HELSINKI UNIVERSITY OF TECHNOLOGY | **Exercise 2**
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S-38.145 Introduction to Teletraffic Theory, Fall 1999 | Aalto/Nyberg

1. Consider a statistical multiplexer with four incoming links of capacity 155 Mbps. The average packet arrival rates from these four links are as follows: 10, 12, 5 and 3 packets/ms. The average packet length is 400 bytes. Model this as a pure waiting system of type M/M/1 (with one server and an infinite buffer). a) What is the minimum capacity required for the outgoing link in order that the system be stable? b) Assume then that the capacity of the outgoing link is also 155 Mbps. What is the traffic load? What is the average number of packets in the multiplexer? What is the mean time that the packets stay in the multiplexer?

2. Consider the following (very simple) circuit switched trunk network. There are three nodes connected in a tandem by two links:

   a — b — c

   There are three traffic classes:

   - Class 1 uses link a — b
   - Class 2 uses link b — c
   - Class 3 uses both link a — b and link b — c

   Assume further that there are two parallel channels in each link. a) Determine the state space of this system. b) Determine the blocking states for each class.

3. Consider still the circuit switched trunk network defined in the previous problem. Assume that, for each class $r$, new calls arrive according to a Poisson process at rate $\lambda_r$. Let $\lambda_1 = \lambda_2 = 1/3$ calls per minute and $\lambda_3 = 2/3$ calls per minute. Call holding times (for all classes) are assumed to be independently and identically distributed with mean $h = 3$ min. a) Calculate the end-to-end blocking probabilities for each class with the exact formula. b) Determine the intensity of carried traffic for each class. c) Approximate the end-to-end blocking probabilities for each class with the Product Bound method.