

- • Answers only -

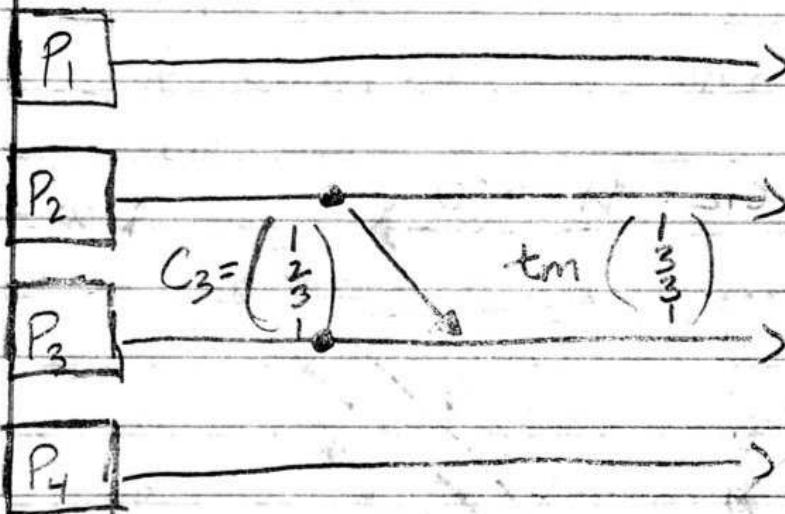
CSE 461 - HW 4 - Yousef Jarraf

3/11/19

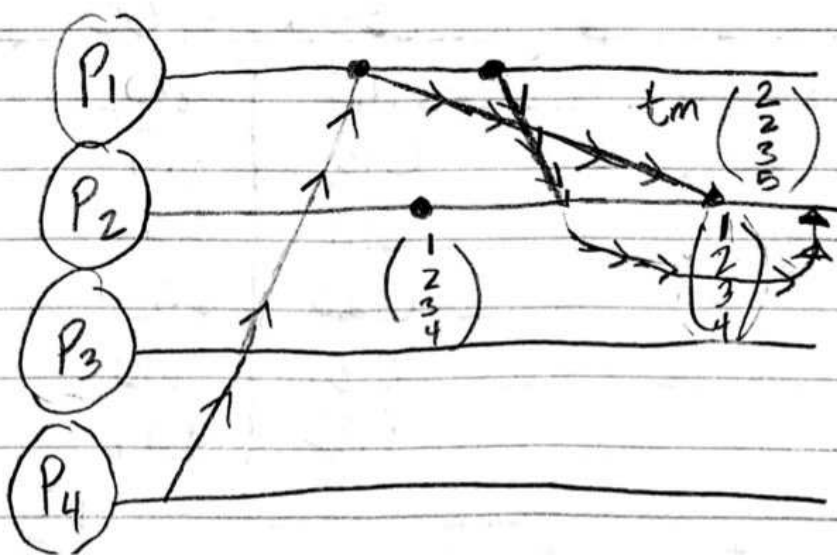
## (cse 461 only do 6 questions, any more is extra points!) ##

Dr. Tong Yu

#1A)  $P_3$  should deliver the message immediately  
 $C_3[2] = tm[2] - 1$  and  $C_3[k] \geq tm[k]$   
 where  $(k = 1, 3, 4)$



#1B) We know that  $C_2[1] = tm[2] - 1$ , but  $C_2[4] < tm[4]$ .  $P_2$  should buffer message until it receives the previous message from  $P_1$ .

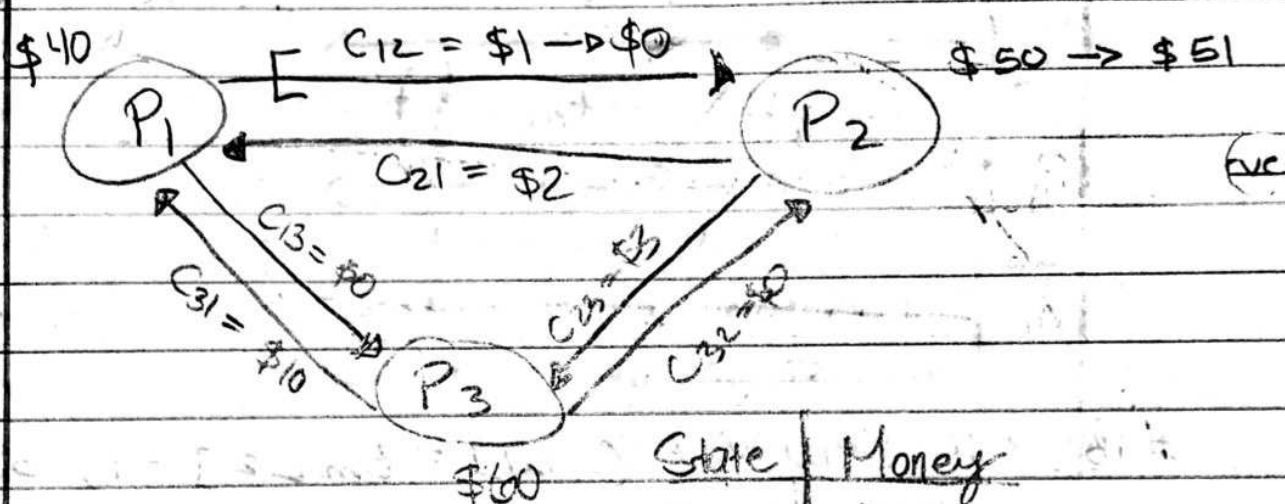


#2 C is inconsistent cut because:

$$t_c > \begin{pmatrix} C_1 [1] \\ C_2 [2] \\ C_3 [3] \end{pmatrix} = \begin{pmatrix} 2 \\ 2 \\ 3 \end{pmatrix}$$

and since  $C[i] \neq T_c[i]$

#3



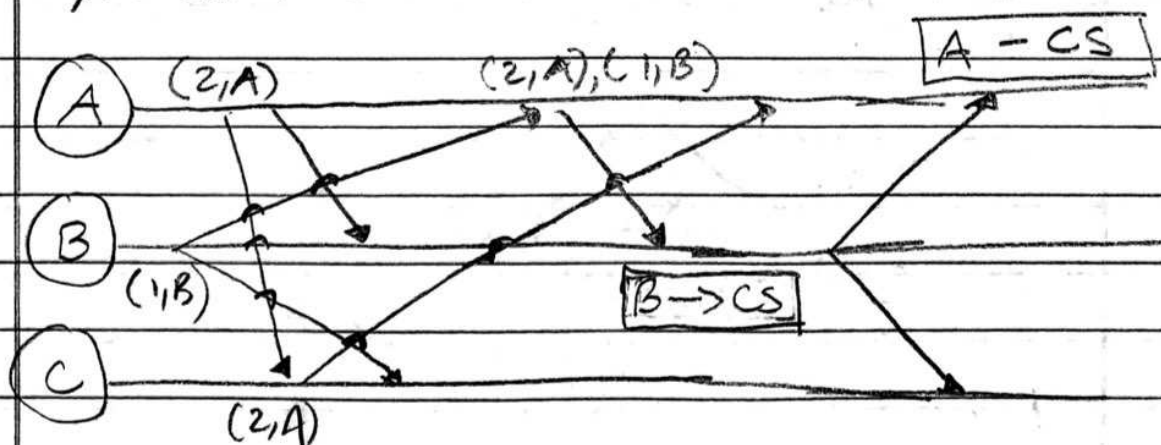
State	Money
LS1	\$40
LS2	\$51
LS3	\$60
C12	\$0
C13	\$0
C21	\$2
C23	\$3
C31	\$10
C32	\$0

#4

• Condition 1 is needed to guarantee the mutual exclusion b/c all the queues that each process needs to be in synchronization. Since each of the processes own queue might not be updated the same as the other. 2 processes might think that they are <sup>at</sup> the TOP of queue, when they are not.

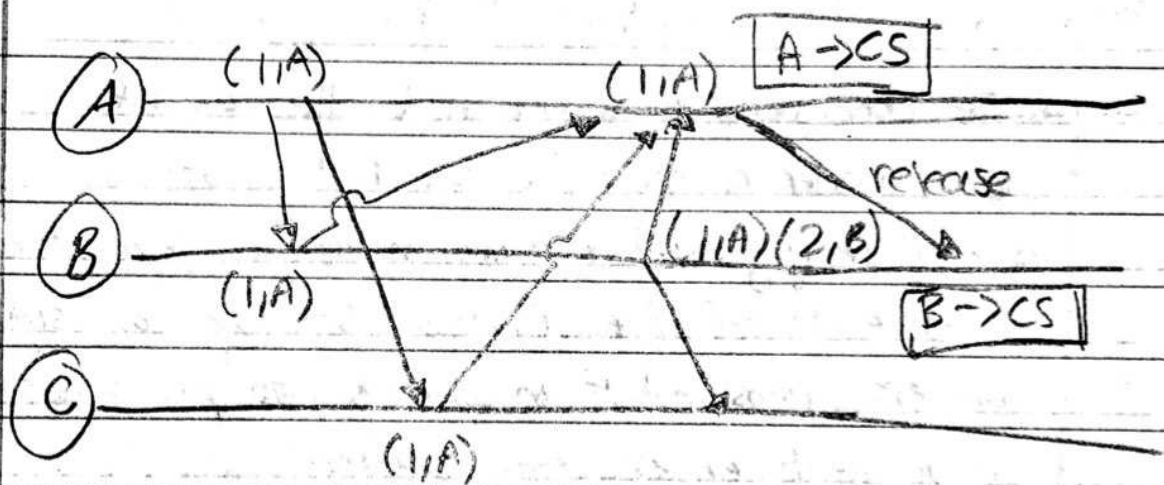
→ This condition (1) serves as a substitution of shared memory, since they do not have shared memory.

• If condition 2 is removed, the algorithm still works under a certain case. A "release message" serves as a reply. A release message from the process who entered the Critical Section can signal another process who's next in queue, to prepare another process to enter the Critical Section.



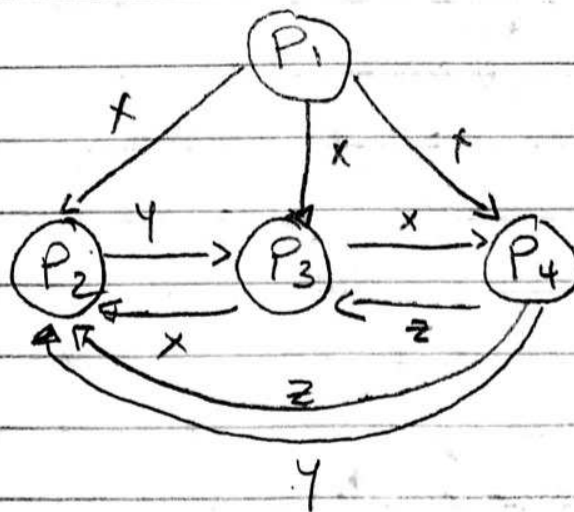
#5

- It is not necessary. If it is executing the Critical section, then it already has visited the C.S.; then it doesn't need to be @ the top of the queue
- When we exit the critical section, process  $P_i$  removes its request from the head of its request - queue and sends a timestamp **RELEASE** to every other process.



#6 According to the Lamport-Shostack-Pease algorithm the agreement cannot be reached, if the number of faulty processors is  $\leq 1/3$  of the total number of processors. A solution, would only be reached (Byzantine Agreement). Among 4 processors if  $\leq 1$  only if there is less than  $1/3$  faulty processes and the maximum of faulty process should be one.

- $P_2$ 's majority =  $\{x, x, z\} = x$ , but  $P_2$  is a traitor so it will retreat.
- $P_3$  majority =  $\{x, y, z\} = \text{retreat}$
- $P_4$  majority =  $\{x, x, y\} = x$ , but  $P_4$  is a traitor so it will retreat



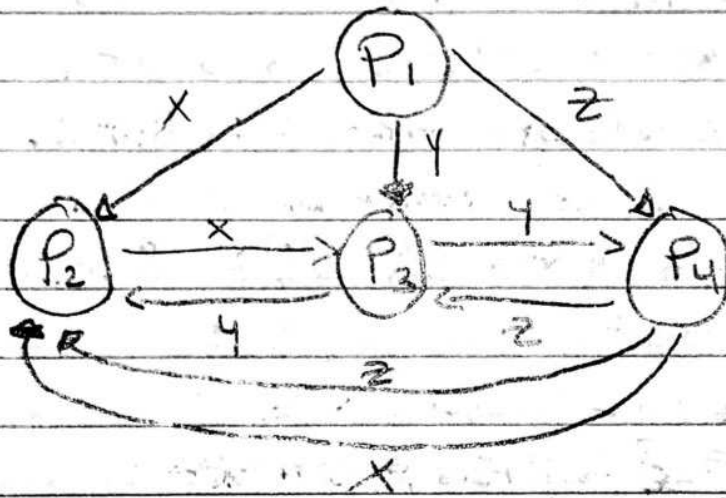
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$P_2$ 's majority =  $\{x, y, z\} = \emptyset$

$P_3$ 's majority =  $\{y, x, z\} = \emptyset$

$P_4$ 's majority =  $\{z, x, y\} = \emptyset$



#7 13 nodes,  $13 = 4(4-1) + 1$ , therefore  $K = 4$

$R_1 = \{1, 2, 3, 4\}$  No site can enter the C.S.

$R_2 = \{2, 5, 8, 11\}$  b/c it needs to release the

$R_3 = \{3, 6, 8, 13\}$  dead lock first.

$R_4 = \{4, 6, 10, 11\}$

$R_5 = \{1, 5, 6, 7\}$   $\rightarrow$  To resolve the deadlock,

$R_6 = \{2, 6, 9, 12\}$  #4 sends inquire message to

$R_7 = \{2, 7, 10, 13\}$  #12  $\rightarrow$  #6. But #6 has a

$R_8 = \{1, 8, 9, 10\}$  lower priority than #1 which has

$R_9 = \{3, 7, 9, 11\}$  a "R" from #4. So #4 should

$R_{10} = \{3, 5, 10, 12\}$  release itself from #12 by letting #12

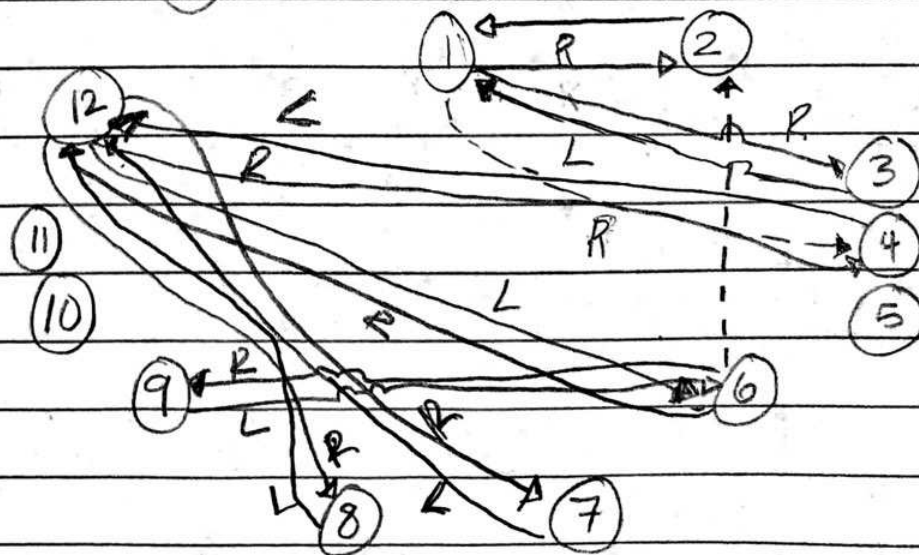
$R_{11} = \{1, 11, 12, 13\}$  reply a yield message. After

$R_{12} = \{4, 7, 8, 12\}$  #4 gets a yield message so it will

$R_{13} = \{4, 5, 9, 13\}$  be available #1  $\rightarrow$  #1 can enter

CS, #1 can enter CS.  $\rightarrow$  #1 release locks

(13) #2, 3, 4. Then #6 can enter CS  $\rightarrow$  #12 enter CS



#8

$p$ : Utilization,  $1-p$ : probability processor idle  
 $P$ : probability at least one task waiting and one server idle

$$P = \sum_{i=1}^N \binom{N}{i} Q_i H_{N-i}$$

• Where  $Q$  is probability that  $i$  servers idle and  $H_{N-i}$  is probability that set of  $(N-i)$  servers are not idle and at least one has a task waiting

$$Q = p^i, H_{N-i} = (1-p)^{N-i} - [(1-p)p]^{N-i}$$

• Substituting and simplifying,

$$P = 1 - (1-p)^N (1-p^N) - p^N (2-p)^N$$

$$p = 1 - 0.6 = 0.4$$

$$N = 20$$

$$P = 1 - (0.6)^{20} (1 - 0.4)^{20} - 0.4^{20} \times 1.6^{20} =$$

$$= 0.99983$$