Report

Analysis:

For each task set, each of the scheduling algorithms i.e., EDF, RM and DM are implemented as

EDF:

- The utilization of all the tasks in each task set is calculated using $\sum_{i=1}^{n} (e_i / p_i)$ if $d_i = p_i$
- If this utilization is <= 1 then the task set is schedulable by EDF else not schedulable
- If $d_i < p_i$ the utilization is calculated using $\sum_{i=1}^{n} (e_i / \text{minimum}(p_i, d_i))$
- If this utilization is <= 1 then the task set is schedulable by EDF else loading factor approach is done
- In loading factor approach, test points are found which are less than or equal to busy period and then loading factor and utilization is found for each test point. If the utilization of each test point is <=1 then task set is schedulable using loading factor approach else not schedulable and the first missing deadline is reported

RM:

- The tasks are sorted according to the periods
- The utilization of all the tasks in each task set is calculated using $\sum_{i=1}^{n} (e_i / p_i)$ if $d_i = p_i$
- If this utilization is <= $n(2^{1/n} - 1)$ then the task set is schedulable by RM else not schedulable
- If $d_i < p_i$ the utilization is calculated using $\sum_{i=1}^{n} (e_i / \text{minimum}(p_i, d_i))$
- Then Utilization bound test is performed on first task, then first two tasks and so on and check if bound test condition is met. If it is met for all tasks, task set is schedulable by RM.
- Else Response Time analysis is performed on the task set to determine the schedulability of the task set
- In response time analysis, execution time is calculated till $a_{n+1} = a_n$ and this worst case execution time is reported

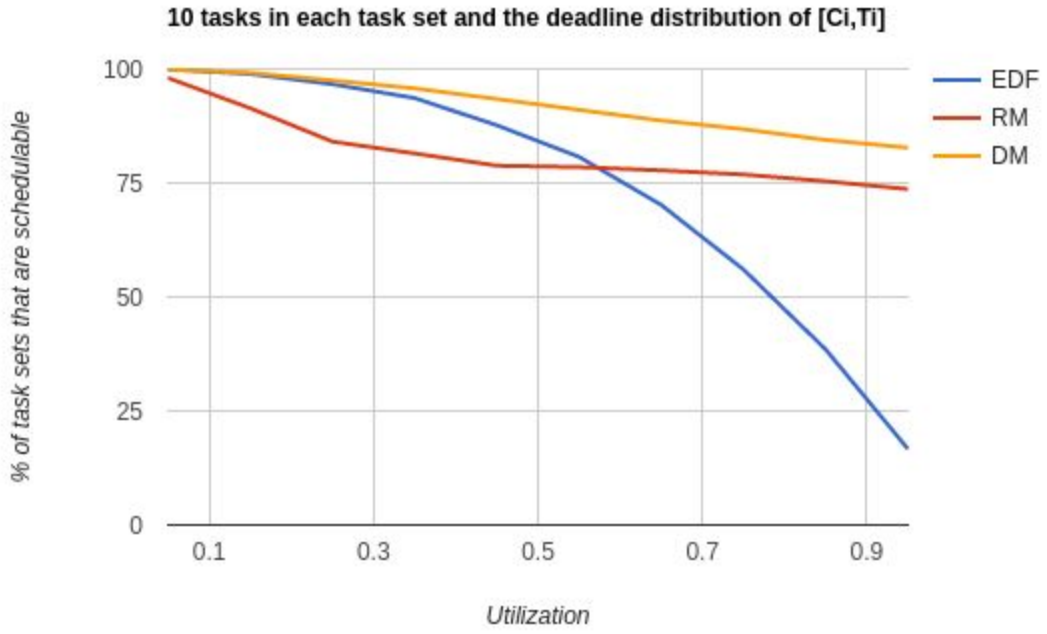
DM:

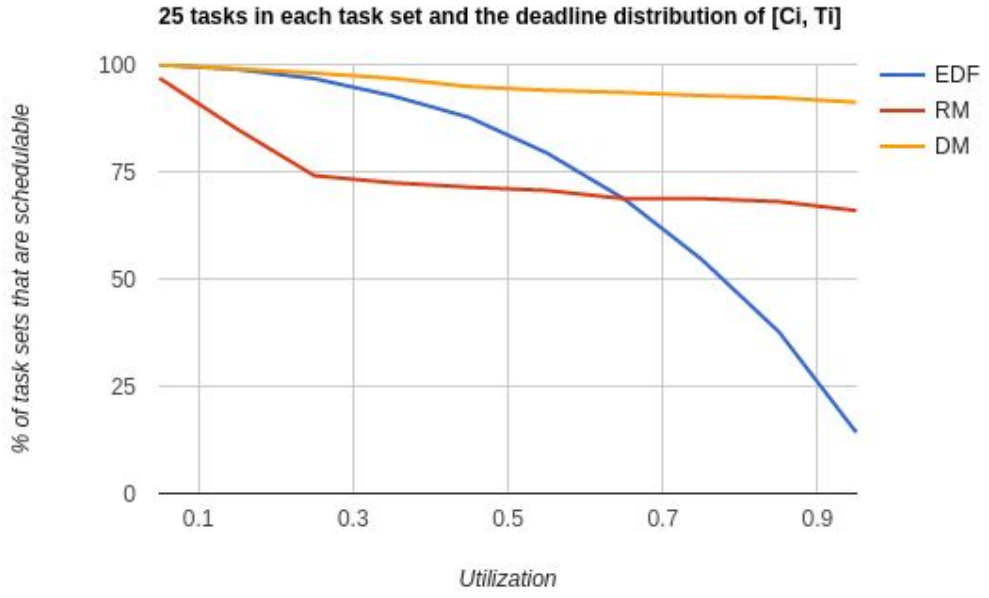
- The tasks are sorted according to the deadlines
- The utilization of all the tasks in each task set is calculated using $\sum_{i=1}^{n} (e_i / p_i)$ if $d_i = p_i$
- If this utilization is <= $n(2^{1/n} - 1)$ then the task set is schedulable by DM else not schedulable

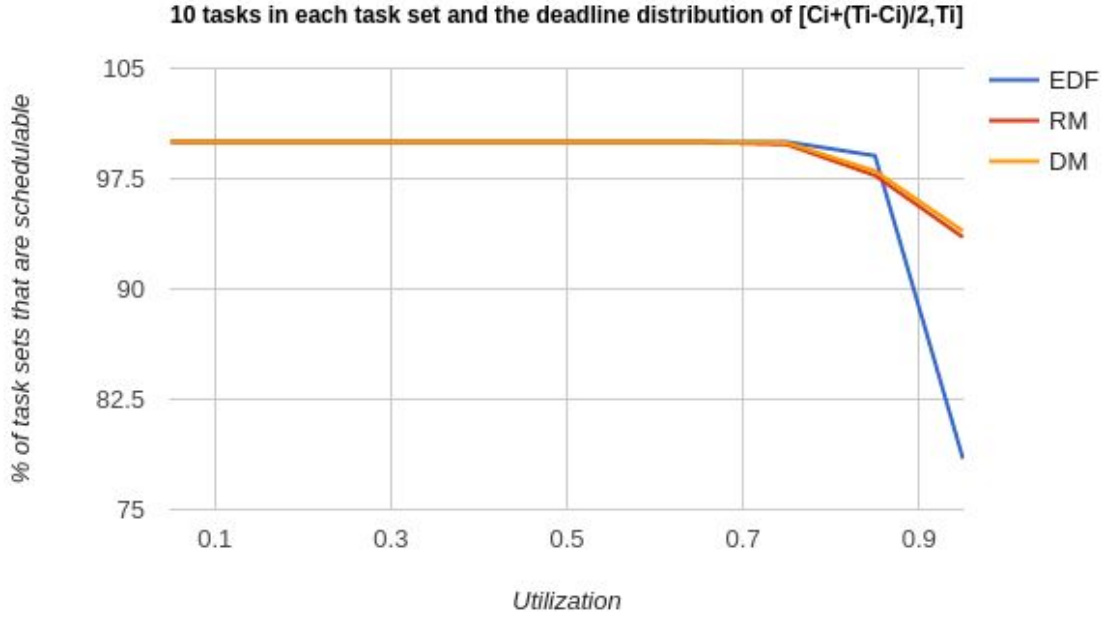
- If $d_i < p_i$ the utilization is calculated using $\sum_{i=1}^{n} (e_i / \text{minimum}(p_i, d_i))$
- Then Utilization bound test is performed on first task, then first two tasks and so on and check if bound test condition is met. If it is met for all tasks, task set is schedulable by DM.
- Else Response Time analysis is performed on the task set to determine the schedulability of the task set
- In response time analysis, execution time is calculated till $a_{n+1} = a_n$ and this worst case execution time is reported

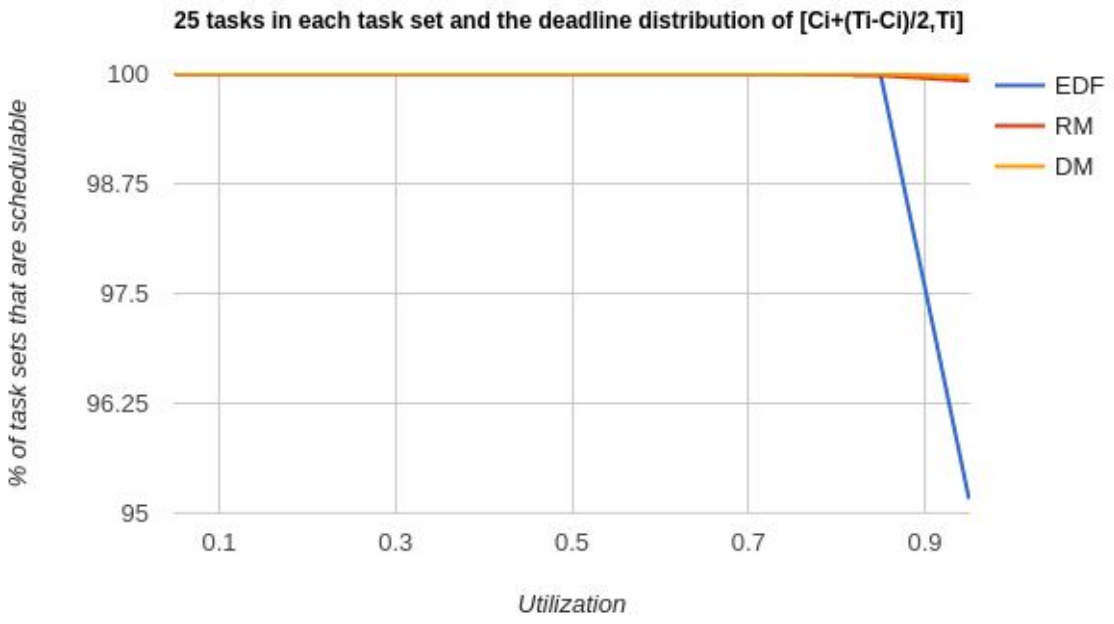
Graphs:

The percentage of task sets that are schedulable by each of the scheduling algorithms for four different cases is as shown below:




25 tasks in each task set and the deadline distribution of [Ci, Ti]
% of task sets that are schedulable
100
75
50
25
0
0.1
0.3
0.5
0.7
0.9
Utilization
EDF
RM
DM


10 tasks in each task set and the deadline distribution of [Ci+(Ti-Ci)/2,Ti]
% of task sets that are schedulable
105
97.5
90
82.5
75
0.1
0.3
0.5
0.7
0.9
Utilization
EDF
RM
DM



NOTE:

From the above plots, we can see that for utilization > 0.75, the performance of EDF algorithm when the deadline is between [Ci,Ti] is worse when compared to deadline between [Ci +(Ti-Ci) / 2, Ti]. The reason behind this could be:

Consider the formula, $\sum_{i=1}^{n} (e_i / \text{minimum}(p_i, d_i))$.

In this, we are calculating minimum(period,deadline). From our data generation algorithm, we are calculating the deadlines which are uniformly spread between:

Case 1: [Ci,Ti]
Here, as the values are spread in this range, if a random value is generated which is close to Ci, and minimum(pi, di) in this case would be 'di' (can be closer to Ci) which can make the summation greater than 1.

Case 2 : [Ci +(Ti-Ci) / 2, Ti]
Here the minimum value of the deadline can be Ci +(Ti-Ci) / 2, making the summation almost less than one in most of the cases.

This is just an intuitive analysis from the above plots.