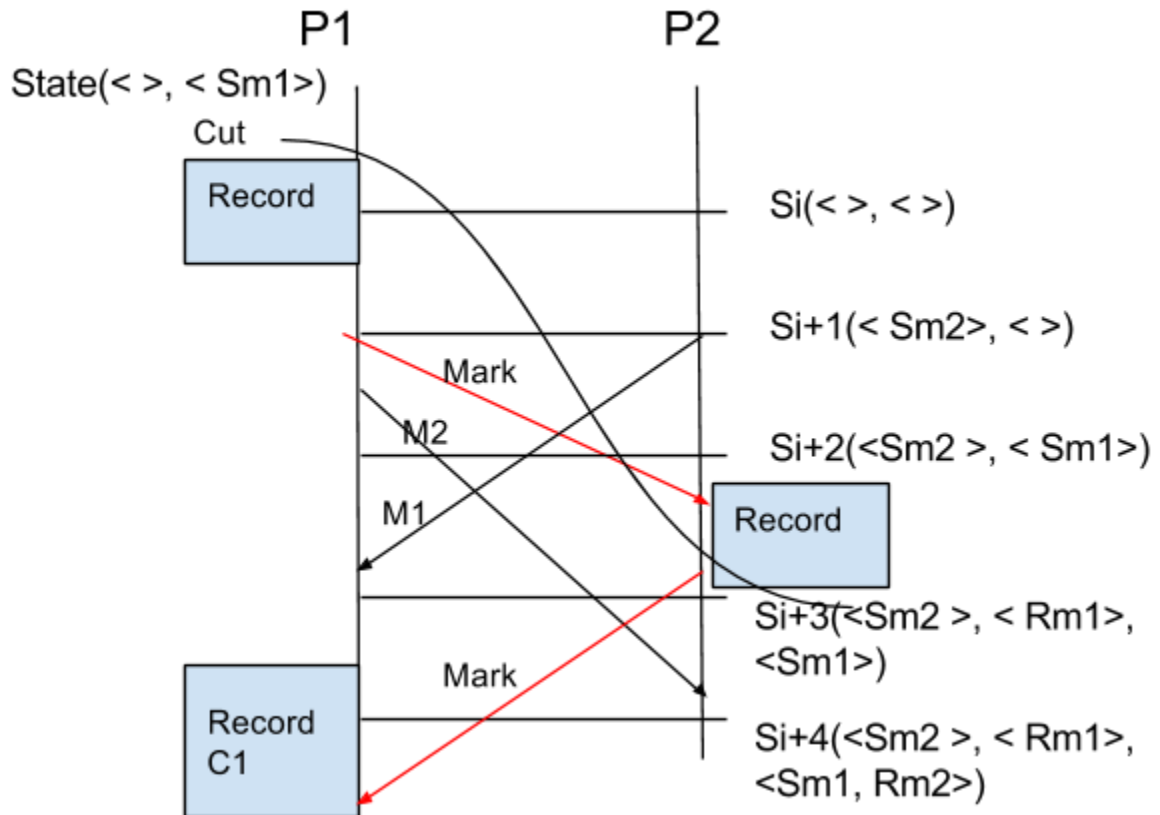


Pre snap: $\{S_{m1}\}$
Post snap: $\{S_{m2}, r_{m1}, r_{m2}\}$

Sys:$<S_{m2}, S_{m1}, r_{m1}, r_{m2}>$
Sys':$<S_{m1}, S_{m2}, r_{m1}, r_{m2}>$

Observed snapshot state $S_{snap} = (<>, <S_{m1}>)$

**b)**



Cut

P1    P2

Record

Sinit(< >, < >)

S1(< >, < $S_{m1}$>)

Mark

M2

S2(<$S_{m2}$ >, < $S_{m1}$>)

M1

Record        Observed snapshot
              State: (< >, <$S_{m1}$>)

S3(<$S_{m2}$, $R_{m1}$>, <$S_{m1}$>)

Mark

Record
C1

SFinal(<$S_{m2}$, $R_{m1}$>, <$S_{m1}$, $R_{m2}$>)