Real Time Systems 2

A Bin-Packing Assignment algorithm for EDF

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- Suppose we have a set of periodic independent pre-emptible tasks to be assigned to a multiprocessor consisting of identical processors.
- The task deadlines equal to their periods.
- Task only require the CPU time as a resource.

A Bin-Packing Assignment algorithm for EDF

- The task set is schedulable under EDF if the total utilization is $<=1$.
- We would like to minimize the number of CPUs needed.
- This is bin-packing problem and many algorithms exists to solve it.
- We present first fit decreasing algorithm

A Bin-Packing Assignment algorithm for EDF

- The first-fit decreasing algorithm:
- Initialize I to 1. Set U(j) =0 for all j;
- While I <= nT do
  - Let j = min{k|U(k) + u(i) <=1}
  - Assign the ith task in L to Pj.
  - I = i+1.

  End while

A Bin-Packing Assignment algorithm for EDF

- Suppose there are nT tasks to be assigned.
- Prepare a sorted list L of the tasks so that their utilizations (u(i)=exi / Pi) are in decreasing order.

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- Example: Consider the following task set:

	Exi	Pi	Ui=(exi/Pi)
T1	5	10	0.5
T2	7	21	0.33
T3	3	22	0.04
T4	1	24	0.04
T5	10	30	0.33
T6	16	40	0. 4
T7	1	50	0.02
T8	3	55	0.05
T9	9	70	0.13
T10	17	90	0.19
T11	21	95	0.22

A Bin-Packing Assignment algorithm for EDF

- The ordered list is L= (T1,T6, T2, T5, T11, T10, T3, T9, T8, T4, T7).
- The assigned Process is summarized in the following table:
- U= (U1, U2, U3, …..) contains the total utilization of processor CPUi in Ui

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Step	Task T_i	$u(i)$	Assigned to	Post-assignment U vector
1	T_1	0.50	p_1	(0.50)
2	T_6	0.40	p_1	(0.90)
3	T_2	0.33	p_2	(0.90,0.33)
4	T_5	0.33	p_2	(0.90,0.66)
5	T_{11}	0.22	p_2	(0.90,0.88)
6	T_{10}	0.18	p_3	(0.90,0.88,0.18)
7	T_3	0.14	p_3	(0.90,0.88,0.32)
8	T_9	0.13	p_3	(0.90,0.88,0.45)
9	T_8	0.06	p_1	(0.96,0.88,0.45)
10	T_4	0.04	p_1	(1.00,0.88,0.45)
11	T_7	0.02	p_2	(1.00,0.90,0.45)

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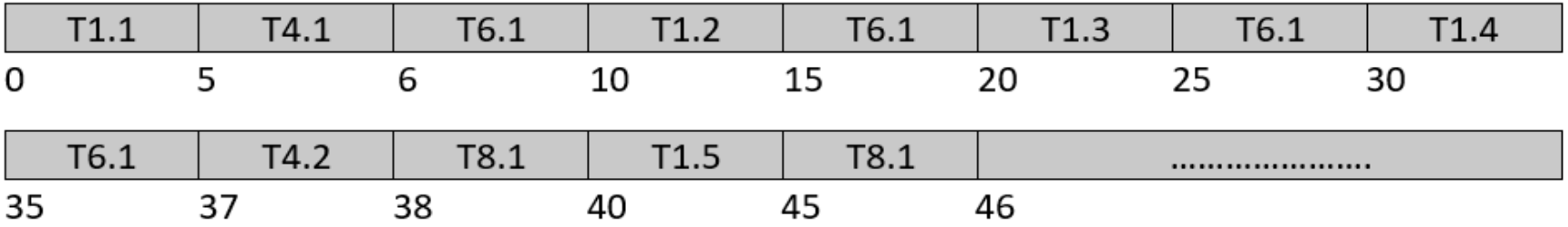
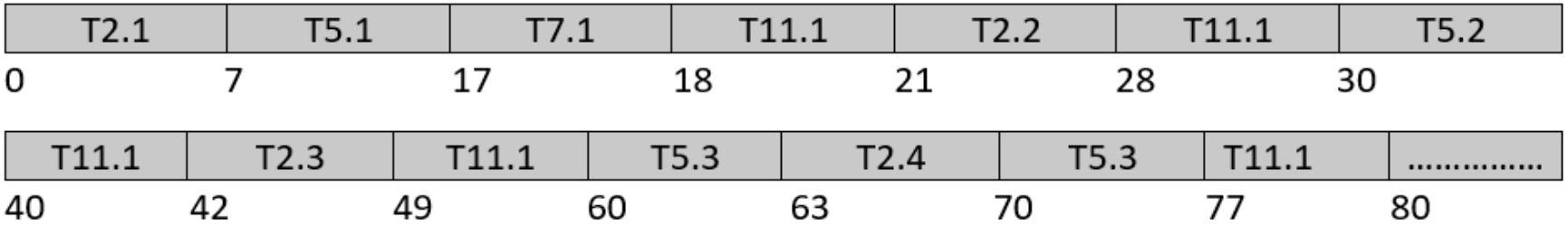
Processor	tasks
P1	T1,T6,T8,T4
P2	T2,T5,T11,T7
P3	T10,T3,T9

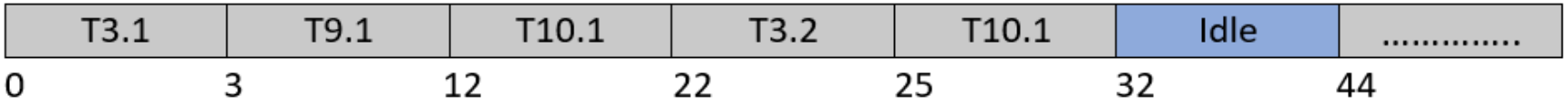
P1:



P2:



P3:



A Bin-Packing Assignment algorithm for EDF- HW

- Consider the following periodic task set:
- Assign them to CPUs using First-fit algorithm.

Tasks	Exi	Pi	U(i)=exi/Pi
T1	5	10	
T2	17	25	
T3	7	35	
T4	10	60	
T5	15	20	
T6	6	20	
T7	7	30	
T8	10	60	
T9	5	30	
T10	10	30	