Revision of System level Timing

CS4271

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Question 1

Given the following set of processes running on a single processor, what is the maximum execution time of process 4 for which all the processes are schedulable under the RMS scheduling policy?

Process	Execution time	Deadline == Period
1	2	10
2	14	100
3	2	20
4	??	25

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Answer

Only process 2 has lower priority than process 4. LCM of all periods is 100.
Let us unroll the schedule until 100 and make sure that the lowest priority process is also scheduled.
If all processes are ready at time 0 (the worst case), there are ---
10 executions of P1, 1 execution of P2, 5 executions of P3 and 4 executions of P4 within 100 time units.
Therefore

$10 * 2 + 1 * 14 + 5 * 2 + 4 * c4 \leq 100$
$20 + 14 + 10 + 4 * c4 \leq 100$
$4 * c4 \leq 100 - 44 = 56$
$c4 \leq 14$

So, the maximum execution time of c4 which will keep the task set schedulable is 14 time units.

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Question 2

Suppose we have two processors connected via a bus.
The computation and bus communication times are shown along the nodes and edges. Communication within a processor costs 0 time.
Suggest a partitioning of processes P1 … P5 to the two processors, so that the overall execution time is minimized.
Also, give the minimum time to execute all the processes and under what scheduling policy in each of the two processors is this achieved?
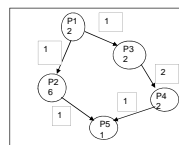
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Answer

The computation costs along the two paths are 2 + 6 + 1 = 9 and 2+2+2+1 = 7 time units.
Therefore we have no hope of reducing the time below 9 time units.
We can achieve this minimum by allocating P1, P2, P5 to processor 1 and P3,P4 to processor 2.

The scheduling policy inside a processor is, in this case, irrelevant since there is a strict dependence across the processes allocated to the same processor.

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