Project 2: Real Time Scheduling

David Martínez García[1]   José Martínez Hernández[2]

[1]david.martinez@estudiantec.cr
2007058596

[2]jpmh.1309@estudiantec.cr
2020426476

MP-6117 Real Time Operating Systems, August 2021

TEC | Tecnológico de Costa Rica

Table of Contents

TEC | Tecnológico de Costa Rica

Table of Contents

TEC | Tecnológico de Costa Rica

Algorithms

In this project, we will study the following real time scheduling algorithms:

- Rate Monotonic (**RM**)
- Earliest Deadline First (**EDF**)
- Least Laxity First (**LLF**)

TEC | Tecnológico de Costa Rica

Rate Monotonic (**RM**)

General Description:

Rate monotonic is a priority assignment algorithm used in real-time operating systems with a static-priority scheduling class. The static priorities are assigned according to the cycle duration of the job, so a shorter cycle duration results in a higher job priority.

Rate Monotonic (**RM**)

Schedulability Test:

$$\prod_{i=0}^{n} \left(\frac{E_i}{P_i} + 1 \right) \leq 2 \tag{1}$$

- E_i: execution time of the task i.
- P_i: period of the task i.

TEC | Tecnológico de Costa Rica

Earliest Deadline First (**EDF**)

General Description:

Earliest Deadline First is a dynamic priority scheduling algorithm used in real-time operating systems to place processes in a priority queue. Whenever a scheduling event occurs the queue will be searched for the process closest to its deadline. This process is the next to be scheduled for execution.

Earliest Deadline First (**EDF**)

Schedulability Test:

$$\sum_{i=0}^{n} \left(\frac{E_i}{P_i} \right) \leq 1 \qquad (2)$$

- E_i: execution time of the task i.
- P_i: period of the task i.

Least Laxity First (**LLF**)

General Description:

Least Laxity First is a job level dynamic priority scheduling algorithm. It means that every instant is a scheduling event because laxity of each task changes on every instant of time. A task which has least laxity at an instant, it will have higher priority than others at this instant. Laxity is mathematically it is described as

$$L_i = D_i - (t_i + C_i^r) \qquad (3)$$

- D_i: next deadline of the task at t_i.
- t_i: current execution time.
- C_i^r: remaining computer time of the task at t_i.

Least Laxity First (**LLF**)

Schedulability Test:

TODO: Missing equations

Table of Contents

TEC | Tecnológico
      de Costa Rica

Schedulability Tests

Task ID	Execution Time	Period
1	1	2
2	1	3
3	1	4
4	1	6

Execution

Task ID	0	1	2	3	4	5	6	7	8	9	10	11	12
1			X		X		X		X		X		X
2				X			X			X			X
3					X				X				X
4							X						X

Table of Contents

TEC | Tecnológico
de Costa Rica

Schedulability Tests

Task ID	Execution Time	Period
1	1	2
2	1	3
3	1	4
4	1	6

Execution

Task ID	0	1	2	3	4	5	6	7	8	9	10	11	12
1			X		X		X		X		X		X
2				X			X			X			X
3					X				X				X
4							X						X

Table of Contents

Schedulability Tests

Task ID	Execution Time	Period
1	1	2
2	1	3
3	1	4
4	1	6

Execution

Task ID	0	1	2	3	4	5	6	7	8	9	10	11	12
1			X		X		X		X		X		X
2				X			X			X			X
3					X				X				X
4							X						X

Table of Contents

Schedulability Tests

Task ID	Execution Time	Period
1	1	2
2	1	3
3	1	4
4	1	6

- RM
- EDF
- LLF

Execution

- RM

Task ID	0	1	2	3	4	5	6	7	8	9	10	11	12
1			X		X		X		X		X		X
2					X		X			X			X
3					X				X				X
4							X						X

- EDF

Task ID	0	1	2	3	4	5	6	7	8	9	10	11	12
1			X		X		X		X		X		X
2				X			X			X			X
3					X				X				X
4							X						X

- LLF

Task ID	0	1	2	3	4	5	6	7	8	9	10	11	12
1			X		X		X		X		X		X
2				X			X			X			X
3					X				X				X
4							X						X