Worksheet 19.1: for testing basic understanding

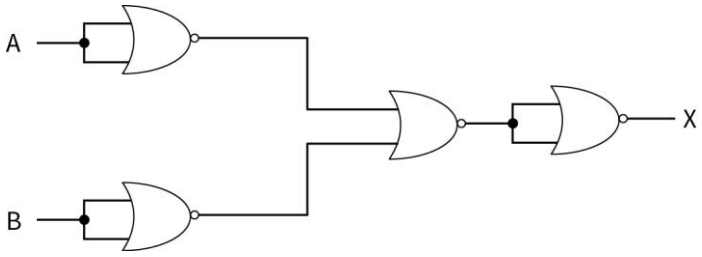
1 A logic circuit can be described as combinational or sequential.

a Explain the difference between the two types of circuit.

b Are there any differences in the components used for the two types?

c Give an example for each type.

2 **a** Create a truth table for the following circuit:



b What is the overall logic equivalent to?

c Why are circuits often constructed from NOR gates?

d Why would this logic be created using NOR gates?

3 Choose whether each statement is true or false:

A A half adder circuit has two inputs and two outputs.

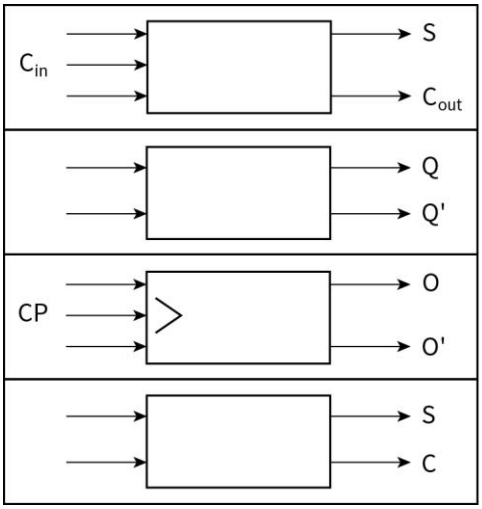
B A full adder circuit has three inputs and three outputs.

C A full adder is an example of a sequential circuit.

D A clocked circuit has an extra input.

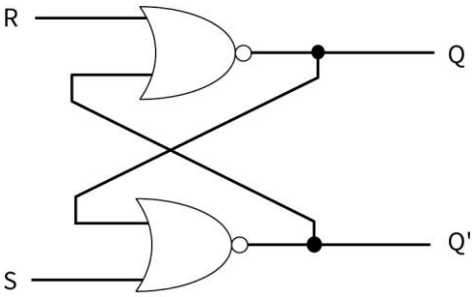
E A half adder circuit can be constructed from only NAND gates and a full adder circuit can be constructed from only NOR gates.

4 Match each symbol (only partially labelled) with the correct identification.



Half adder
Full adder
SR flip-flop
JK flip-flop

5



The above diagram shows a logic circuit for an RS flip-flop. The table below shows some relevant rows of the corresponding truth table. Each row of the table is labelled A–H.

	Input signals		Initial state		Final state	
	S	**R**	**Q**	**Q'**	**Q**	**Q'**
A	1	0	0	0	1	0
B	0	1	0	0	0	1
C	0	0	1	0	1	0
D	0	0	0	1	0	1
E	1	0	0	1	1	0
F	1	0	1	0	1	0
G	0	1	0	1	0	1
H	0	1	1	0	0	1

Identify a row that shows:

a that the flip-flop retains the value stored if no input signal is received

b how an undefined state can be set to a state in which a value is stored

c no change even though a signal is input

d a value being changed but where there must have been an intermediate state (as demonstrated by examination of the circuit diagram).

6 Starting with the expression $\overline{A}.B + A.\overline{B} + A.B$, show the sequence of steps from the following list that can be used to convert this to the simplest possible form:

- $\overline{A}.B + A.\overline{B} + A.B$
- $A + B$
- $\overline{A}.B + A.\overline{B} + A.B + A.B$
- $A.1 + 1.B$
- $A.(B + \overline{B}) + (A + \overline{A}).B$

7 Consider the following truth table:

A	B	C	X
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

a Create the corresponding Karnaugh map.

b Create the Boolean algebra expression corresponding to this Karnaugh map.

8 Match each Karnaugh map with the corresponding Boolean algebra expression.

A \ BC	00	01	11	10
0	1	1	1	1
1	0	0	0	0

A \ BC	00	01	11	10
0	0	1	1	1
1	0	1	1	1

A \ BC	00	01	11	10
0	1	1	1	0
1	0	1	1	1

A \ BC	00	01	11	10
0	1	0	1	1
1	1	0	1	1

$B + \overline{C}$
$\overline{A}.\overline{B} + C + A.B$
$\overline{A}$
$B + C$