S-38.110 Telecommunication Switching Technology I, Exercise 3

Brax/Ilvesmäki 10.2.2000

The answers are to be returned before the exercise begins either to the exercise assistant (in person or via email to lynx@tct.hut.fi) or to a box underneath the lab's noticeboard.

Task 1

Using heuristic reasoning show the dimensions of a 3-stage switching fabric if it is to be non-blocking. Use symmetric switching fabric with equal number of inputs(N) and outputs(M). A switch has m or n inputs which are grouped to x or y groups. Assume that a first (and a thrid) stage switch may be connected only once to a single second stage switch. Start from the worst-case scenario where all of the inputs but one on a particular primary switch A and all of the outputs but one on a particular tertiary switch B are each connected via a different secondary switch matrix. Count also the number of cross-points for the switching matrix. Assume in all cases that N=M, n=m and x=y.

Task 2

Compute the crosspoint complexity and the logical depth (the number of logical gates in a path) for the following networks:

A) The full $N \times N$ crosspoint switch.

B) The three stage rearrangable Clos network contstucted using $\sqrt{N} \times \sqrt{N}$ switches.

C) The Benes network

(Hui: Chapter 3. Exercise 1 a,b and c)

Task 3

Consider the crosspoint complexity of three stage Clos networks.

A) Show that the strict-sense network has roughly twice the complexity of the rearrangeable network.

B) For the rearrangeable network, show that the optimal choice of p (figure 12 of Hui) for minimizing crosspoint count is $\sqrt{N/2}$, which gives a crospoint complexity $2 \cdot \sqrt{2N^{3/2}}$

C) For the strict-sence network, show that the minimum crosspoint count is roughly given by $4 \cdot \sqrt{2N^{3/2}}$

Hui: Chapter 2. Exercise 2abc, 5ab