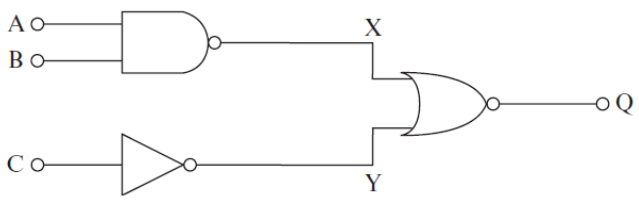
Logic Circuits – Build these in the [Falstad Simulator](http://www.falstad.com/circuit/index.html)

http://www.falstad.com/circuit/index.html

1



Complete the truth table.

A	B	C	X	Y	Q
0	0	0			
0	0	1			
0	1	0			
0	1	1			
1	0	0			
1	0	1			
1	1	0			
1	1	1			

2

Build the circuit that matches this logic expression.

$$Q = A.B + \overline{A + B}$$

Create a truth table similar to the one above.

3

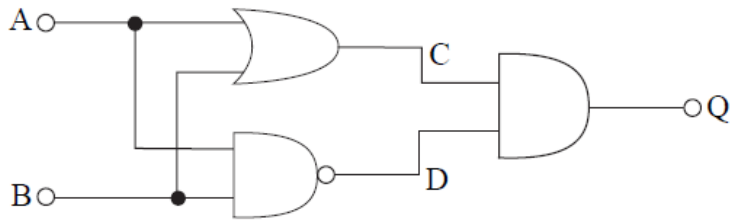
Build the circuit that matches this logic expression.

$$Q = (A + B) \ . \ (\overline{A \ . \ B})$$

Create a truth table similar to the one above.

4

Build this in the simulator and complete the truth table.



Complete the truth table below to show the operation of this logic circuit.

A	B	C	D	Q
0	0			
0	1			
1	0			
1	1			

5

Use the simulator to build a circuit to solve this truth table.
Copy the circuit into the space below.

The truth table for a logic circuit is shown below.

A	B	C	D	Q
0	0	1	0	0
0	1	1	1	1
1	0	1	1	1
1	1	0	1	0

(a) Inputs A and B are both connected to two gates, having outputs C and D.
C and D then form the inputs to a third gate providing the output Q.
In the space below draw the logic circuit that would give these outputs.

A ○—— C

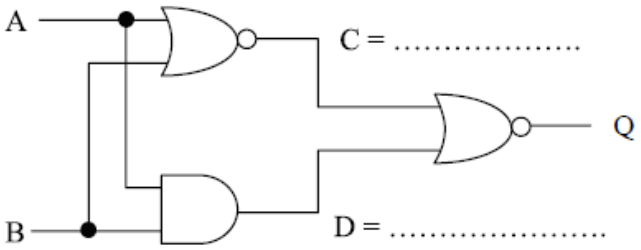
——○ Q

D

B ○——

6

Build this in the simulator



Complete the truth table to show the logic values of C, D and Q for all the combinations of variables A and B.

A	B	C	D	Q
0	0			
0	1			
1	0			
1	1			

7

Use the simulator to build a circuit to solve this truth table.
Copy the circuit into the space below.

The Boolean equation for a logic circuit with inputs A and B and output Q is

$$Q = (\overline{A} + \overline{B}) \cdot (A + B)$$

(a) Complete the truth table to show the logic values of the terms below for all the combinations of variables A and B.

A	B	$\overline{A}$	$\overline{B}$	$\overline{A} + \overline{B}$	A + B	Q
0	0					
0	1					
1	0					
1	1					

(5 marks)

(b) Complete the diagram below to show how a logic circuit can be constructed from **two** NOT gates, **two** OR gates and **one** AND gate to represent the Boolean equation above.

(5 marks)

(c) State which single logic gate has the same function as the complete circuit above.