Performance Evaluation of Computer Networks

Assignment #3

1. A data center has 4 machines and staff of 2 people that maintain and service failed machines. Suppose that the failure rate of a machine equals to 0.1 fails/hour and the repair rate of a machine equals to 0.5 repairs/hour. Find the following:

- **a.** MTTF (Mean Time To Failure)
- **b.** MTTR (Mean Time To Repair)
- **c.** The Probability that 0, 1, 2, 3 , and 4 machines are operating
- **d.** Average Failure Rate of Machines
- **e.** Average Repair Rate of Machines
- **f.** Average Number of Operating Machines
- **g.** Average Number of Failed Machines
- **h.** The Probability that at least 3 machines are operating
- **i.** The Probability that at most 3 machines are operating

2. An E-Commerce site offers four e-business functions: access the home page (h), Search the catalog (s), add to the shopping card (a), and buy (b). The site functionality is implemented by a machine that consists of one CPU and one Disk. Assume that 10 new sessions are started at the site per second and 40% of sessions are of type A and 60% of sessions are of type B. The Customer Behavior Model Graphs (CBMG) of these two types of sessions are shown in Figure 1 and Figure 2. Table 1 gives the CPU and Disk service demands for each of the e-business functions offered by the site.

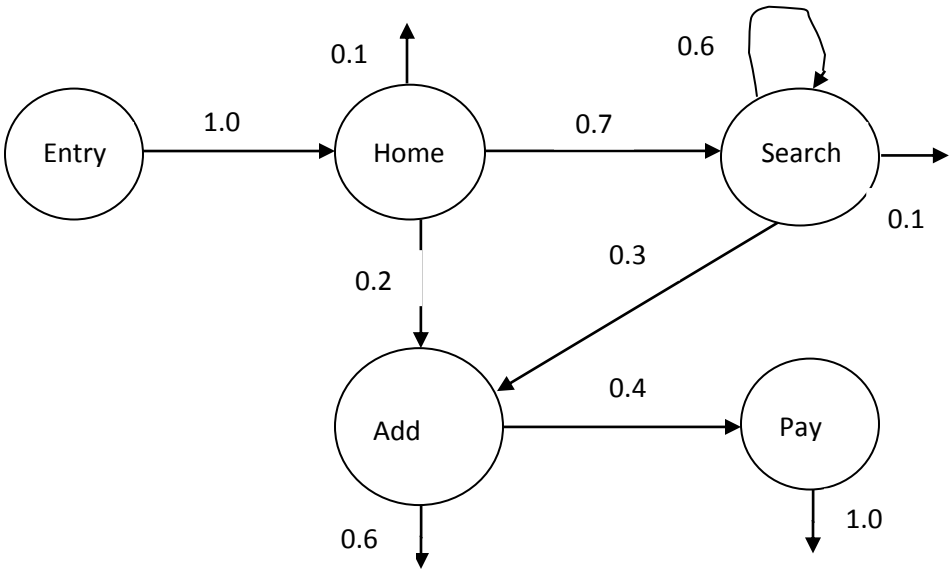

Figure1. CBMG for type A sessions

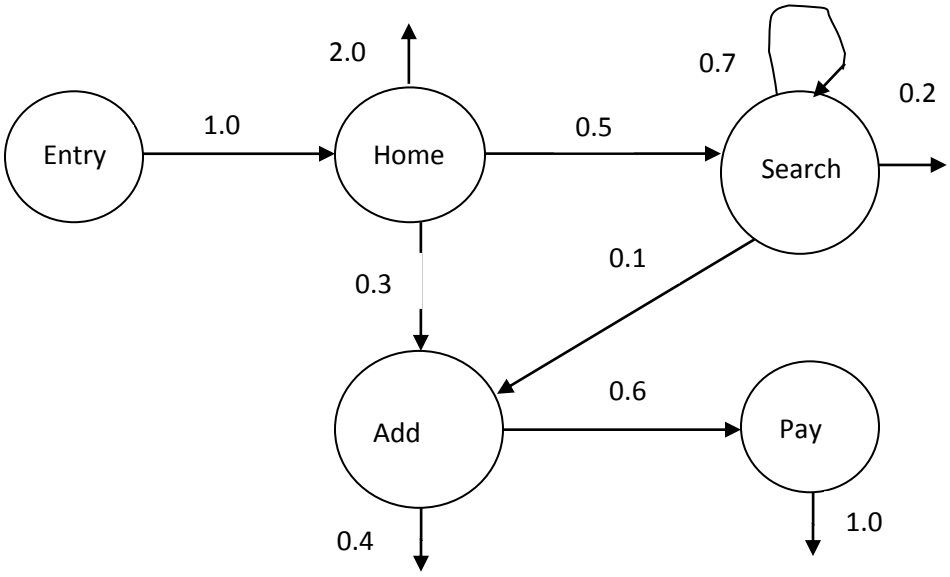

Figure2. CBMG for type B sessions

	Home	***Search***	***Add to Card***	***Pay***
CPU	***0.01***	***0.015***	***0.01***	***0.02***
Disk	***0.015***	***0.025***	***0.015***	***0.01***

Table 1. Service demands at the CPU and Disk

a. Find the average number of visits per session to each of the four e-business functions.
b. What is the arrival rate of requests to execute each of the four e-business functions?
c. What is the total utilization of the CPU and of the disk?
d. What are the residence times at the CPU and disk for each of the four e-business functions?
e. What is the response time of each of the four e-business functions?