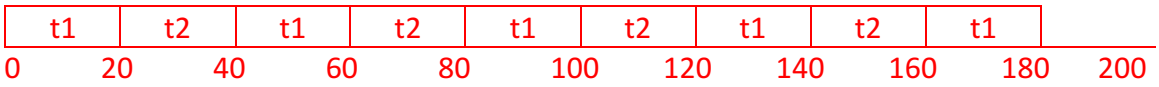
Q1: (30%) Please draw the scheduling result of the RM scheduling algorithm from time 0 to time 200 for the following task set: (Assume that they are ready at time 0)
t_1 has its period 40 and execution time 20
t_2 has its period 100 and execution time 40
Answer:



Q2: (30%) Consider 4 tasks, t_1, t_2, t_3, and t_4 which have priorities x_1, x_2, x_3, and x_4, respectively, and assume $x_1>x_2>x_3>x_4$ (x_1 is the highest priority). After we profile the programs of the 4 tasks, we have the following information:

- Task t_1 will lock semaphore S_1 for 3ms.
- Task t_2 will lock semaphore S_2 for 4ms and lock semaphore S_3 for 5ms.
- Task t_3 will lock semaphore S_2 for 6ms and lock semaphore S_1 for 7ms.
- Task t_4 will lock semaphore S_1 for 8ms and lock semaphore S_3 for 10ms.

Please derive the priority ceiling of each semaphore. If the Priority Ceiling Protocol (PCP) is used to manage the semaphore locking, please derive the worst-case blocking time of each task.
Answer: Priority Ceiling: S1: x1, S2: x2, S3: x2
Blocking Time: t1: 8 ms, t2: 10 ms, t3: 10 ms, t4: 0ms

Q3: (40%) A sporadic server has a replenishment period 5 and the maximum execution budget 2. Let the sporadic server have the budget 2 at time 0. Assume that events arrive at 1, 2, 4, 9, 10, and each event consumes the execution time 1. Please draw a diagram to show the changing of the execution budget from time 0 to time 20.
Answer: