Exercise: Solution

- Major cycle = 20

- Frame size = 2, 4, 5, 10

- For F=2,

  - $2*2-\gcd(F,4) = 4- 2 <=4$ *OK*

  - $2*2-\gcd(F,5) = 4-1<= 5$ *OK*

  - $2*2-\gcd(F,20) = 4-2<=20$ *OK*

Example 3

- For F=4,

  - $2*4 - gcd(F,4) = 8 - 4 <= 4$ *OK*

  - $2*4 - gcd(F,5) = 8 - 1 <= 5$ *Not OK*

  - $2*4 - gcd(F,20) = 8 - 4 <= 20$ *OK*

  - **Frame size=2 can be chosen**

Pros and Cons of Cyclic Schedulers

- **Pro:**
  - Simple and efficient

- **Con:**
  - As number of tasks increases: It becomes very difficult to select a suitable frame size.

Cons of Cyclic Schedulers

- **Inflexible**:

  - Difficult to modify and maintain

- **Fragile**:

  - Overrun may cause system to fail

- Difficult to handle sporadic and aperiodic tasks.

Solution

- The foreground task needs 50mSec of execution time every 100msec.

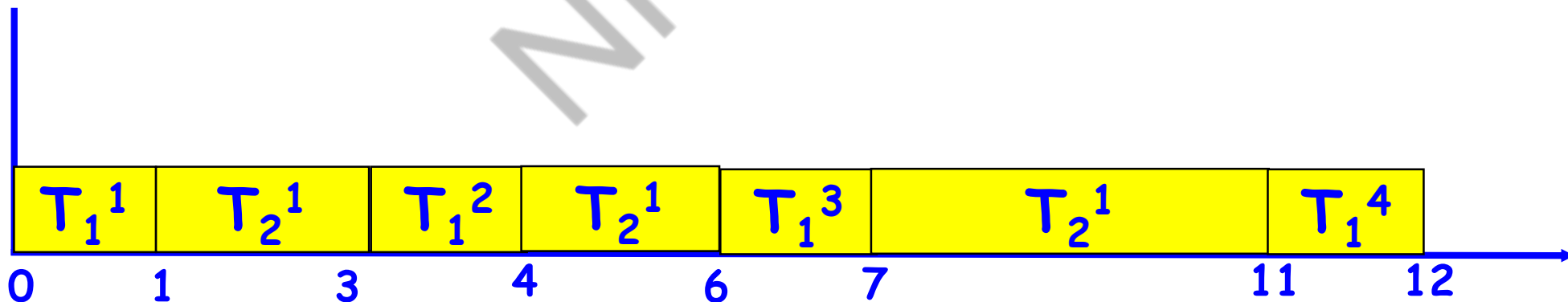- So, the completion time of the background task = **1020/(50/100) =2040 mSecs**

EDF Scheduler – Example 1

Task set: $T_i = (e_i, p_i, d_i)$

$T1 = (1,3,3)$ and $T2 = (8,12,12)$

Schedulability check:

$1/3 + 8/12 = 0.33 + 0.67 = 1.0$

T_1^1	T_2^1	T_1^2	T_2^1	T_1^3	T_2^1	T_1^4

0   1   3   4   6   7   11   12

Rate Monotonic Scheduling

Process Priority determined by arrival rate (since rate = 1/period)
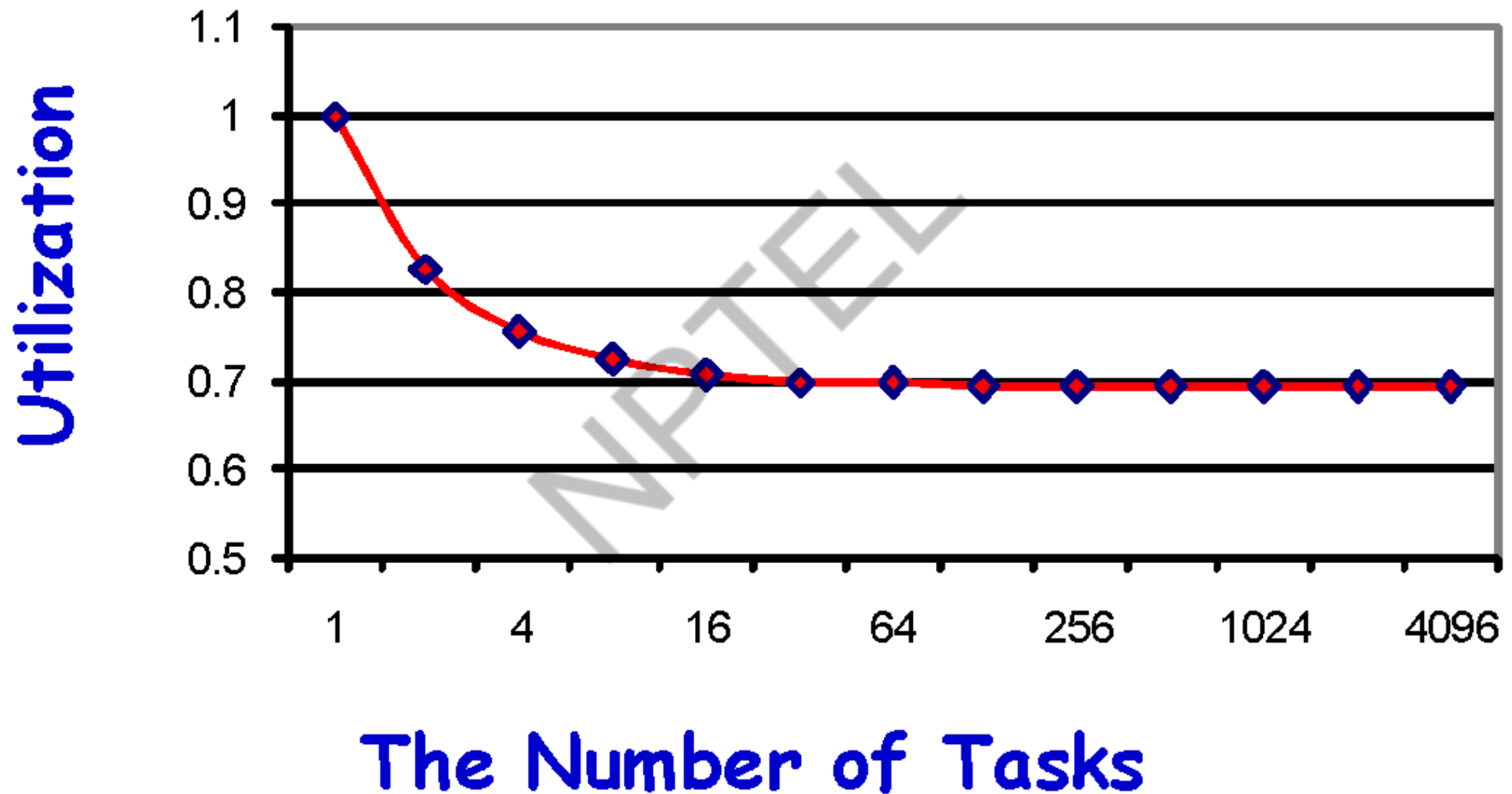

Process 1 : High Priority

Process 2 : Lower Priority

Preemptive Scheduling

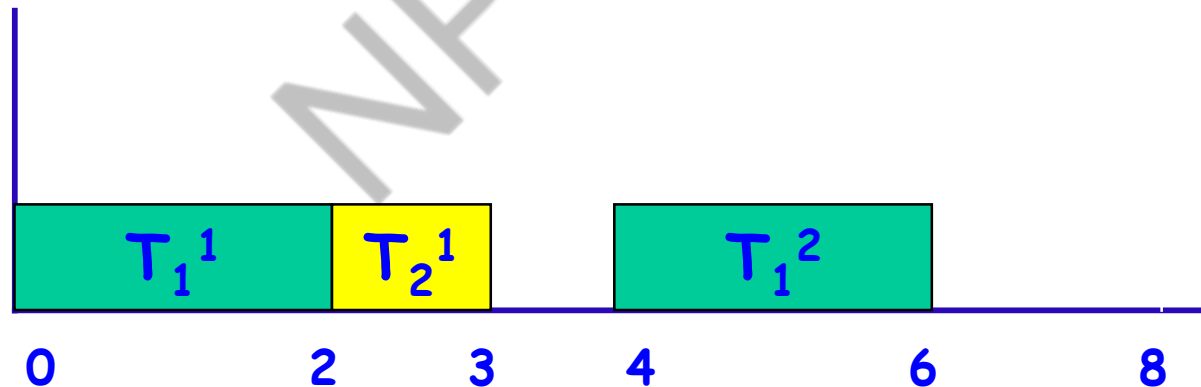# RM Utilization Bounds

Utilization vs. The Number of Tasks

RMA Scheduler -- Example 1

Task set: $T_i = (c_i, p_i)$
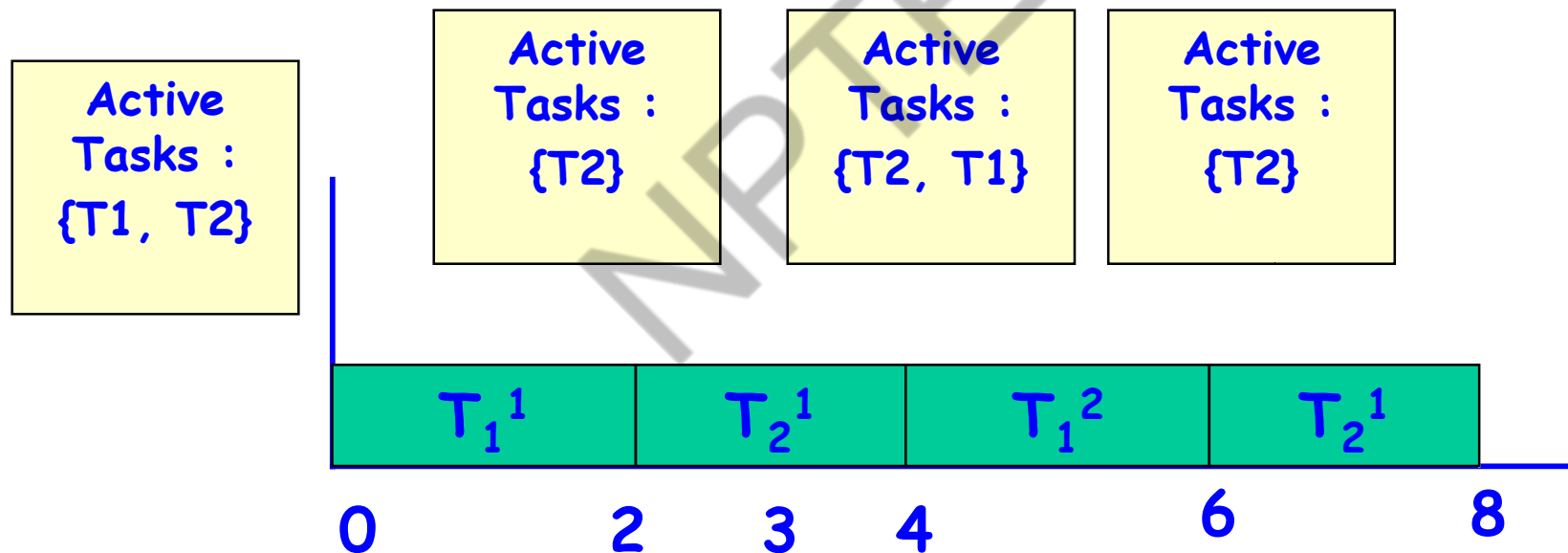
T1 = (2,4) and T2 = (1,8)

Schedulability check:

$2/4 + 1/8 = 0.5 + 0.125 = 0.625 \leq 2(\sqrt{2} - 1) = 0.82$

RMS scheduler -- Example-2

Task set: $T_i = (c_i, p_i)$

T1 = (2,4) and T2 = (4,8)

Schedulability check:

$2/4 + 4/8 = 0.5 + 0.5 = 1.0 > 2(\sqrt{2} - 1) = 0.82$

Active Tasks : {T1, T2}

Active Tasks : {T2}

Active Tasks : {T2, T1}

Active Tasks : {T2}

| T_1^1 | T_2^1 | T_1^2 | T_2^1 |

0   2   3   4   6   8

Some task sets that FAIL the utilization-based schedulability test are also schedulable under RMS ➔ We need exact analysis.
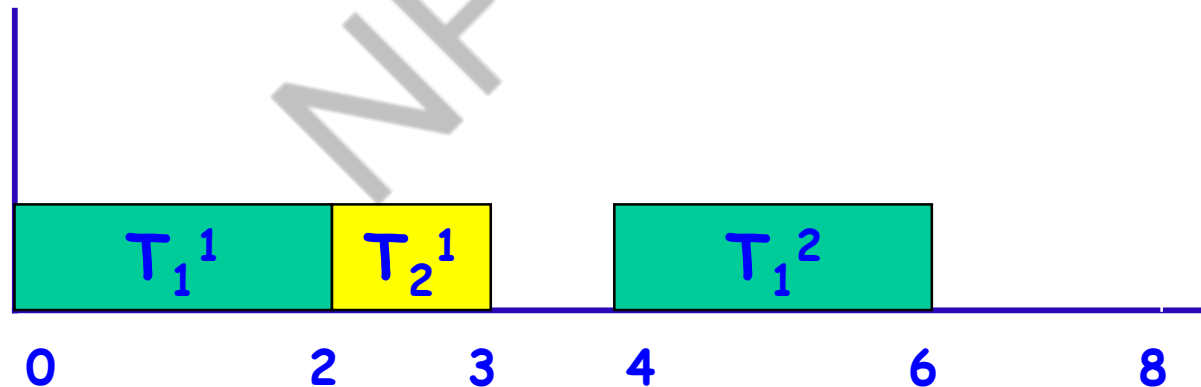
RMA Scheduler -- Example 1

Task set: $T_i = (c_i, p_i)$
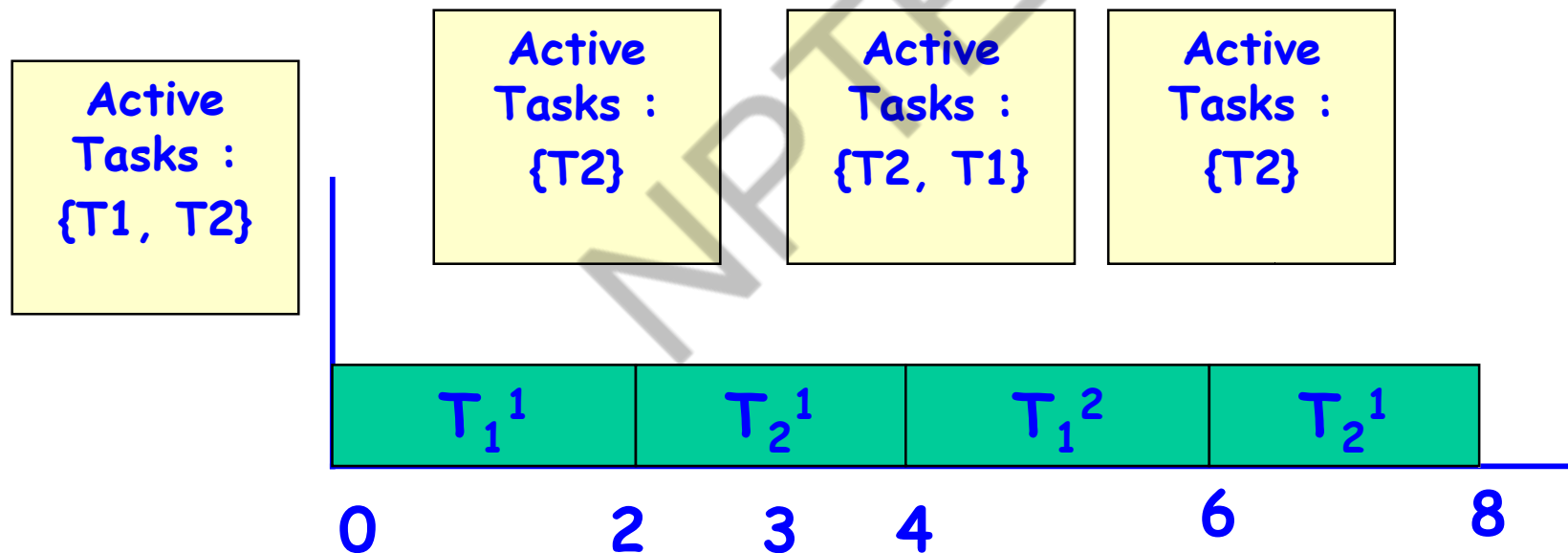
T1 = (2,4) and T2 = (1,8)

Schedulability check:

$2/4 + 1/8 = 0.5 + 0.125 = 0.625 \leq 2(\sqrt{2} - 1) = 0.82$

RMS scheduler -- Example-2

Task set: $T_i = (c_i, p_i)$

T1 = (2,4) and T2 = (4,8)

Schedulability check:

$2/4 + 4/8 = 0.5 + 0.5 = 1.0 > 2(\sqrt{2} - 1) = 0.82$

Active
Tasks :
{T1, T2}

Active
Tasks :
{T2}

Active
Tasks :
{T2, T1}

Active
Tasks :
{T2}

| T_1^1 | T_2^1 | T_1^2 | T_2^1 |

0   2   3   4   6   8

Some task sets that FAIL the utilization-based schedulability test are also schedulable under RMS ➔ We need exact analysis.

RMA vs. EDF

RMA	EDF
• Implementation multi-level priority queue, $O(1)$	• Heap, $O(\log n)$
• Processor utilization 0.69 (expected 0.88)	• Processor utilization ---full utilization
• Context switches -- many	• context switches few
• Guarantee test nontrivial	• simple