ECE 697O: Solutions to Real-Time Systems Homework 3

(1) EDF is optimal for this scheduling problem. Since we get a reward of 3 for each task, all that matters is the total processor utilization. Since the schedulability test for EDF is that the total utilization not exceed 1, the processor will serve all the offered load up to 100% utilization. Hence, the average reward rate is $3\min\{1, u_1 + u_2 + \cdots + u_n\}$, where the total number of tasks is n.

(2) We want to equalize the total execution times as much as possible. It is easy to see that this will happen if we assign 3 units to tasks T_1 and T_2, and 5 units to T_3 and T_4. Hence, the schedule will be: run T_1 over $[0, 3)$; T_2 over $[3, 6)$; T_3 over $[6, 11)$; and T_4 over $[11, 16]$.

(3) Suppose we slow the clock down by a factor of k. Then, the conditions for schedulability become:

For T_1:	k	$\leq 3 \Rightarrow k \leq 3$
For T_2:	$2k$	$\leq 3 \Rightarrow k \leq 3/2$ or
	$3k$	$\leq 5 \Rightarrow k \leq 5/3$
For T_3:	$4k$	$\leq 3 \Rightarrow k \leq 3/4$
	$5k$	$\leq 5 \Rightarrow k \leq 1$
	$7k$	$\leq 7 \Rightarrow K \leq 1$

From this, we see that no slowdown is possible owing to T_3. So, we cannot run at a lower voltage and thereby save energy.