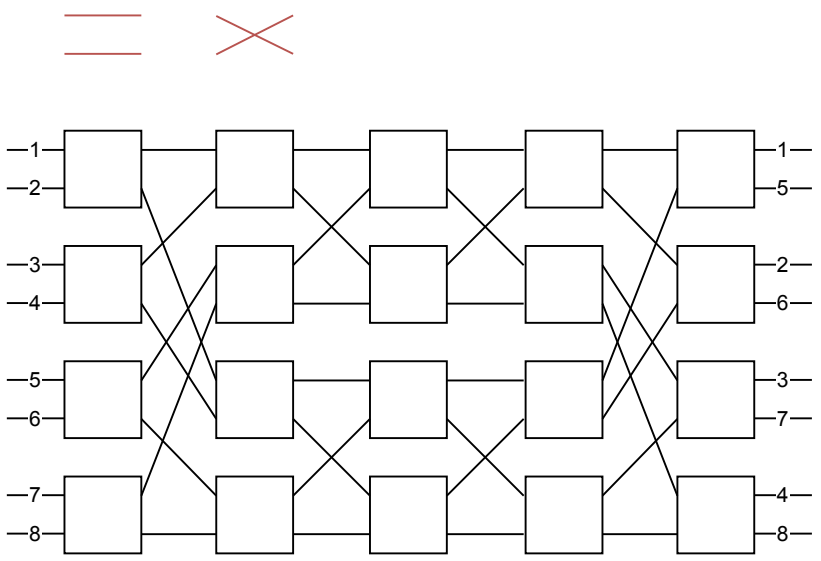
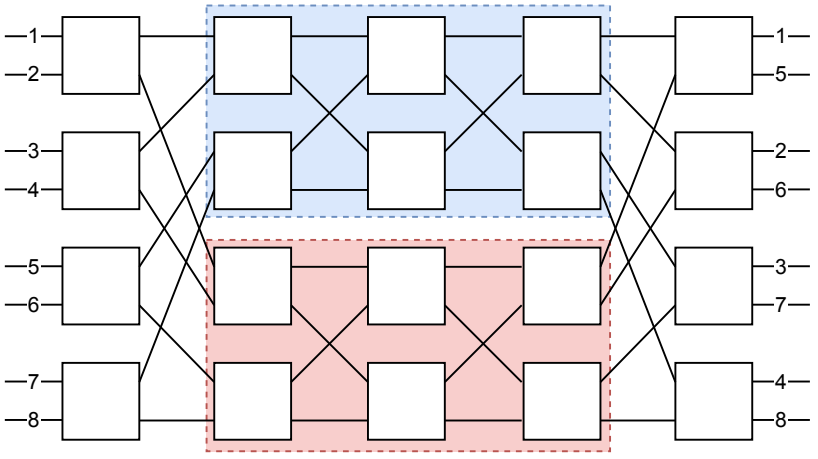
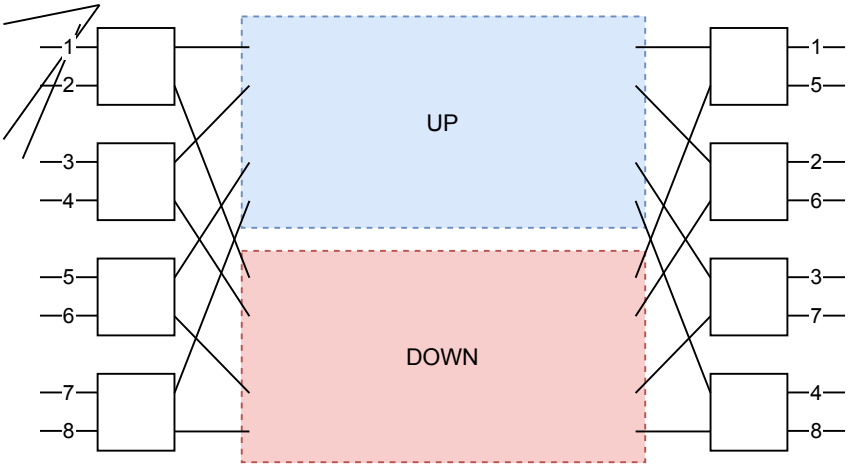
Given Input and Output Sequence



No data exchange between blue and red part in the inner stage -> if 1 in input side goes blue part, then 1 in the output side must also choose to go blue

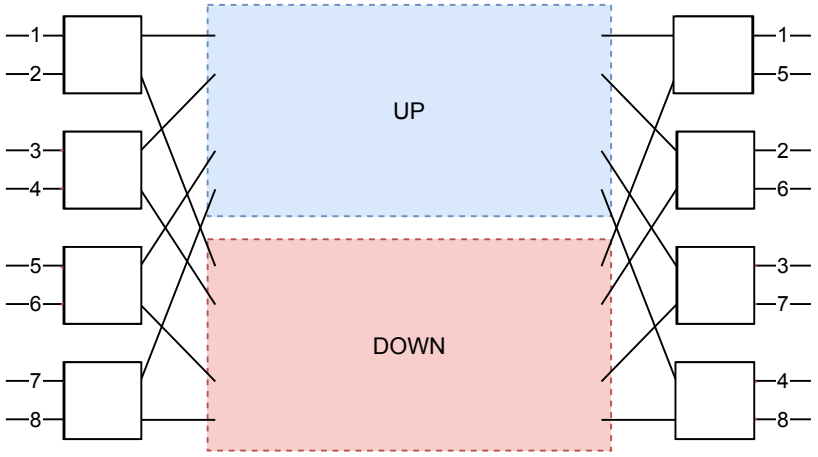


same data choose to go to the same part either UP or DOWN.
Control Words are generated from outside to inside



Step 1: Random Pick one source "A" and choose to go up or down randomly
Step 2: Then go to the source "A" in the output side, which must also go the same part as STEP1

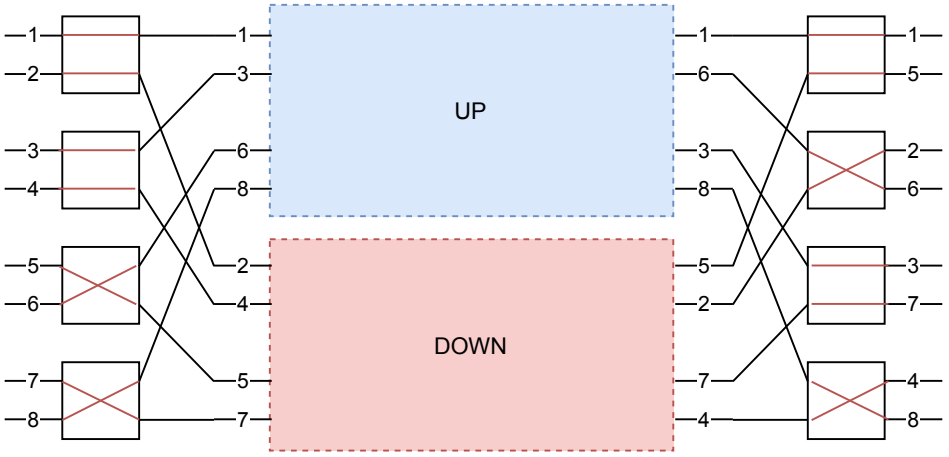
Step 3: Then the data "B" sharing the same switch with "A" must go another part, becuase 1 data of 2 input could go UP/DOWN part.
Step 4: Then go the "B" in the input side, make "B" goes the same part as chosen in STEP3
Step 5: Similar to Step 3, the data "C" sharing the same switch with "B" must go another part.
.... Until finish all data or form a loop.
If form a loop then restart at a un-touched data randomly, in other words, repeat from Step 1 until finish all data.



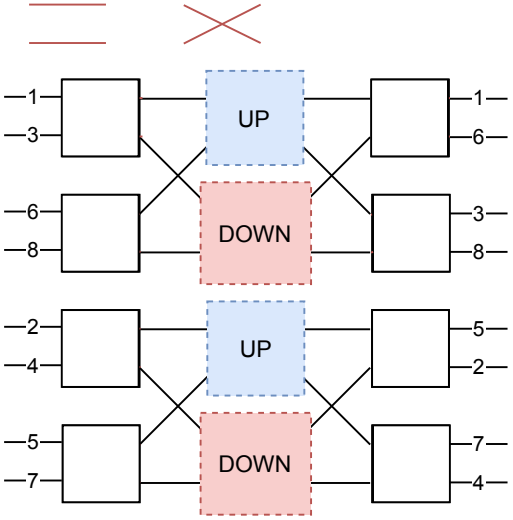
E.G. we start from "1 in input side goes blue randomly " -> "1 in the output side must also go UP accordingly" -> 5 in the output side have to go DOWN -> "5 in input side must go DOWN " -> "6 in the output side must also go blue" -> 5 in the output side must go DOWN -> ...

Random Pick one source and choose to go up or down randomly

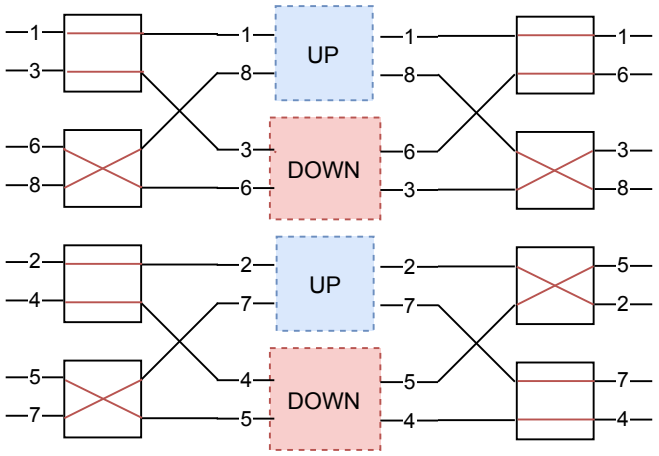
If the chain forms a loop. just choose another one as source



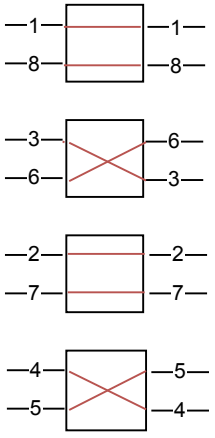
Choose the inside control words using the same way.



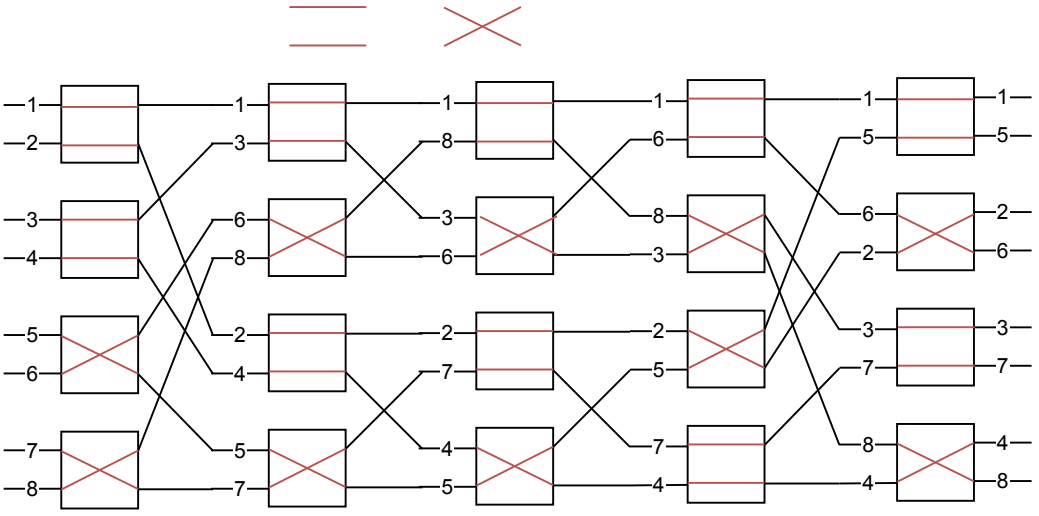
For example, we choose as the following way , starts at "1 goes UP"

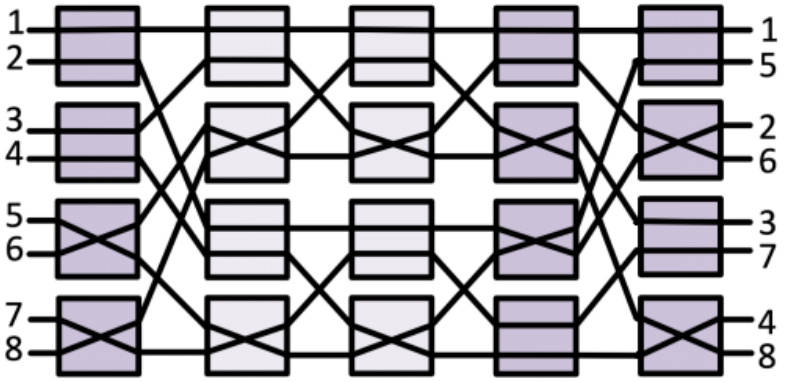


When coming into the last stage, just connect to make data pass



The control words generated as following;
NOTE: There are also other control words to achieve the same result




1
2
3
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1
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2
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8