長庚大學113學年度第二學期 作業系統實務 第二次小考（總分100）

系級：　　　　　　　姓名：　　　　　　　學號：

1. (60%) Please briefly explain (a) the **Rate Monotonic (RM)** scheduling algorithm and (b) the **Earliest Deadline First (EDF)** scheduling algorithm for real-time task scheduling. For three periodic tasks P_1, P_2 and P_3, P_1 has its period 30 and execution time 10, P_2 has its period 50 and execution time 15, and P_3 has its period 75 and execution time 20. Assume P_1, P_2 and P_3 are ready at time 0. Please draw the scheduling results from time 0 to 150 for (c) the RM scheduling and (d) the EDF scheduling.

Answer: (a) A task with a shorter period will be assigned a higher priority.
(b) A task with the earliest deadline will be assigned the highest priority.
(c)
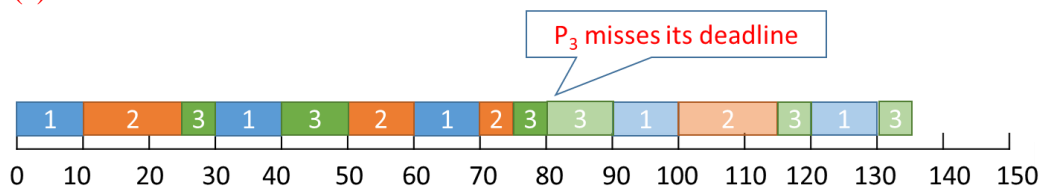
(d)
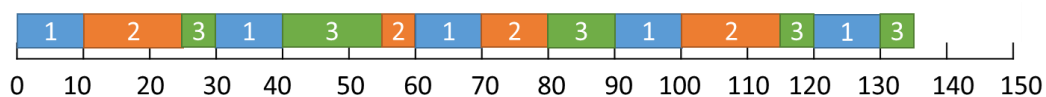
2. (40%) Consider 4 tasks, t_1, t_2, t_3, and t_4 which have priorities x_1, x_2, x_3, and x_4, respectively, and assume $x_1>x_2>x_3>x_4$ (x_1 is the highest priority). After we profiled the programs of the 4 tasks, we have the following information:
   - Task t_1 will lock semaphore S_1 for 5 ms.
   - Task t_2 will lock semaphore S_1 for 20 ms and lock semaphore S_2 for 15 ms.
   - Task t_3 will lock semaphore S_2 for 10ms and lock semaphore S_3 for 25ms.
   - Task t_4 will lock semaphore S_3 for 30ms and lock semaphore S_4 for 35ms.

(a) Please derive the priority ceiling of each semaphore. If the priority ceiling protocol is used to manage the semaphore locking, (b) please derive the worst-case blocking time of each task. You have to provide the reason to support each of your answers.

Answer: (a) Priority ceilings: S_1: x_1, S_2: x_2, S_3: x_3
(b) Worst-case blocking times: t_1: 20 ms, t_2: 10 ms, t_3: 30 ms, t_4: 0 ms.