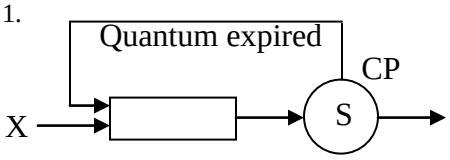
CS841: COMPUTER PERFORMANCE EVALUATION Homework

Topic: Open queuing networks **Dr. Jozo Dujmović**

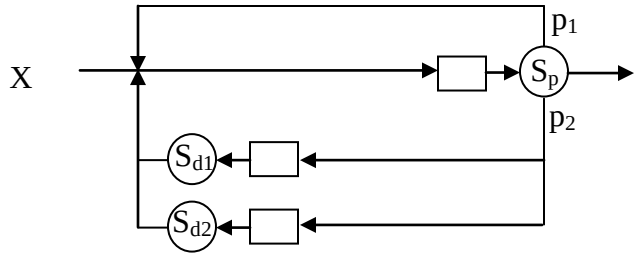
1.



An average quantum of processor time assigned by a processor scheduler is S=20 ms. An average transaction needs 100 ms and makes multiple visits to central processor. Compute and plot the response time R(X).

2. A storage system consists of three disk drives sharing a common queue. The average time to service an I/O request is 50 ms. The I/O requests arrive to the storage system at the rate of 30 requests per second. Using an M/M/3 model for this system, determine the following:
   a. Average disk drive utilization (U_d)
   b. Probability of the system being idle, p_0 (see the formula on p. 116 of the reader)
   c. Average number of jobs in the system (J)
   d. Average number of jobs waiting in the queue (Q_W)
   e. Mean response time (R)

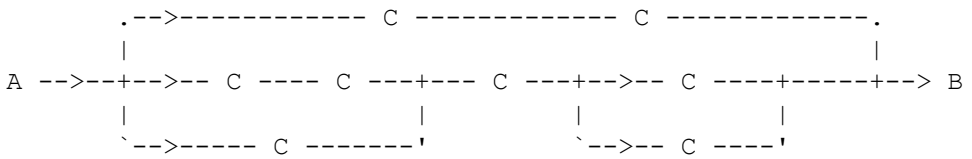
3.

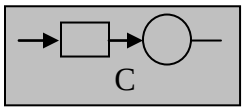


S_p = 4 ms (central processor)
S_{d1} = 10 ms (disk D1)
S_{d2} = 20 ms (disk D2)
p_1 = 0.4 (prob. of more proc. time)
p_2 = 0.4 (probability of disk access)

For this system the disk load is balanced so that the utilization of each disk is 60%. Compute:
(a) Utilization of all servers (U_p, U_{d1}, U_{d2})
(b) Queue lengths for all queues (Q_p, Q_{d1}, Q_{d2})
(c) Average number of jobs in the system (J)
(d) Response time (R) for this specific throughput (X) and plot the curve R(X)
(e) Maximum throughput of the system (X_{max})

4. Let A and B be two points connected by a computer network having the following configuration:





Data packets coming from point A form a Poisson arrival process whose average rate is 30 packets per second. Computer nodes C can be modeled as M/M/1 systems having the average service time of 20 ms per packet. The packet distribution policy is that in all branching points packets are sent to adjacent nodes with equal probability.

(a) What are the probabilities that individual processors are idle?
(b) What is the average propagation time from A to B?
(c) What is the maximum input arrival rate $\mathbf{X_{max}}$ for the above packet distribution policy?
(d) What increase of $\mathbf{X_{max}}$ can be achieved if we change the packet distribution policy?