Real Time Systems2

lecture 1

Earliest Deadline First Algorithm (EDF)

EARLIEST DEADLINE FIRST

- The Earliest Deadline First (EDF) algorithm is a dynamic scheduling rule that selects tasks according to their absolute deadlines. Specifically, tasks with earlier deadlines will be executed at higher priorities.

- Since the absolute deadline of a periodic task depends on the current *j*th instance as
- $di,j = \Phi i + (j - 1)Ti + Di,$

EARLIEST DEADLINE FIRST

- EDF is a dynamic priority assignment. Moreover, it is typically executed in preemptive mode, thus the currently executing task is preempted whenever another periodic instance with earlier deadline becomes active.

- Note that EDF does not make any specific assumption on the periodicity of the tasks; hence, it can be used for scheduling periodic as well as aperiodic tasks.

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- *A set of periodic tasks is schedulable with EDF if and only if*
- ***Σ (Ci/Pi) <= 1 for all task i***
- *Example:.*
- Consider the following periodic task set

Task	Execution	period
T1	2	5
T2	4	7

- U= 2/5 + 4/7 = 34/35 ~ 0.97

EARLIEST DEADLINE FIRST

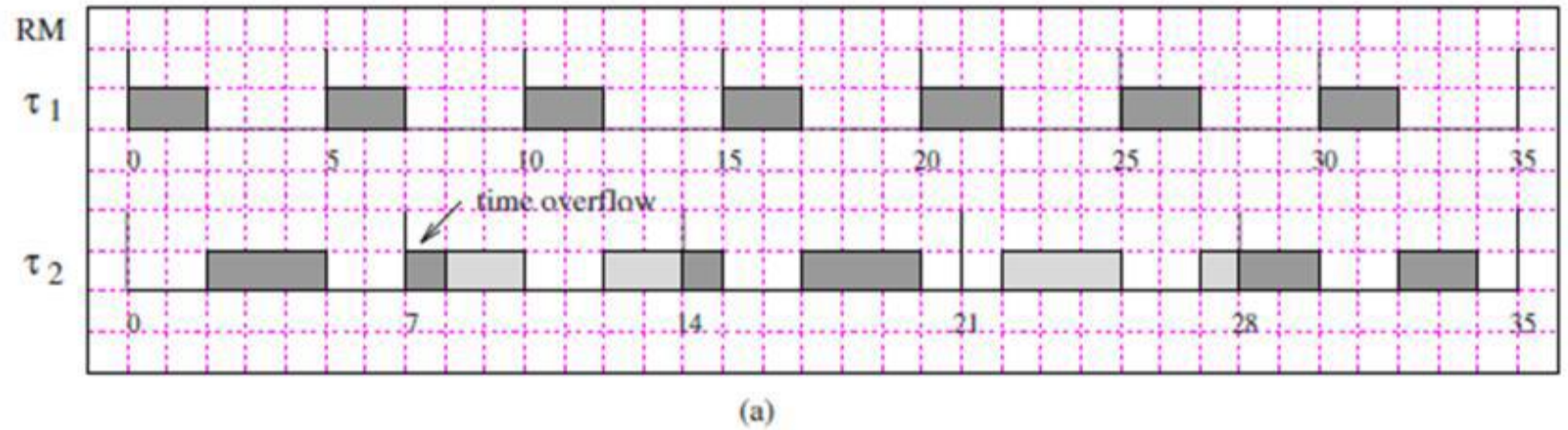
- This means that 97 percent of the processor time is used to execute the periodic tasks, whereas the CPU is idle in the remaining 3 percent.
- Being $U > 2(\sqrt{2}-1) \sim 0.83$, the schedulability of the task set cannot be guaranteed under RM, whereas it is guaranteed under EDF.

- Indeed, as shown in Figure below , RM generates a deadline miss at time $t = 7$, whereas EDF completes all tasks within their deadlines.

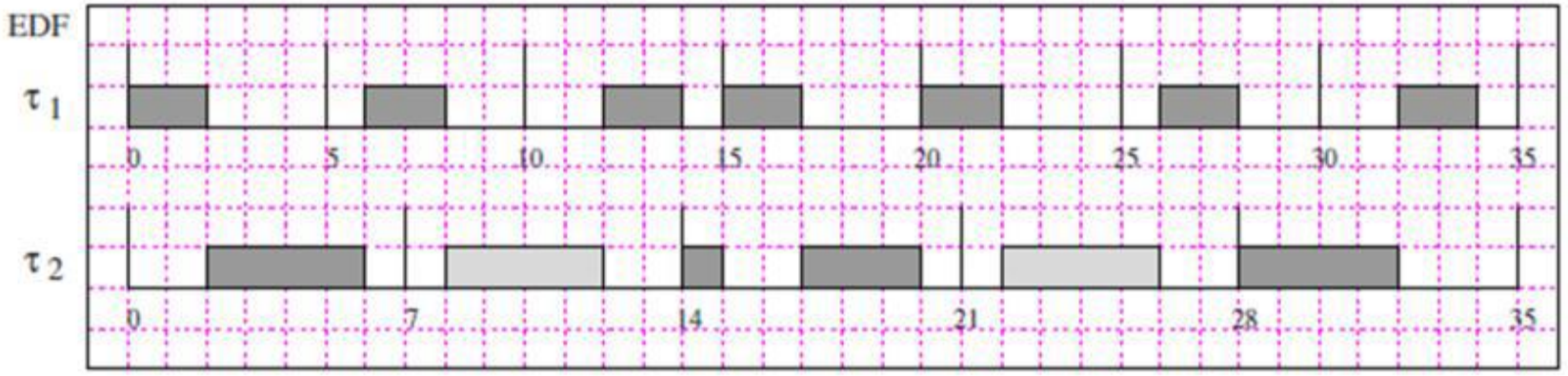
EARLIEST DEADLINE FIRST

- Another important difference between RM and EDF concerns the number of preemptions occurring in the schedule.
- As shown in Figure below, under RM every instance of task $\tau 2$ is preempted, for a total number of five preemptions in the interval $T = T$ 1 $T2$.
- Under EDF, the same task is preempted only once in the same interval. The smaller number of preemptions in EDF is a direct consequence of the dynamic priority assignment, which at any instant privileges the task with the earliest deadline, independently of tasks periods.

EARLIEST DEADLINE FIRST



(a)



(b)

T1	T2
0	0
5	7
10	14
15	21
20	28
25	35
30	
35	

RM

T1		T2 -1			T1		T2 -1			T1		T2*	Idle	T2 -3	T1		T2*			T1		T2 -1			T1		T2*	T2 -2		T1		T2*		Idle
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34

Deadline of T2

EDF

T1		T2				T1		T2				T1	T2 -3	T1		T2*			T1		T2				T1		T2				T1	Idle
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34

d1=10 > d2=7

d1=10 < d2=14

d1=15 > d2=14

d1=20 < d2=21

d1=25 < d2=28

d1=30 > d2=28

d1=35 = d2=35

في حالة تساوي deadline نكمل تنفيذ المهمة بدون قطعها

Task	Ei	Di
T1	2	6
T2	3	9
T3	2	12
T4	1	7

→

Task	Ei	Di
T1	2	6
T4	1	7
T2	3	9
T3	2	12

T1	T4	T2	T3
0	0	0	0
6	7	9	12
12	14	18	24
18	21	27	36
24	28	36	
30	35		
36			

EDF

T1	T4	T2	T3	T1	T4	T2	T1	T4	T3	T1	T2	T4	T1	T3 -1	T4	T3*	T1	T2

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34

d3=12 < d4=14

d1=12 < d2=18

d4=21 > d1=18

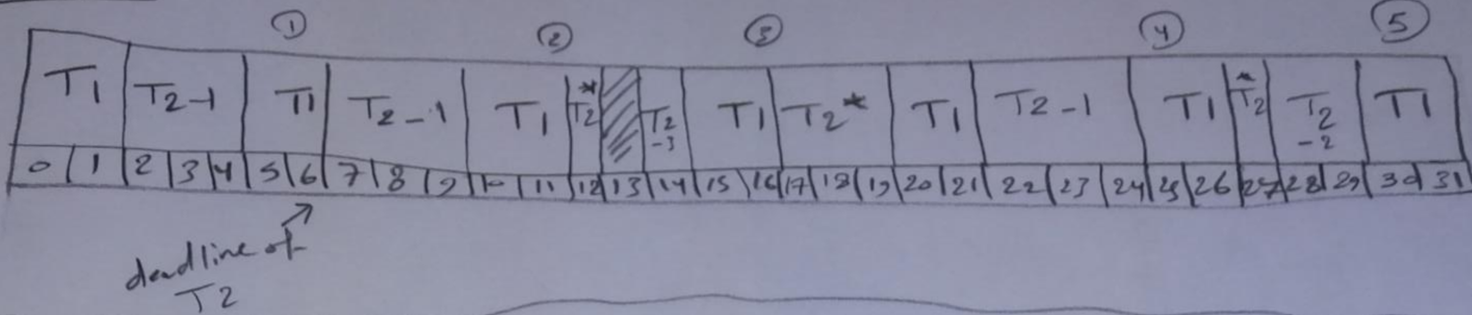
d3=24 < d2=27

d3=24 = d1=24

في حالة المساواة تستمر T3

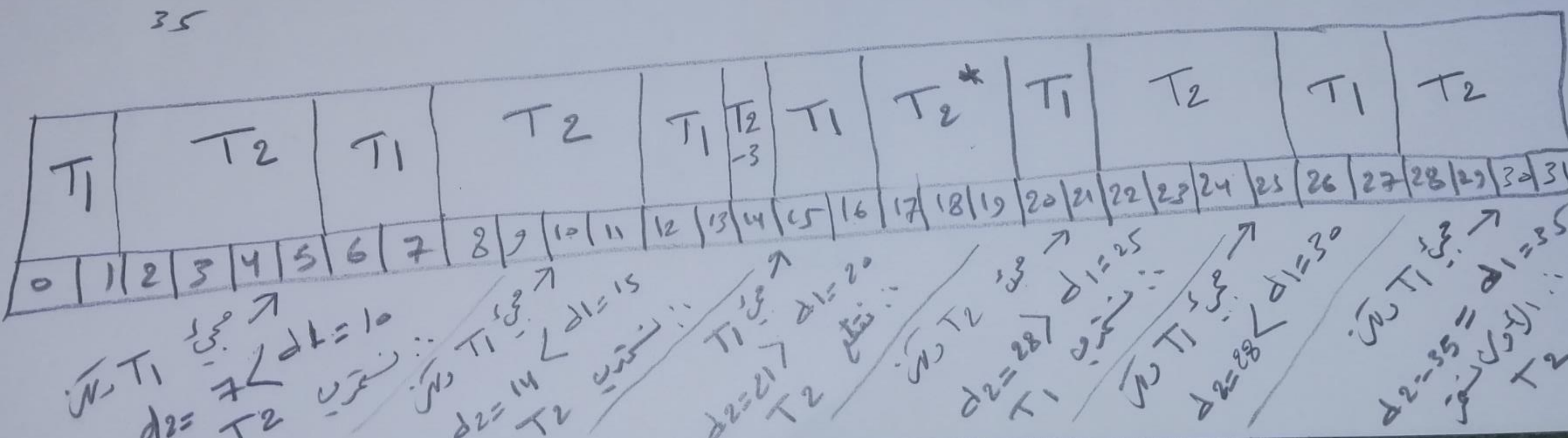
d4=35 < d3=36

RM



EDF

T1	T2
~~0~~	~~0~~
~~5~~	7
~~10~~	~~14~~
~~15~~	~~21~~
~~20~~	28
~~25~~	35
30	
35	

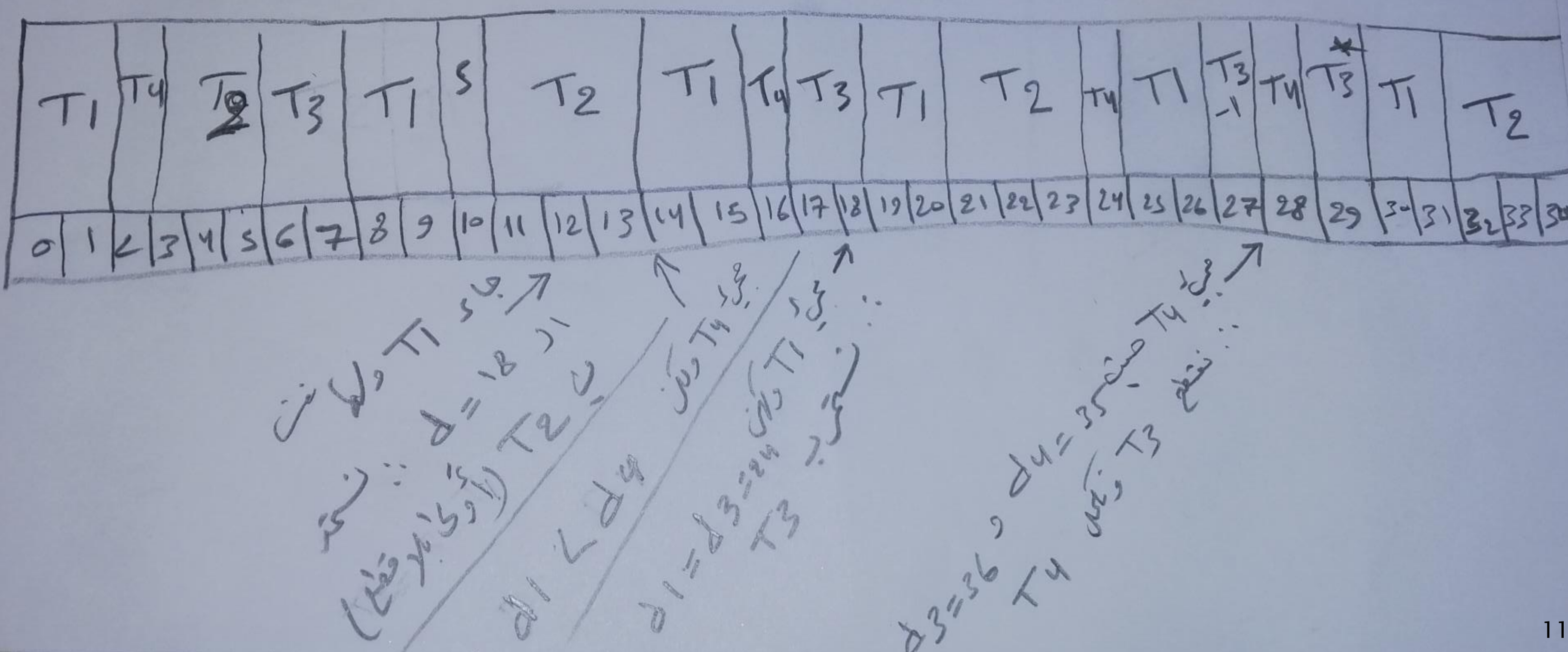


Task	ei	di
T1	2	6
T2	3	9
T3	2	12
T4	1	7

⟹

task	ei	di
T1	2	6
T4	1	7
T2	3	9
T3	2	12

T1	T4	T2	T3
0	0	0	0
~~6~~	~~7~~	~~9~~	~~12~~
~~12~~	~~14~~	~~18~~	~~24~~
~~18~~	~~21~~	~~27~~	~~36~~
~~24~~	~~28~~	36	
30	~~35~~		
~~36~~			



- HW:

Task	Exi	di	Pi
T1	3	7	20
T2	2	4	5
T3	2	8	10