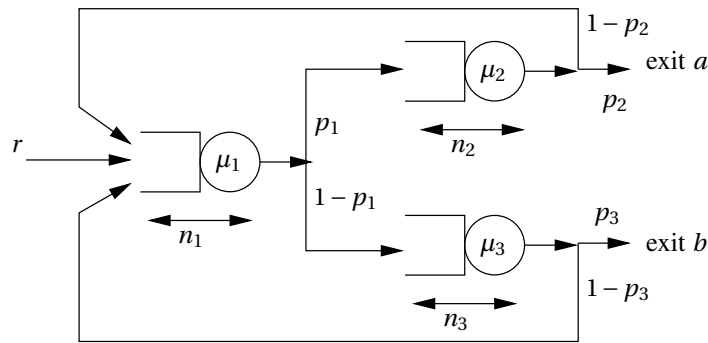**Problem 22.1**

22.1.A Derive a close formula for the stationary distribution of the network shown in the figure using the general product form for a Jackson network. Suppose that $r = 1$ customers/s, $\mu_1 = \mu_2 = \mu_3 = 2$ customers/s, $p_1 = 0, 5$, $p_2 = 0, 5$, $p_3 = 0, 8$. Check the system stability.

22.1.B Compute the average number of customers/s leaving the system at exit a and exit b.

22.1.C Compute the average number of customers in the system and the average time in the system.

Problem 22.2
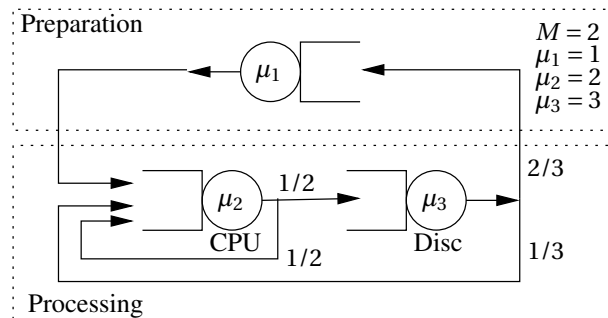
The system of the figure consists of $M = 2$ processes that follow 2 stages: First they are prepared and then executed in a processing unit that consists of a CPU and a Disk. All services in the queues that model these units are exponential with rates μ_i processes/time unit.

22.2.A Compute the stationary distribution using the general product form for a Jackson network.

22.2.B Can be the throughput (number of processes per time unit dispatched by the preparation stage) higher than 1 process/time unit? Why?

22.2.C Compute the throughput.

22.2.D Compute the processing time (expected time in the processing stage).

22.2.E Compute the expected number of times that each process entering in the processing stage will be run by the CPU.