S-38.120 Telecommunication Switching Technology, Exercise 3

Brax/Ilvesmäki Friday 22.2.2002, 0915am, Lecture Hall S4

The answers are to be returned before the exercise begins (see the above date and time) either to the exercise assistant (in person or via email to lynx@tct.hut.fi) or, preferably, to a box underneath the lab's noticeboard on G-wing 2nd floor. Since we aim to publish the results immediately after the exercise all late answers will be disregarded. Please, adhere to the deadline.

Task 1 (Moderate)

a) We have a simple switch that consists of crosspoints. A single crosspoint can either be open or closed. If the switch has X crosspoints how many different configurations (different states) can the switch have?
b) Different states (open or closed) of crosspoints may or may not result in a new switch configuration. In any case, what is the lower bound for the number of crosspoints required to build a switch with a certain number of configurations?

Task 2 (Moderate-Hard, related to Task 1)

Let us consider NxN (N inputs and N outputs) point-to-point switch. It can connect any input link to any output link as long as no two different input links are connected to the same output link (and v.v.).
a) How many (legal) configurations may be achieved with this kind of switch?
b) Using the result of the previous task what is the minimum number of crosspoints on such a switch?

Task 3 (Moderate)

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

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

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

Task 4 (Moderate-Hard)

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 $2 \cdot \sqrt{2} N^{3/2}$

Hui: Chapter 3. Exercise 2ab.