

### Exercise 1:

A router has 3 inputs (In1, In2, In3) and 3 outputs (OutA, OutB, OutC). VOQ is used in input lines to route input packets to their outputs. Let's suppose the following data flows in input lines:

- In1: Flow1 to OutA and Flow2 to OutC
- In2: Flow3 to OutB and Flow4 to OutC
- In3: Flow5 to OutA

Flows have the same packet size and their rate is the same.

Q1: What are the possible connection patterns that can occur if is used PIM algorithm?

Q2: For the patterns found previously, what is the probability of each pattern running PIM? To do it, run PIM algorithm step by step and show the probabilities in each step.

Q3: Does PIM algorithm assign a fair internal bandwidth distribution of the 5 flows? To answer, use the Q2 result to calculate the probability of each flow and show their relationship

Q4: What would happen using RRM? To answer it, run RRM algorithm and obtain the different connection patterns.

*NOTE: Initial Accept Pointers: In1:  $a1=2$ ; In2:  $a2=1$ ; In3:  $a3=2$*

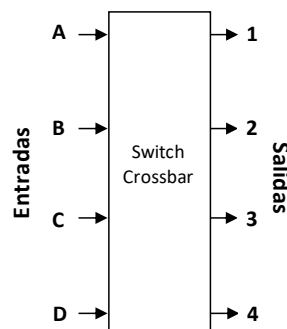
*Initial Grant Pointers: OutA:  $g1=1$ ; OutB:  $g2=3$ ; OutC:  $g3=3$*

### Exercise 2

A router has a crossbar switch with 4 input (ingress) ports and 4 output (egress) ports as shown in the figure. Input ports have the following packets waiting to be switched

	1st packet	2nd packet	3rd packet
Port A	1	2	3
Port B	1	3	4
Port C	1	3	4
Port D	2	4	3

In the table, 1 means a packet for output 1, 3 a packet for output 3, etc.

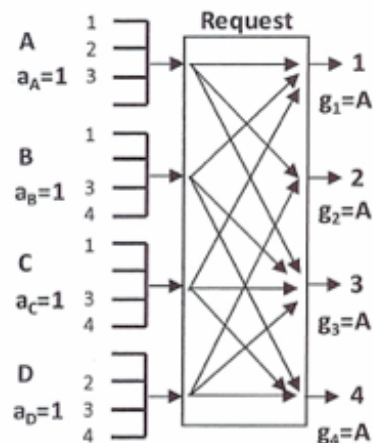


VOQ (Virtual Output Queing) is used

How many times will the crossbar switch to transfer all the packets to the output ports using iSLIP ? Which are those packets? Which is the order?

To take into account: Initial pointers are the following ones where:

- $a_A=1$ : input port pointer A is output 1
- $g_1=A$ : output port pointer 1 is input A



Answer in the table below.

Note: Use only the required Lumber of packet switching.

	1st Switch	2nd Switch	3rd Switch	4th Switch	5th Switch	6th Switch	7th Switch	8th Switch
Port A	Packet=							
Port B	Packet=							
Port C	Packet=							
Port D	Packet=							

### Exercise 3:

An 8 port router has the following content in its input buffers:

Interfaz 1: 4 6 1	Interfaz 3: 7 1	Interfaz 5: 	Interfaz 7: 3
Interfaz 2: 2 3	Interfaz 4: 7 5 2	Interfaz 6: 8 5 2	Interfaz 8: 1 6 4

Note: Each cell represents a packet in the input buffer. The number is the output interface.

VOQ is used to avoid blockings at the switching matrix input by an implementation of algorithm RRM. In which order will all the shown packets be sent (show in each step the pointers values)?

Note: Suppose that initially all the port pointers are set to themselves