Advanced OS Mid-2 Solution to Selected Problems

Answer to Question 3:

Each message should be evaluated against the accept and delay rules (reject is similar and does not come into play here so I have not included it). The table below shows each condition and weather it was met (box shaded green) or not met (pink shade).

Msg	Source (i)	T	S	Conditions								Decision
				Accept				Delay				
				$T_i = S_i + 1$	$T_k <= S_k$ $k = 1$	$T_k <= S_k$ $k = 2$	$T_k <= S_k$ $k = 3$	$T_i > S_i + 1$	$T_k > S_k$ $k = 1$	$T_k > S_k$ $k = 2$	$T_k > S_k$ $k = 3$	
m_a	2	(1, 1, 0, 0)	(0, 0, 0, 0)	1 = 0+1	1 /<= 0	---	0 <= 0	1 /> 0+1	1 > 0	---	0 /> 0	Delay
m_b	1	(1, 0, 0, 0)	(0, 0, 0, 0)	1 = 0+1	---	0 <= 0	0 <= 0	1 /> 0+1	---	0 /> 0	0 /> 0	**Accept**
m_c	3	(1, 0, 1, 0)	(0, 0, 0, 0)	1 = 0+1	1 /<= 0	0 <= 0	---	1 /> 0+1	1 > 0	0 /> 0	---	Delay
Only m_b is acceptable, so we deliver/accept it. Now S updates to (1, 0, 0, 0).												
m_a	2	(1, 1, 0, 0)	(1, 0, 0, 0)	1 = 0+1	1 <= 1	---	0 <= 0	1 /> 0+1	1 /> 1	---	0 /> 0	**Accept**
m_c	3	(1, 0, 1, 0)	(1, 0, 0, 0)	1 = 0+1	1 <= 1	0 <= 0	---	1 /> 0+1	1 /> 1	0 /> 0	---	**Accept**
Both m_a and m_c are acceptable, so we can deliver them in any order. Hence there are two correct orders of delivery: a) m_b, m_a, m_c b) m_b, m_c, m_a												
Symbols = equal to <= less than or equal to /<= NOT less than or equal to > greater than /> NOT greater than												

Answer to Question 4:

Part a

R_1 is received first. Since it is at the moment the only request, it gets the vote. **Action: REPLY to node 3.**
R_2 is received second. Since its timestamp is lower than that of R_1, vote switching should be attempted. **Action: INQUIRE to node 3.**
R_3 is received. Since its timestamp is larger than R_2 (our current favorite candidate), **no immediate action will be taken**.

Part b

From part a, only one INQUIRE has been sent to node 3 for vote switching to R_2. If no RELINQUISH messages are received, **the vote shall remain with R_1**.

Part c

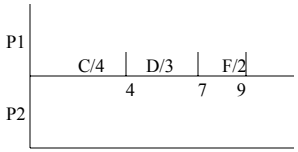
Again, from part a, only node 3 has been INQUIREd. If it returns a RELINQUISH then the current **node will switch its vote to R_2**.

Answer to Question 5:

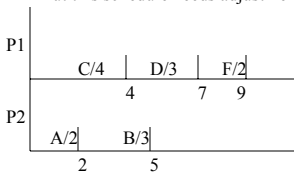
Let us first find the critical path. Below all paths are listed with their path length (actually, path lenght is the sum of execution times):

ADF = 2 + 3 + 2 = 7
BDF = 3 + 3 + 2 = 8
CDF = 4 + 3 + 2 = 9 this is the critical path
BEF = 3 + 2 + 2 = 7
CEF = 4 + 2 + 2 = 8

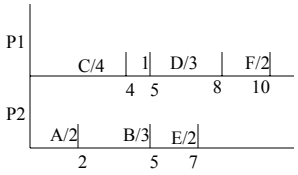
1. We first schedule the critical path processes.



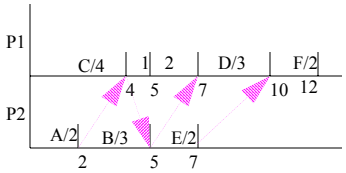
2. We then list schedule (no processor should remain idle) A and B.
But this schedule needs adjustment since D should not start until B finishes.



3. We add 1 time unit delay before D/3. Now we schedule E/2.



4. In the end, we add the communication delays. Makespan = 12.



Using the same approach, another schedule is also possible. It schedules B/3 first and A/2 later. This schedule has a makespan of 13.