Scheduling process analysis

The purpose of this exercise is to study the scheduling of a computer system where two processes P_1 and P_2 run.

Each processes can be in different states: *Ready* (the process can run but the CPU is assigned to another process), *Running* (process has the CPU assigned and it runs), *IOserve* (the I/O request is under service), Exit (the process is no longer active in the system because it has completed its processing).

Initially, all processes are in the *Ready* state; during its execution, each process performs a series of I/O activities (*IOserve* state), each preceded by CPU activity. When a process has completed all its I/O activities it performs a last CPU activity and completes (*Exit* state). The processes P_1 and P_2 need to perform 1, and 5 I/O activity respectively. The processes are scheduled to access the CPU according to a *Round Robin* algorithm, whose quantum time is set to q unit times.

The duration of the P_i process I/O activities, with $i = 1, 2$, is an exponentially distributed random variable with average value to_i. The duration of the CPU activity of the process P_i is a multiple of the quantum of time equal to $n_i \cdot q$, with $i = 1, 2$.

By making the appropriate simplification assumptions, evaluate the distribution of each process completion time and the CPU utilization.

Use the numerical values shown in table 1 as system parameters:

Remark: When a process performs its I/O activities, the operating systems assigns the CPU to the other processes.

Parameter	**Value**
q	8 ms
n_1	10
n_2	4
to_1	1.2 s
to_2	0.8 s

Table 1: System parameter values