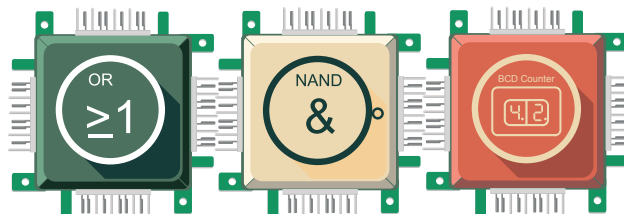


Name: .....

Class: .....

Date: .....

## Exercise booklet - Logic



**Worksheet with excercises and repetitive tasks  
for students and learners**

**1** Find the seven logic gates in the puzzle. The words can be hidden horizontally from left to right or vertically from top to bottom. We already highlighted the first word for you.

L	Q	B	W	P	F	F	C	G	L
K	N	M	B	P	A	F	X	O	R
O	O	R	W	P	N	Z	C	N	Y
Y	A	C	H	B	D	X	H	V	L
U	R	O	L	A	C	J	G	O	N
P	N	I	R	N	A	N	D	C	C
S	D	Z	O	I	W	F	H	R	L
T	F	N	L	X	N	O	R	T	N
F	J	O	T	T	D	F	R	Z	O
P	Y	R	A	P	J	N	C	A	T

**2** Complete the truth tables.

OR

X1	X2	y
0	0	
0	1	1
1	0	
1	1	

NAND

X1	X2	y
0	0	
0	1	
1	0	1
1	1	

**3** Which logic gates are described by the following truth tables?

.....

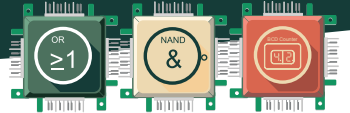
X1	X2	y
0	0	0
0	1	0
1	0	0
1	1	1

.....

X1	X2	y
0	0	1
0	1	0
1	0	0
1	1	1

**4** Convert the following figures from the decimal to binary or from the binary to decimal number system.

Decimal number	Binary number
2	
	0101
7	
	1000
12	
	1110
15	



**5**

Complete the gaps:

**Positive logic**

When using positive logic, the logic ....complies with the low level and the logic...complies with the high level.

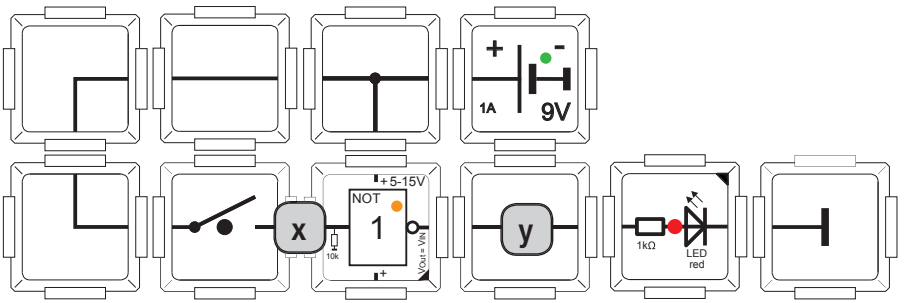
**Negative logic**

When using negative logic, the logic 0 complies with the.....and the logic 1 complies with the..... .

**6**

What happens in the following NOT circuit when pushing the button?

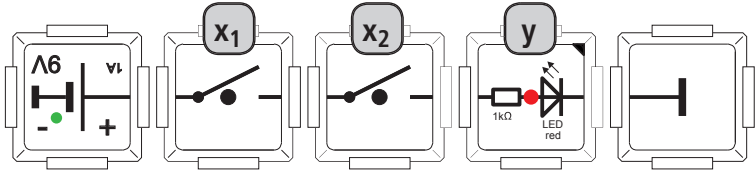
- The LED lightens up
- The LED does not lighten up



**7**

Mark the correct button(s) that you need to push in the following circuits to make the LED lighten up.

- Button  $x_1$
- Button  $x_2$



**8**

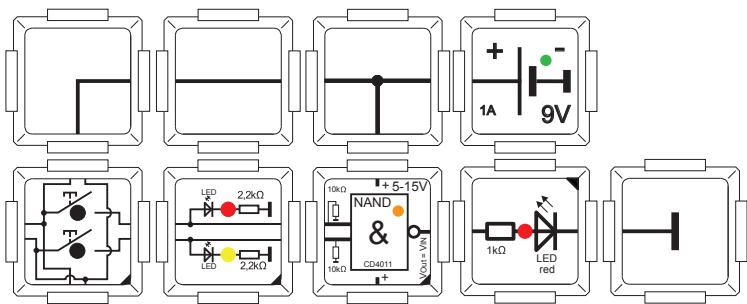
Complete the gaps in the following text about the OR gate.

The OR gate realises a logic....link between two or more inputs. In contrast to the ....gate, the output is not inverted.

**9**

Define the LEDs condition (red, on the right) when no button is pushed.

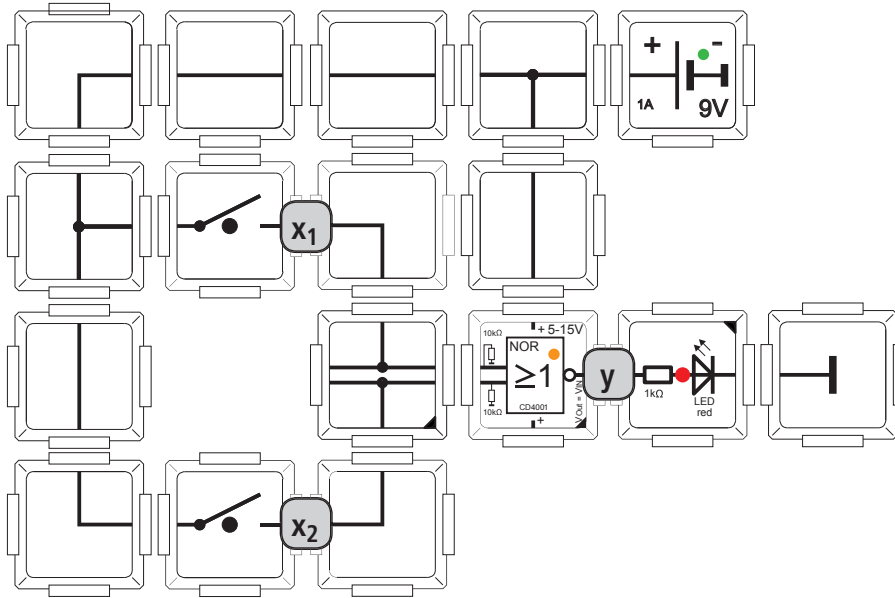
- The LED lightens up
- The LED does not lighten up





**10** Mark the correct answer(s) for the following NOR circuit.

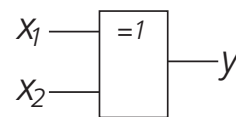
- When both buttons are pushed, the LED does not lighten up.
- Only as long as both buttons are being pushed, the LED does not lighten up.
- When one or both buttons are pushed, the LED lightens up.
- Only if no button is pushed, the LED lightens up.



**11** The following equation and the circuit symbol belong to which logic gate?

.....  

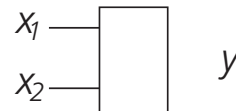
$$y = (\overline{x_1} \wedge x_2) \vee (x_1 \wedge \overline{x_2})$$



**12** Complete the equation and the circuit symbol for the XNOR gate.

.....  

$$y = (x_1 \quad x_2) \quad (x_1 \quad x_2)$$

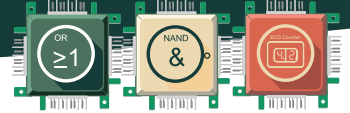


**13** What is the reason for glitches occurring in digital circuits that present a momentary false statement and a temporary falsification?

.....  
 .....

**14** Name the difference between a Programmable Array Logic (PAL) element and a Generic Array Logic (GAL) element.

.....  
 .....

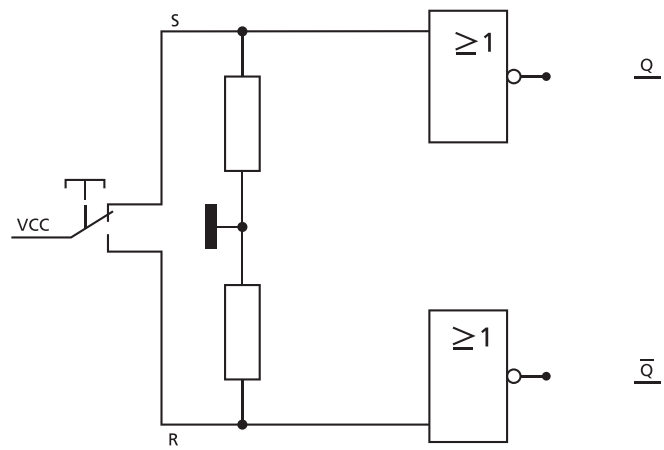


**15** What is the reason for so called "bouncing", a disruptive effect in digital technology?

.....

.....

**16** Complete the following drawing of a debouncing circuit consisting of NOR gates.



**17** Complete the following text.

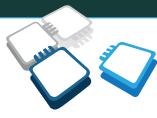
The...is the easiest calculation circuit and can add two single-digit binary digits.

**18** Complete the following truth table of the 1bit full adder.

Transmission input	Addend A	Addend B	Sum S	Transmission output
0	0	0	0	0
0	1	0		
0	0	1	1	
0	1	1		0
1	0	0		
1	1	0		
1	0	1	0	
1	1	1		1

**19** Calculate the following digits.

$2^0 =$      
  $2^1 =$      
  $2^2 =$      
  $2^3 =$



20

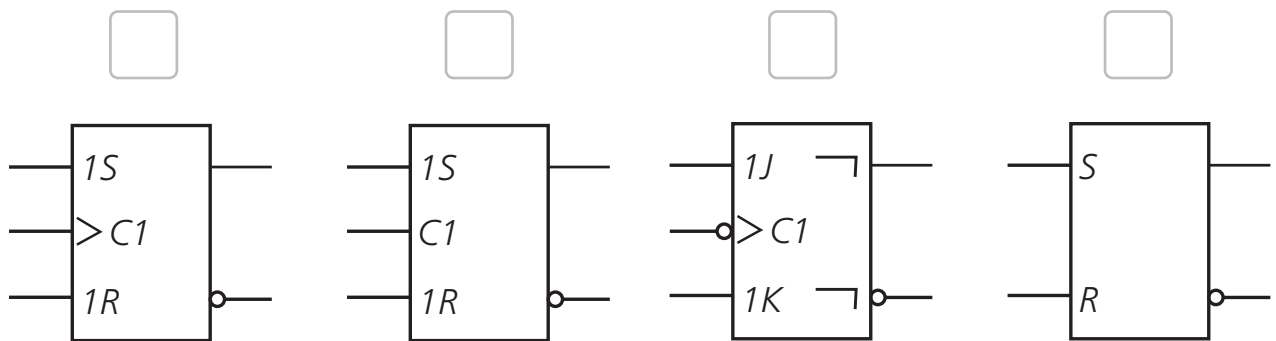
Fill in the names of the described types of flip-flops and assign the correct circuit symbol to them by entering the correct letter.

a) .....  
Flip-flops without clock input are fully independent of a clock. Their set inputs and reset inputs can be addressed at any time.

b) .....  
The set inputs and reset inputs (1S and 1R) of this flip-flop are only active as long as there is a signal level at the clock input (C1).

c) .....  
The set and reset input (1S and 1R) of this type of flip-flop is only active when changing the edge at the clock input C1. The susceptibility is reduced. The clock edge triggering is indicated by the triangle as circuit symbol.

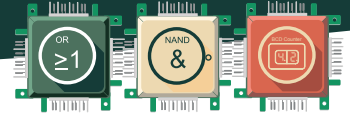
d) .....  
During the first clock edge, this type of flip-flop receives the input status and dispenses it again with the following clock edge. The susceptibility is minimized. The clock edge triggering is indicated by the triangle as circuit symbol.



21

Complete the following table of a non-clock-controlled RS flip-flop.

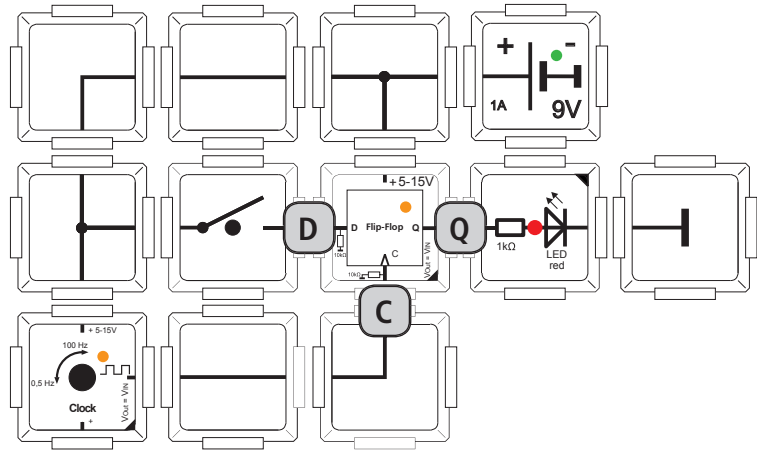
Set input S	Reset input R	Output Q	Output $\bar{Q}$	Explanation
1	0			Set
	0	Q		
0	1		1	
		0	0	Prohibited condition



22

Describe what happens in the following circuit when we keep pushing the button and the clock generator changes from 0 to 1.

.....  
 .....



23

According to the truth table, explain which changes of the inputs (J, K and C) on the JK flip-flop are responsible for the following conditions.

No change: .....

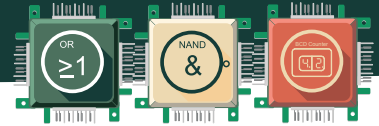
.....  
 .....

Set: .....

Reset: .....

Toggle outputs: .....

Input J	Input K	Clock input C	Output Q	Output $\bar{Q}$	Explanation
0	0	0 → 1	Q	$\bar{Q}$	No change
1	0	0 → 1	1	0	Set
0	1	0 → 1	0	1	Reset
1	1	0 → 1	$\bar{Q}$	Q	Toggle outputs



**24** In the following text, fill in the gaps regarding the topic of shift registers.

Shift registers consist of.....toggled flip-flops that are clocked synchronously. Next to addition, the bit by bit shifting is one of the fundamental operations of a .....computing unit.

For example, when the swiped binary number is moved one position to the right, the decimal outcome of a ..... complies with 2.

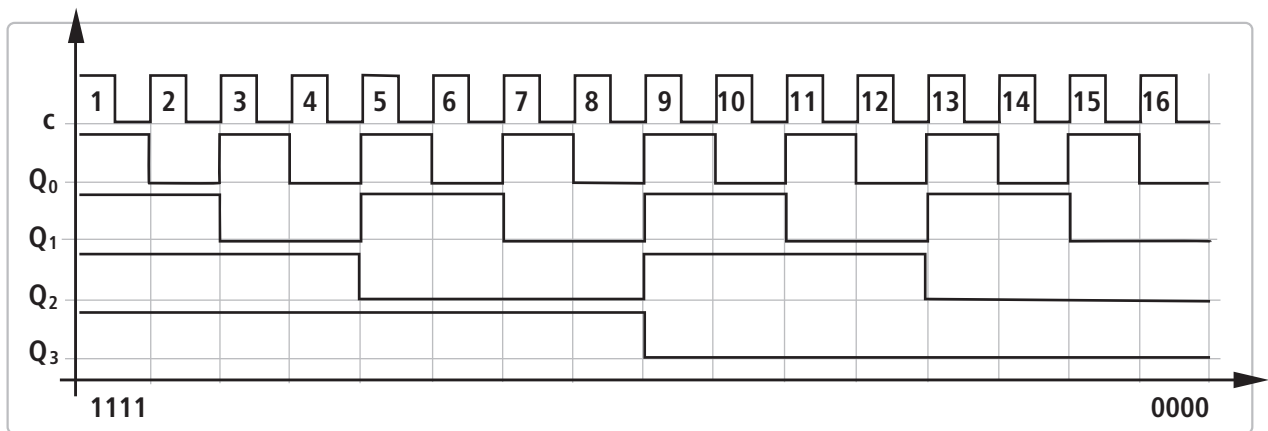
For....., the respective binary number needs to be moved one position to the left.

Depending on the specific application, shift registers have a different bit width, shift to the right or to the left and can be loaded serially or..... For many tasks, shift registers are suitable as.....that already include all standard functionalities.

**25** In the following drawing, decide whether this is a timing diagram of a 4 bit binary upwards counter or of a 4 bit binary downwards counter.

4 bit binary upwards counter

4 bit binary downwards counter



**26** What's the task of a BCD counter?

.....

.....

Points: ..... /26