— • Answers only —

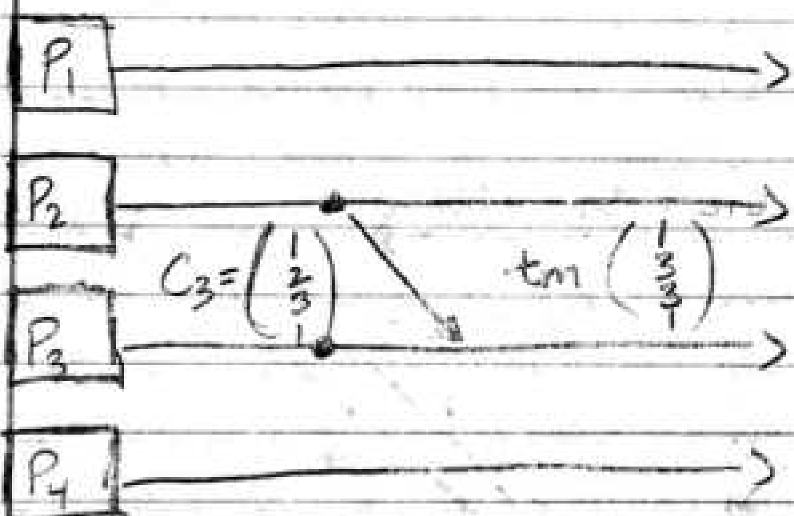
CSE 461 – HW 4 – Yousef Jarrar 3/11/19

** (cse 461 only do 6 questions, any more is extra points!) ** Dr. Tong Yu

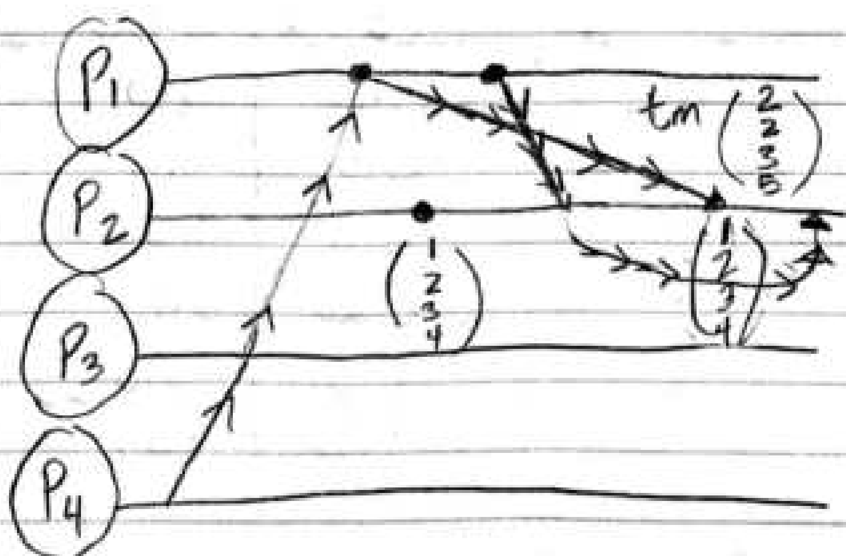
#1A) P_3 should deliver the message immediately

$C_3[2] = tm[2]-1$ and $C_3[k] >= tm[k]$

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.

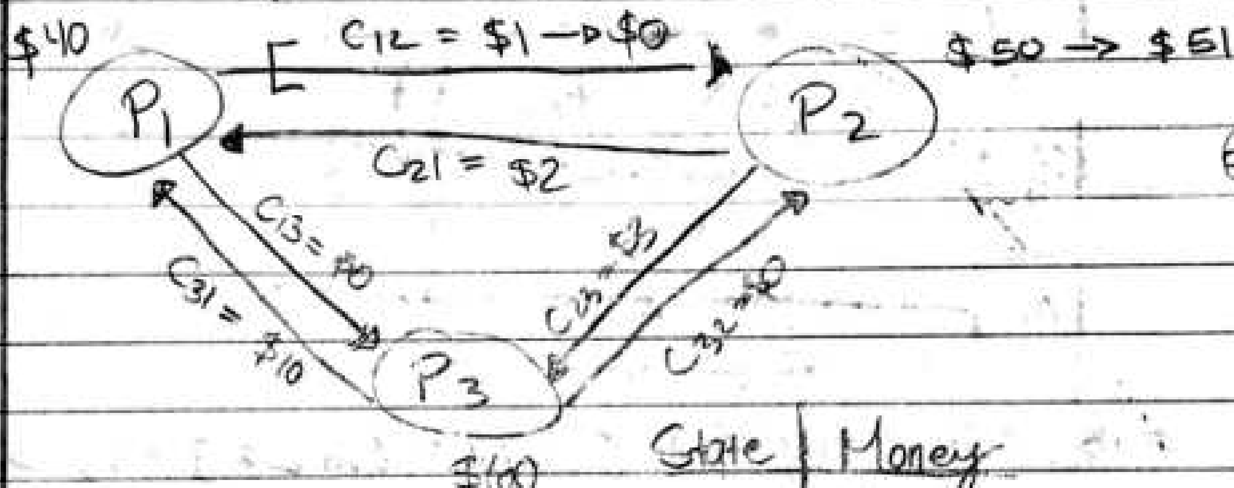


#2 C is inconsistent cut because:

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

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

#3

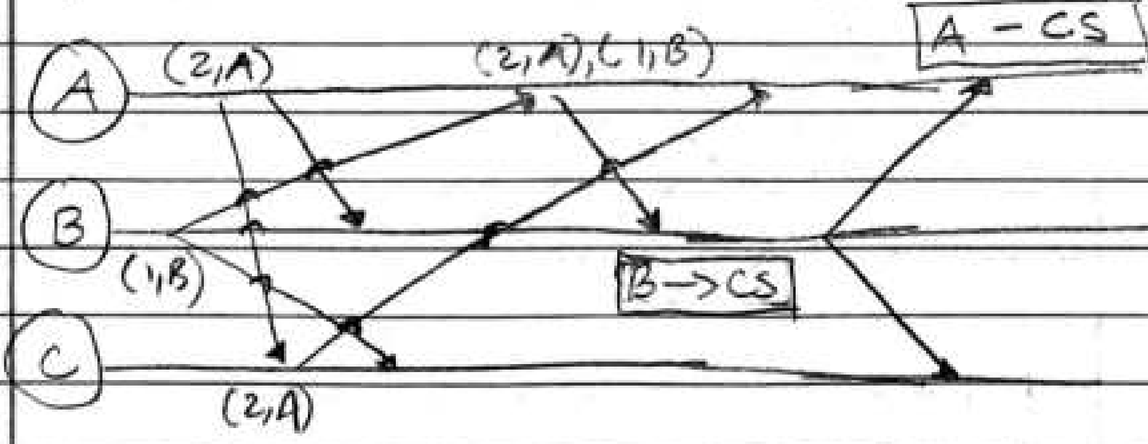


State	Money
LS1	$40
LS2	$51
LS3	$60
C12	$0
C13	$0
C21	$2
C23	$3
C31	$10
C32	$0

(#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 at the TOP of queue, when they are not.

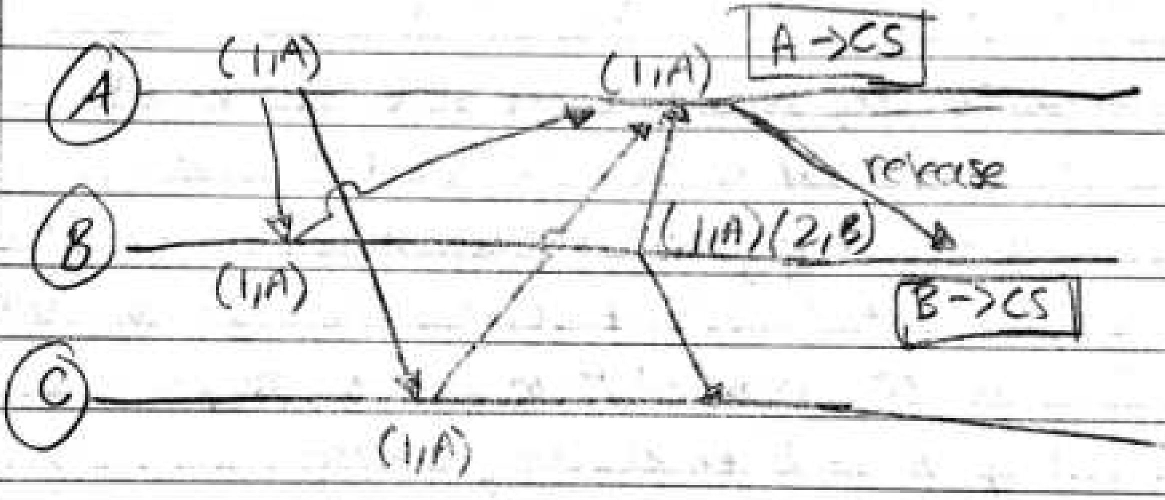
-> This condition (1) serves as a substitution of shared memory, since they do not have shared memory.

• If condition 2 is removed, the algorithim 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.



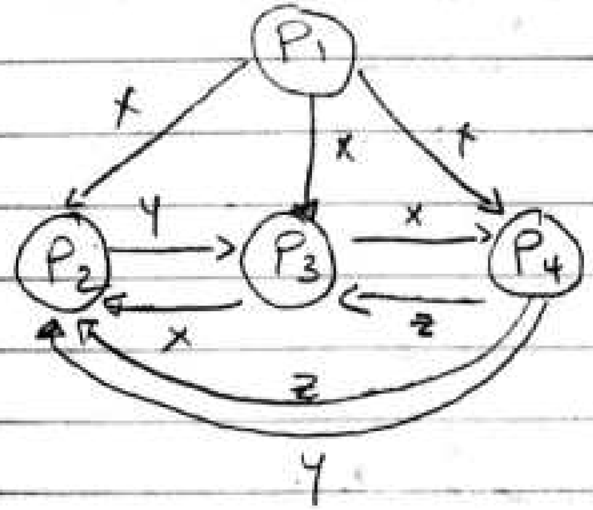
#5

- 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 it's 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 <1/3 of the total number of processors. A solution, would only be reached (Byzantine Agreement). Among 4 processors if & 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} = retreat
- P_4 majority = {x, x, y} = x, but P_4 is a traitor so it will retreat

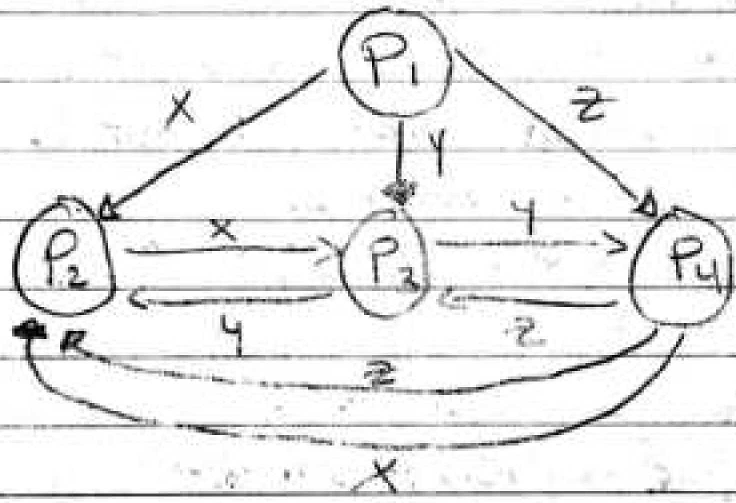


cont on back →

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 $K = 4$

$R_1 = \{1, 2, 3, 4\}$

$R_2 = \{2, 5, 8, 11\}$

$R_3 = \{3, 6, 8, 13\}$

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

$R_5 = \{1, 5, 6, 7\}$

$R_6 = \{2, 6, 9, 12\}$

$R_7 = \{2, 7, 10, 13\}$

$R_8 = \{1, 8, 9, 10\}$

$R_9 = \{3, 7, 9, 11\}$

$R_{10} = \{3, 5, 10, 12\}$

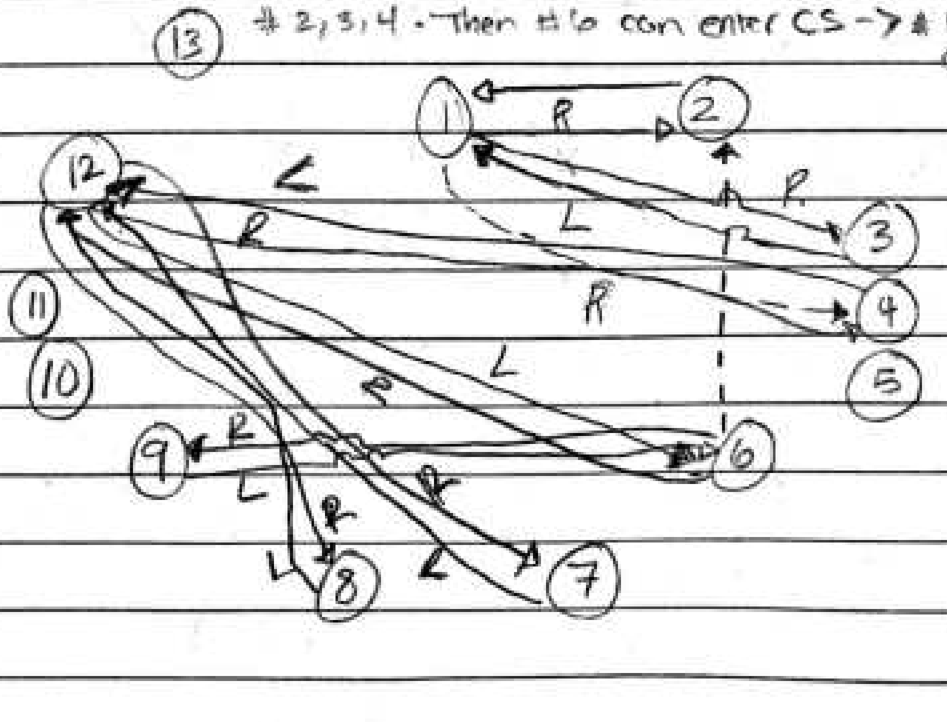
$R_{11} = \{1, 11, 12, 13\}$

$R_{12} = \{4, 7, 8, 12\}$

$R_{13} = \{4, 5, 9, 13\}$

• No site can enter the C.S. b/c it needs to release the dead lock first.

⇒ To resolve the deadlock, #4 sends inquire message to #12 → #6. But #6 has a lower priority than #1 which has a "R" from #4. So #4 should release itself from #12 by letting #12 reply a yield message. After #4 gets a yield message so it will be available #1 → #1 can enter CS, #1 can enter CS. → #1 release locks #2, 3, 4. Then #6 can enter CS → #12 enter CS.



#8

ρ: Utilization, $R = 1-\rho$: probability processor idle
P: probability at least one task waiting and one server idle

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

- 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

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

- Substituting and simplifying

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

$$R = 1-0.6 = 0.4$$

$$N = 20$$

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

$$= 0.99983$$