HELSINKI UNIVERSITY OF TECHNOLOGY
Department of Communications and Networking
S-38.3141 Teletraffic Theory, IV/2008

Exercise 2
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1. Poissonian traffic with intensity a is offered to a primary group of four trunks. Using the Riordan formula calculate the peakedness factor z of the overflow traffic for the following values of the offered traffic a a) 2 erl, b) 4 erl, c) 6 erl.

2. In the ERT method, one has to solve the parameters a^* (offered traffic intensity) and n^* (number of servers) of a hypothetical overflow system such that the intensity of the overflow traffic and its variance are the same, a and v, as those of the non-Poissonian traffic to be modelled. By using the Riordan formula show that n^* can be solved in terms of a^* and the parameters a and $z = v/a$ as follows,
$$n^* = \frac{a^*(a+z)}{a+z-1} - a - 1$$

3. Consider three links with the offered traffic intensities and capacities (a, m) having the values (9,13), (11,12) and (13,15). The overflow traffic streams from all three links are offered to a common overflow link with capacity 7. Estimate the blocking probability in the overflow link using the Hayward method.

4. By using the Rapp approximation $a^* = v + 3z(z-1)$, together with the result of the previous problem, dimension the capacity of the overflow link such that its blocking probability is 1 %, when the link receives overflow traffic streams from three other links with offered traffic intensities and capacities (a, m) as follows (9,13), (11,12) and (13,15). How much additional capacity would be needed altogether if no overflow link were available but the capacities of the links had to be increased separately in order to meet the blocking probability requirement?

5. In a three level symmetric hierarchical circuit switched network there are $m_i = 4,\ 1,\ 8$ links on levels $i = 1,\ 2,\ 3$, respectively. The cost per link of adding one trunk at different levels is $c_i = 2,\ 7,\ 1$ (in some units). The traffic intensities offered to links of different levels are $a_i = 5,\ 14,\ 2$ Erl. Dimension the network using Moe's method so that the end-to-end blocking probabilities are less than 0.01. Start with an under-dimensioned network, where each link is separately dimensioned for a maximum blocking of 0.01.

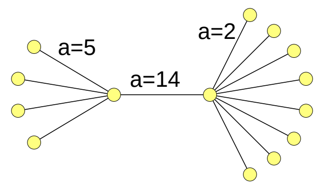

Figure 1: Symmetric hierarchical circuit switched network.

6. Compute the total cost of the network (of the previous problem) when it is required that the blocking probability is at most 0.0033 on each link.