Review Questions and Problems Chapter 9

1. Consider a task set T composed of the following three periodic tasks {T1, T2, T3}:

   - T1(0,1,3,3) (release time, computation time, deadline, period)
   - T2(0,1,4,4)
   - T3(0,2,3,6)

   a) Compute the processor utilization factor and the major cycle for the task set.

   b) Build the schedule for the task set under the three scheduling algorithms RM, DM, and EDF.

2. Consider a task set with the following three periodic tasks {T1, T2, T3}:

   - T1(0, 2, 7) (release time, computation time, period)
   - T2(0, 1, 4)
   - T3(0, 1, 8)
   - T4(0, x, 5) (x is to be determined)

   a) Compute the relative priorities for this task set according the RM algorithm.

   b) How much computation time x can be granted to T4 such that schedulability can be guaranteed for all four tasks under the RM algorithm?

   c) How much computation time x can be granted to T4 such that schedulability can be guaranteed under the EDF algorithm?

3. On a given system with a round-robin scheduler (time slice scheduler) an average task runs for a time T until it is blocked by an input/output operation. A context switch takes a fixed time S; this time is lost for the actual purpose of the system.

   Please compute the CPU efficiency for this round-robin scheduler with a quantum Q (the time slice granted to each task before a context switch is enforced), the efficiency being the ratio of usable CPU time to total CPU time for the following cases:

   (a) $Q = \infty$
   (b) $Q > T$
   (c) $S < Q < T$
   (d) $Q = S$
   (e) Q almost 0

4. Four Tasks, T1 to T4, are released simultaneously to run on a single CPU. Their computation times are 7, 4, 8, for T1, T2, and T3, respectively, and some time X for T4.

   In what order should the scheduler execute the four tasks such that the average response time for this task set is minimized?

   Solution hints:

   - To compute the average response time, first assume four tasks Ta, Tb, Tc, and Td are being executed in that order.
   - Compute the actual response time for task Ta with computation time a, for task Tb with computation time b, and so on.
   - For this case, develop a formula for the average response time.
   - Now assign the computation times of T1 to T4 to their proxies Ta to Td such that the average response time is minimized.
   - The answer depends on X, thus there is more than one solution.