HELSINKI UNIVERSITY OF TECHNOLOGY
Networking Laboratory
S-38.145 Introduction to Teletraffic Theory, Spring 2005

Exercise 7
17.3.2005

Problems 3–4 are homework exercises. Mark the problems you have solved in the beginning of the exercise class.

1. *Demo*
   Consider a link in a circuit switched trunk network. Denote by n the number of parallel channels of the link. Users generate new calls according to a Poisson process. The mean interarrival time between new calls is denoted by t, and the mean call holding time by h. What is the queueing model in question? Determine the time blocking, the call blocking, and the traffic carried for $n = 2$, $t = 4$ min, and $h = 3$ min.

2. *Demo*
   Consider a link in a circuit switched access network. Denote by n the number of parallel channels of the link. There are k users generating new calls when idle. The mean idle time is denoted by t, and the mean call holding time by h. What is the queueing model in question? Determine the time blocking, the call blocking, and the traffic carried for $n = 2$, $k = 4$, $t = 9$ min, and $h = 3$ min.

3. *Homework exercise (1 point)*
   A company has a centralized call center with three parallel phone lines. When a customer calls and all service lines are busy, the call is blocked and thus lost. Customers generate calls according to a Poisson process with intensity 0.1 calls per minute, and the call holding times are independent and exponentially distributed with mean 10 minutes. What is the queueing model in question? Determine the time blocking and the call blocking.

4. *Homework exercise (2 points)*
   A computer application has a multi-user lisence for two concurrent users, while the number of potential users is three. Each session holds for an exponentially ditributed time interval with mean 1.0 time units, after which the user is idle for an exponentially distributed time interval with mean 2.0 time units. All these intervals are independent of each other.

   (a) Let $X(t)$ denote the number of concurrent users at time t. What is the queueing model in question (using Kendall's notation)? Process $X(t)$ is a Markov process. Draw the state transition diagram for this process, and derive its equilibrium distribution.

   (b) What is the mean number of concurrent users? What is the probability that there are two concurrent users? How long does such a situation take on average? What is the probability that a new session is rejected?