Exercise– CLOS Networks

Design a Clos network of size 100 x 100, using modules 10x10. In the first stage, only 10 inputs per module are allowed. Consider both cases, strictly non-blocking and rearrangeable network.

Strictly non-blocking

$m \geq 2n-1 \Rightarrow m = 2n-1 = 19$

$r = N/n = 10$

Rearrangeable non-blocking

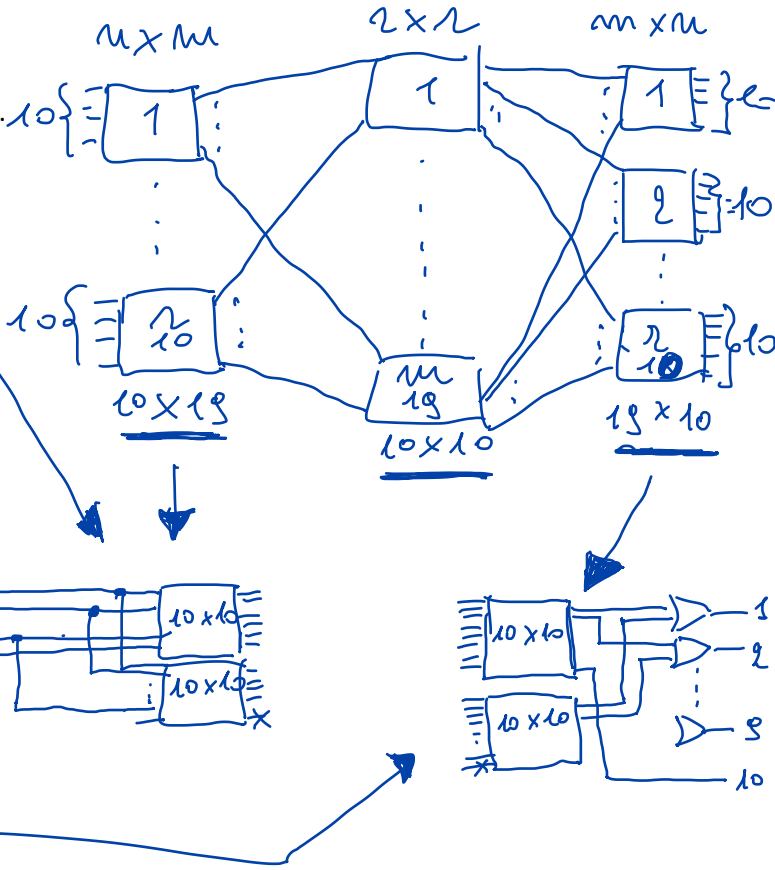
$m \geq n \Rightarrow m = 10$

in each stage we have 10 modules (crossbar) 10x10

stage 1: 10 modules 10x19

stage 2: 19 modules 10x10

stage 3: 10 modules 19x10



Compare the cost of the crossbar 100 x 100 and the Clos network, strictly non-blocking and rearrangeable, designed in the previous point, giving the gain in both cases.

$C_{CR} = 100 \times 100 = 10^4$

$C_{SN} = (\#\text{ OF SWITCHES}) \cdot (\text{COST OF A SWITCH}) = (10 \times 2 + 19 + 10 \times 2) \times 10^2 = 59 \times 10^2$

(switches: 10 x 2 + 19 + 10 x 2; CROSSBAR 10x10)

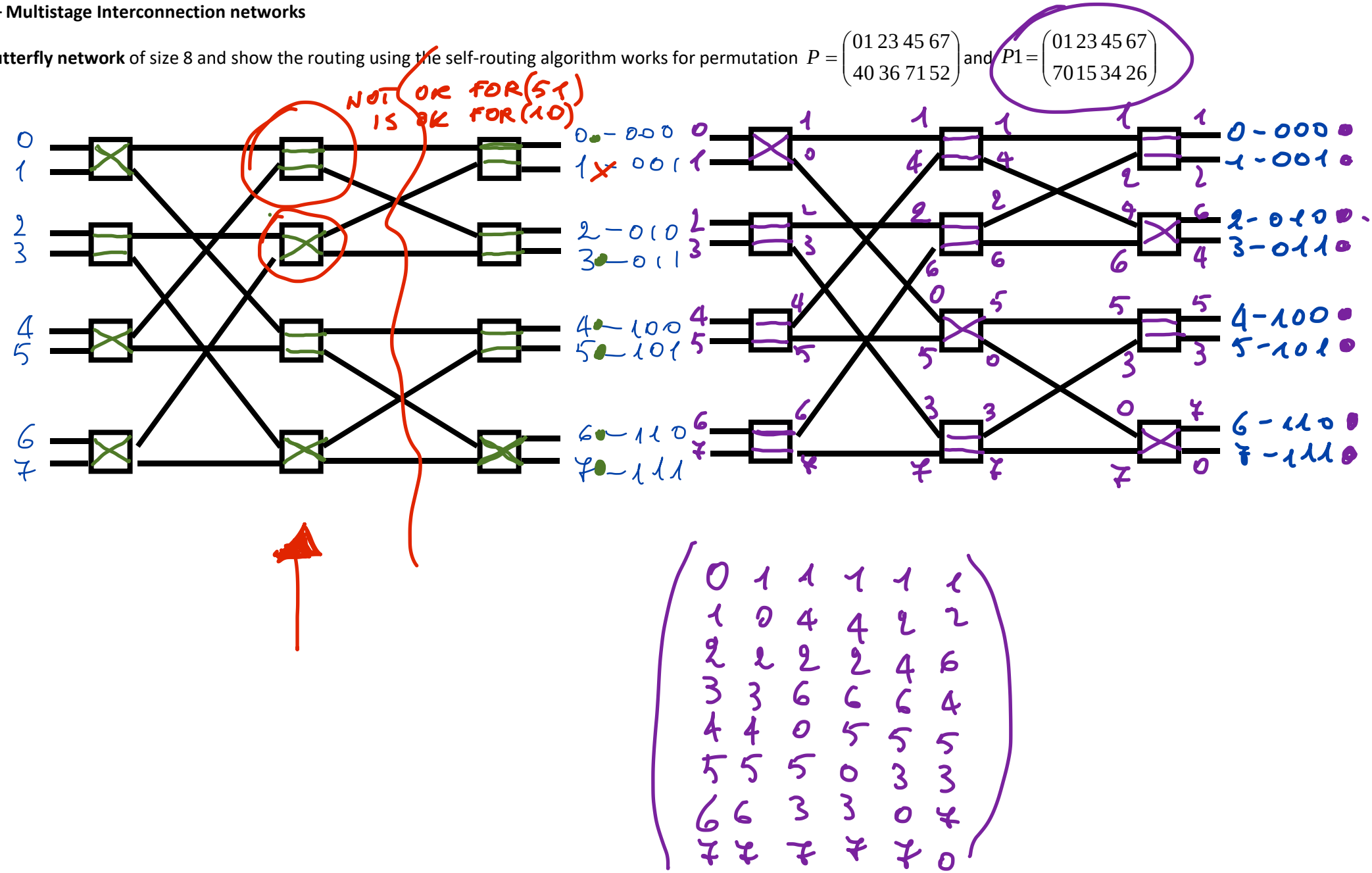
$C_{RN} = (\#\text{ OF SWITCHES}) \cdot (\text{COST OF A SWITCH}) = (10+10+10) \times 10^2 = 30 \times 10^2$

$G_{C-SN} = \frac{10^4}{59 \times 10^2} \simeq 1,7$

$G_{C-RN} = \frac{10^4}{30 \times 10^2} \simeq 3,3$

Exercise – Multistage Interconnection networks

Draw a **Butterfly network** of size 8 and show the routing using the self-routing algorithm works for permutation $P = \begin{pmatrix} 01\,23\,45\,67 \\ 40\,36\,71\,52 \end{pmatrix}$ and $P1 = \begin{pmatrix} 01\,23\,45\,67 \\ 70\,15\,34\,26 \end{pmatrix}$



0	1	1	1	1	1
1	0	4	4	2	2
2	2	2	2	4	6
3	3	6	6	6	4
4	4	0	5	5	5
5	5	5	0	3	3
6	6	3	3	0	4
7	7	7	7	7	0

Draw a **Omega network** of size 8 and show the routing using the self-routing algorithm works for permutation $P = \begin{pmatrix} 01\,23\,45\,67 \\ 40\,36\,71\,52 \end{pmatrix}$ and $P1 = \begin{pmatrix} 01\,23\,45\,67 \\ 70\,15\,34\,26 \end{pmatrix}$