## Proyecto 3: Scheduling en Tiempo Real

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# Algoritmo Rate Monotonic (RM)

Presentado por Liu y Layland en 1973.

Algoritmo de scheduling dinamico, derivado de HPF Prioridades Fijas. Supuestos de RM:

- Las solicitudes de todas las tareas criticas son periodicas.
- Todas las tareas son independientes.
- El deadline de cada tarea es igual al periodo.
- Se conoce a priori el tiempo de computacion.
- El cambio de contexto es igual a cero, o esta incluido en el tiempo de computacion.

La condicion suficiente para la schedulability de n tareas bajo RM es:

$$\mu \leq U(n) = n(2^{\frac{1}{n}}-1)$$

Donde:

$$\mu = \sum_{i=1}^{n} \frac{c_i}{p_i}$$

# Algoritmo Earliest Deadline First (EDF)

Presentado por Liu y Layland en 1973.

Algoritmo de scheduling dinamico, derivado de HPF Prioridades Fijas.

Supuestos de EDF son los mismos que los de RM.

Prioridad es inversamente proporcional al tiempo pendiente para que se de el deadline de la tarea.

Algoritmo expropiativo:

- Cuando una tarea llega a la cola de ready se revisan las prioridades.
- Se puede quitar a una tarea que este usando el CPU.

La condicion necesaria y suficiente para la schedulability de n tareas bajo EDF es:

$$\mu \leq 1$$

Donde:

$$\mu = \sum_{i=1}^{n} \frac{c_i}{p_i}$$

## Algoritmo Least Laxity First (LLF)

Prioridad es inversamente proporcional al laxity de la tarea.

Algoritmo expropiativo

Supuestos de LLF:

- Las solicitudes de todas las tareas crticas son peridicas.
- Todas las tareas son independientes.
- Se conoce a priori el tiempo de computacion.
- El cambio de contexto es igual a cero, o esta incluido en el tiempo de computacion.
- El Laxity corresponde a:  $X_i = d_i t c_i$ .

Donde  $d_i$  es el deadline, t es el tiempo actual, y  $c_i$  es el tiempo de ejecucion que le falta a la tarea.

La condicion necesaria y suficiente para la schedulability de n tareas bajo LLF es:

$$\mu \leq 1$$

Donde:

$$\mu = \sum_{i=1}^{n} \frac{c_i}{p_i}$$



### Tests de Schedulability Rate Monotonic

Tarea	$P_i$	$C_i$
T1	500	100
T2	500	200
Т3	500	200
T4	500	1
T5	500	2
T6	500	3

Tabla: Datos Rate Monotonic

Condicion:  $\mu \le U(n)$   $\mu = 1,012000$ U(n) = 0,734772

Dado que  $\mu > U(n)$  el algoritmo indica que las tareas no son schedulable



#### Tests de Schedulability Earliest Deadline First

Tarea	$P_i$	$C_i$
T1	500	100
T2	500	200
Т3	500	200
T4	500	1
T5	500	2
T6	500	3

Tabla: Datos Earliest Deadline First

Condicion:  $\mu \le 1$  $\mu = 1,012000$ 

Dado que  $\mu>1$  el algoritmo indica que las tareas no son schedulable



#### Tests de Schedulability Least Laxity First

Tarea	$P_i$	$C_i$
T1	500	100
T2	500	200
Т3	500	200
T4	500	1
T5	500	2
T6	500	3

Tabla: Datos Least Laxity First

Condicion:  $\mu \le 1$  $\mu = 1,012000$ 

Dado que  $\mu>1$  el algoritmo indica que las tareas no son schedulable



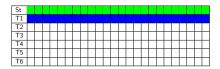


Tabla: Rate Monotonic 1

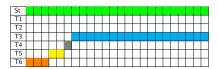


Tabla: Earliest Deadline First 1

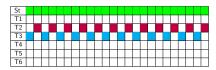


Tabla: Least Laxity First 1

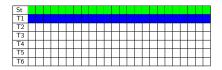


Tabla: Rate Monotonic 2



Tabla: Earliest Deadline First 2

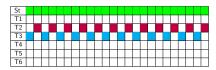


Tabla: Least Laxity First 2

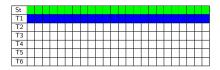


Tabla: Rate Monotonic 3

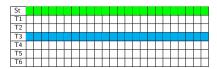


Tabla: Earliest Deadline First 3

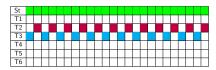


Tabla: Least Laxity First 3

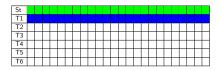


Tabla: Rate Monotonic 4

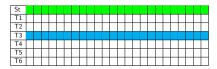


Tabla: Earliest Deadline First 4

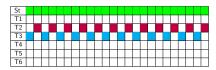


Tabla: Least Laxity First 4



Tabla: Rate Monotonic 5

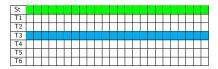


Tabla: Earliest Deadline First 5

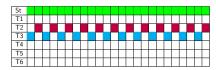


Tabla: Least Laxity First 5



Tabla: Rate Monotonic 6

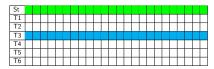


Tabla: Earliest Deadline First 6

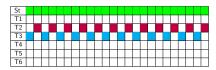


Tabla: Least Laxity First 6

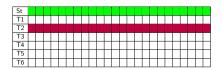


Tabla: Rate Monotonic 7

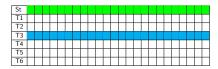


Tabla: Earliest Deadline First 7

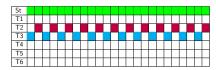


Tabla: Least Laxity First 7



Tabla: Rate Monotonic 8

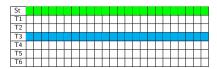


Tabla: Earliest Deadline First 8

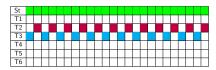


Tabla: Least Laxity First 8



Tabla: Rate Monotonic 9



Tabla: Earliest Deadline First 9

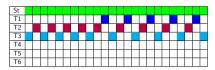


Tabla: Least Laxity First 9



Tabla: Rate Monotonic 10



Tabla: Earliest Deadline First 10

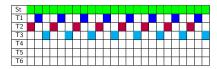


Tabla: Least Laxity First 10



Tabla: Rate Monotonic 11



Tabla: Earliest Deadline First 11

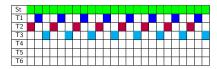


Tabla: Least Laxity First 11



Tabla: Rate Monotonic 12



Tabla: Earliest Deadline First 12

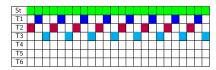


Tabla: Least Laxity First 12

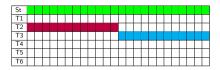


Tabla: Rate Monotonic 13



Tabla: Earliest Deadline First 13

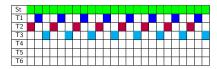


Tabla: Least Laxity First 13

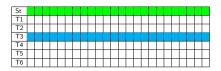


Tabla: Rate Monotonic 14



Tabla: Earliest Deadline First 14

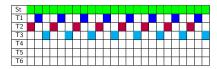


Tabla: Least Laxity First 14

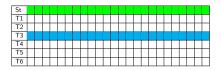


Tabla: Rate Monotonic 15



Tabla: Earliest Deadline First 15

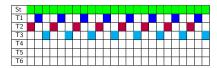


Tabla: Least Laxity First 15

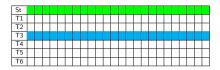


Tabla: Rate Monotonic 16



Tabla: Earliest Deadline First 16

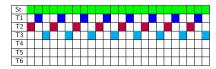


Tabla: Least Laxity First 16

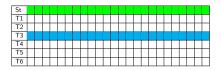


Tabla: Rate Monotonic 17



Tabla: Earliest Deadline First 17

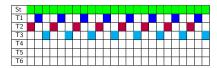


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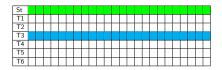


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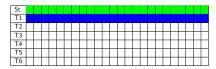


Tabla: Earliest Deadline First 18

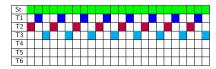


Tabla: Least Laxity First 18

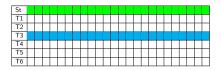


Tabla: Rate Monotonic 19

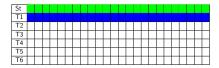


Tabla: Earliest Deadline First 19

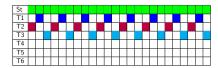


Tabla: Least Laxity First 19

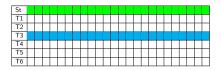


Tabla: Rate Monotonic 20

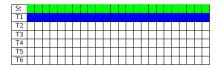


Tabla: Earliest Deadline First 20

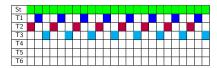


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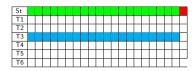


Tabla: Rate Monotonic 21

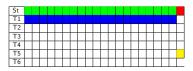


Tabla: Earliest Deadline First 21

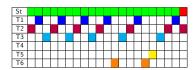


Tabla: Least Laxity First 21

#### Informacion de Tabla de Tiempo Completa

Informacion General:

• Escala Bloque : Ciclos = 1 : 1

• mcm: 500

Informacion de Rate Monotonic:

Posicion Fallo: 501

Informacion de Earliest Deadline First:

Posicion Fallo: 501

Informacion de Least Laxity First:

Posicion Fallo: 501