COS 10004 Computer Systems – Lab 01

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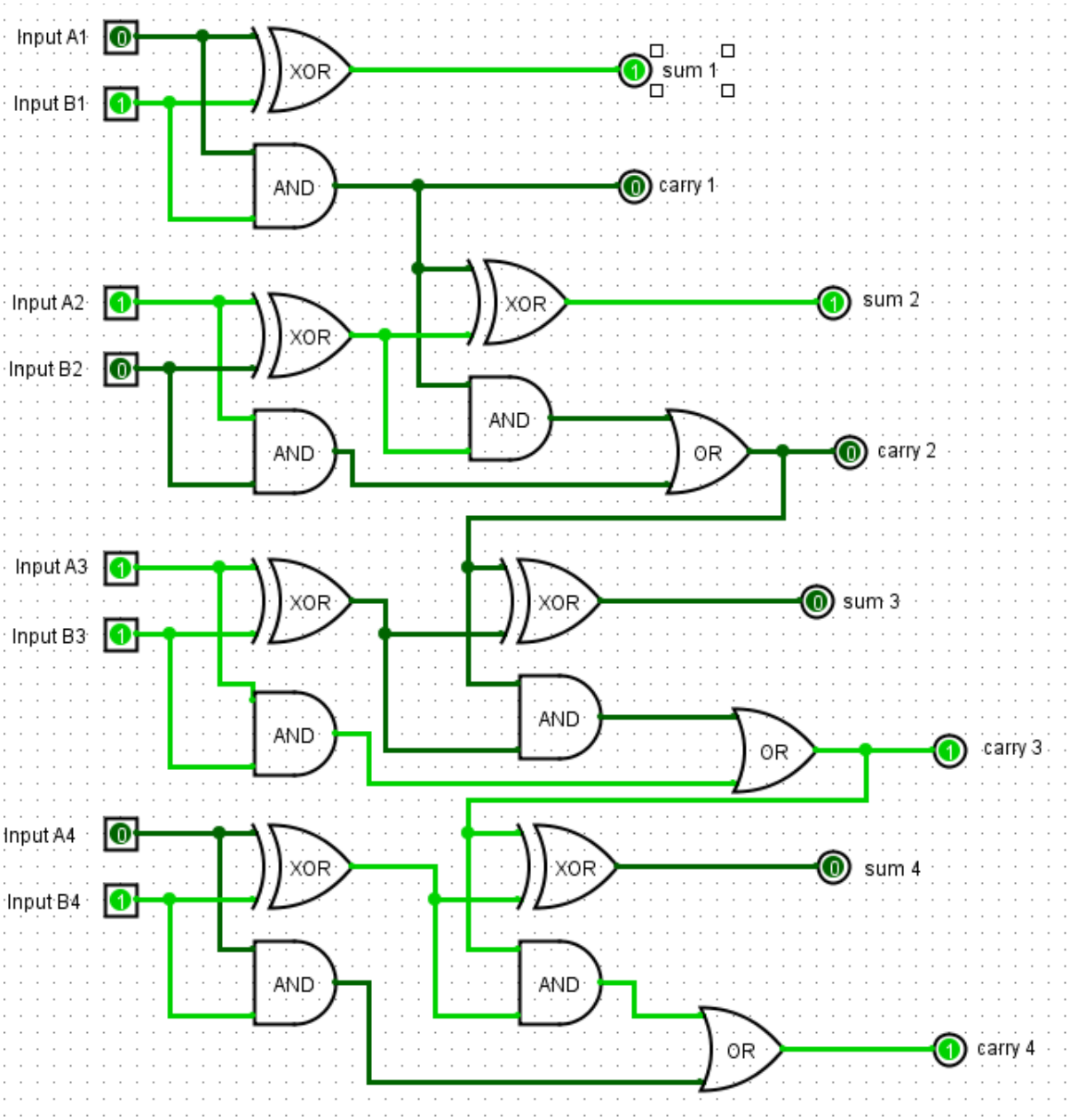
4 bit Adder

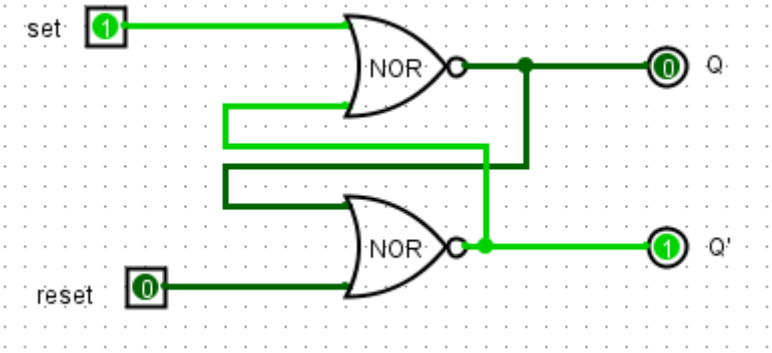


Input A	Input B	Output
0101	0000	0101
0101	0001	0110
0101	0010	0111

0101	0011	1000
0101	0100	1001
0101	0101	1010
0101	0110	1011
0101	0111	1100
0101	1000	1101
0101	1001	1110
0101	1010	1111
0101	1011	0000
0101	1100	0001
0101	1101	0010
0101	1110	0011
0101	1111	0100

Part 2: Storing bits with Flip Flops

R-S Flip Flop



Set	Reset	Q	Q’
1	0	0	1
1	1	0	0
0	1	1	0
1	1	0	0

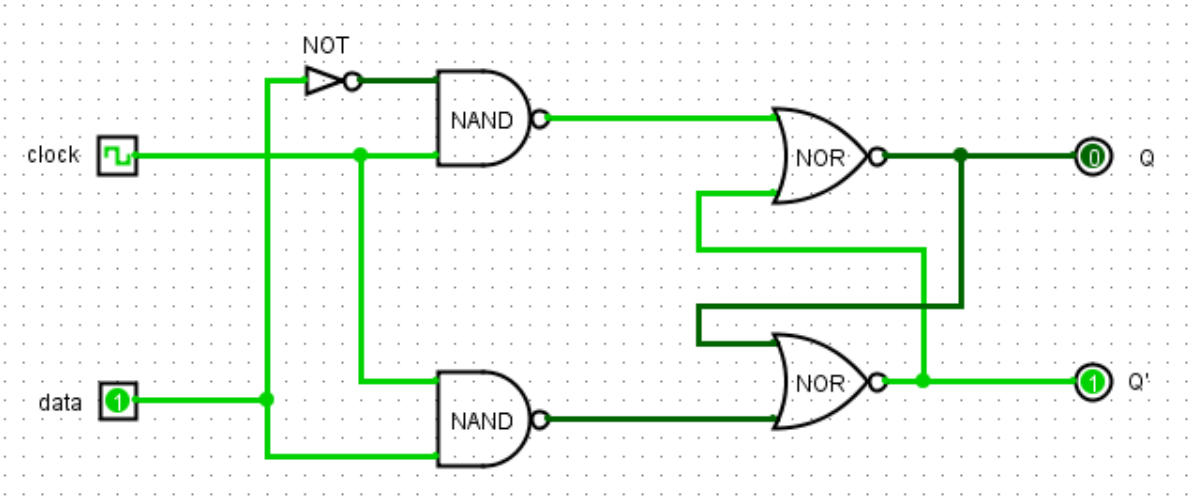
Describe in a sentence, the behaviour of the circuit when one of the inputs is 1 (but not both) and why this is useful for digital circuit design.

- **The R-S Flip Flop is composed of coupled NOR gates which have been crossed in the diagram. It provides a simple switching function whereby a pulse on one input line of the flip flop sets the circuit in one state.**

What do you notice about the two times you set both inputs to 1. Briefly explain what is happening here and why this is an issue for digital circuit design ?

- **If we set both the set and reset to 1 it will enter an illegal state. This creates an issue for the circuit design as the flip flop output should support and supplement each other.**

D Flip Flops



Clock	Data	Q	Q’
0	0	0	0
0	1	0	0
1	1	0	1
1	0	1	0

Briefly explain the behaviour of a D Flip Flop and how it is useful for digital circuit design.

- **The D flip flop only has 1 data input and the clock is used to control the signal. Q is set to be reversed as D and Q’ is the same as D when the clock is on.**

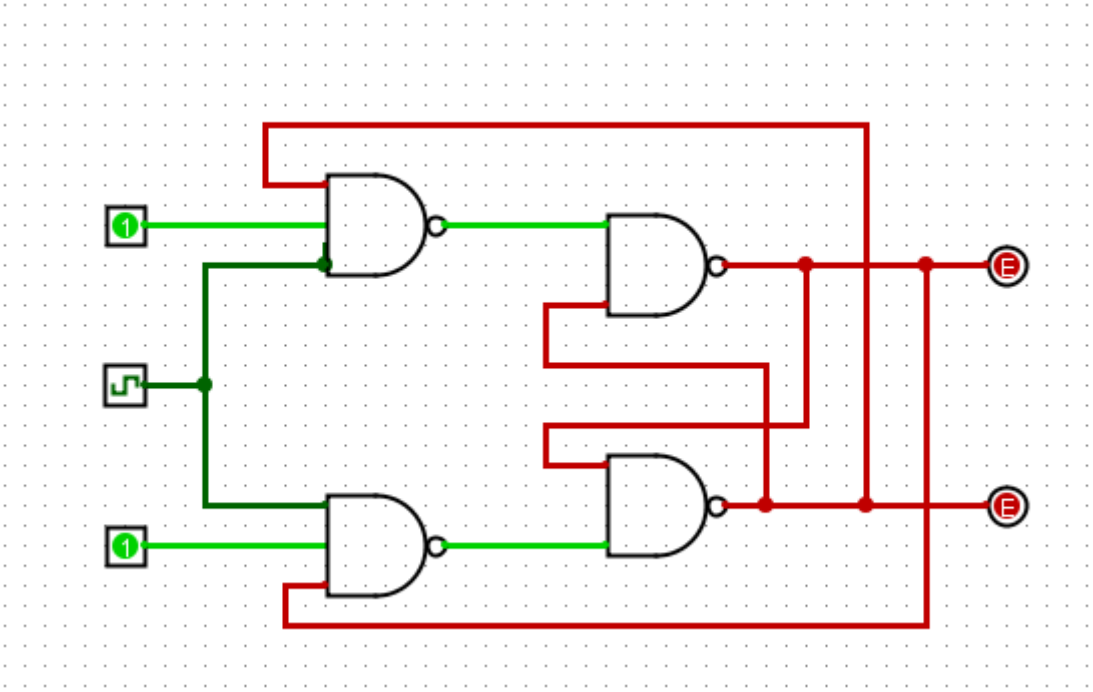
What is the role of the clock ? How does it impact the changing of state of Q and Q’?

- **The clock is used to control the signal**

Why is it generally preferred over the R-S Flip Flop ?

- **It prevents the circuit from entering an illegal state and the clock can be used to synchronise data.**

J-K Flip Flop



How can a J-K Flip Flop be made to behave like a D Flip Flop?

The J-K Flop Flop can behave like a D Flip Flop as it adds one more input which connects with the NAND gate and removes the NOT gate.

How can a J-K Flip Flop be made to behave like a toggle (T Flip Flop)?

If the two inputs are on, the J-K Flip Flop behaves like a toggle.