



1.4.3 Circuits

Q1

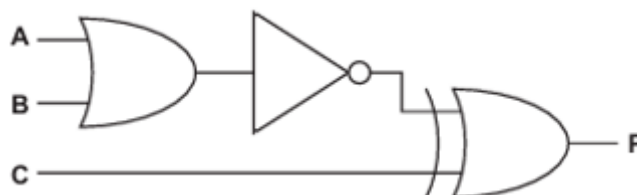
Draw a logic gate diagram to represent the Boolean expression.

$$Q \equiv \neg A \vee B$$

[2 marks]

Q2

An engineer has created the following logic circuit.



- a) Give the Boolean expression that represents the logic circuit. Do not attempt to simplify the expression.

[2 marks]

- b) Complete the truth table for the logic circuit.

A	B	S	P
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

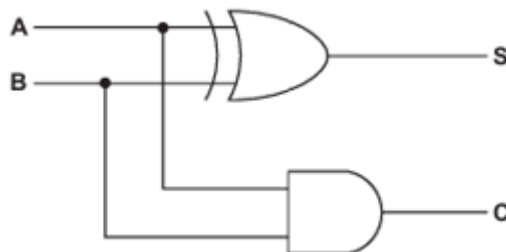
[2 marks]





Q3

The logic circuit below has two inputs (**A**, **B**) and two outputs (**S**, **C**).



a) Give the Boolean expressions for the outputs **S** and **C**.

[2 marks]

b) Complete the truth table for the logic circuit.

A	B	S	C
0	0		
0	1		
1	0		
1	1		

[2 marks]

c) State the name of this circuit.

[1 mark]

d) Describe how this logic circuit can be adapted to add together two 4-bit binary numbers.

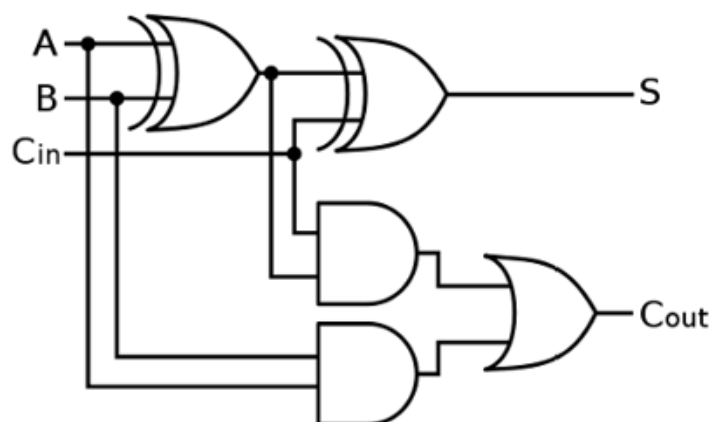
[4 marks]





Q4

A diagram showing a full adder circuit is shown below.



a) Explain what the circuit does. You should refer to A, B, C_{in} , S and C_{out} in your answer.

[4 marks]

b) Complete the truth table below:

[4 marks]

A	B	C_{in}	S	C_{out}
1	1	1		
1	1	0		
1	0	1		
1	0	0		
0	1	1		
0	1	0		
0	0	1		
0	0	0		

c) Write a Boolean expression equivalent to S.

[1 mark]

d) Write a Boolean expression equivalent to C_{out} .

[2 marks]

e) Describe the difference between a half adder circuit and a full adder circuit.

[2 marks]





Q5

A NAND gate and its truth table are shown below.



A	B	Q
0	0	1
0	1	1
1	0	1
1	1	0

a) Draw a set of gates equivalent to a NAND gate, but built only of AND, OR and NOT gates.

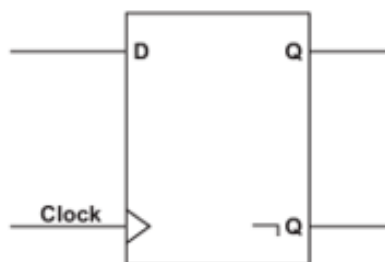
[2 marks]





Q6

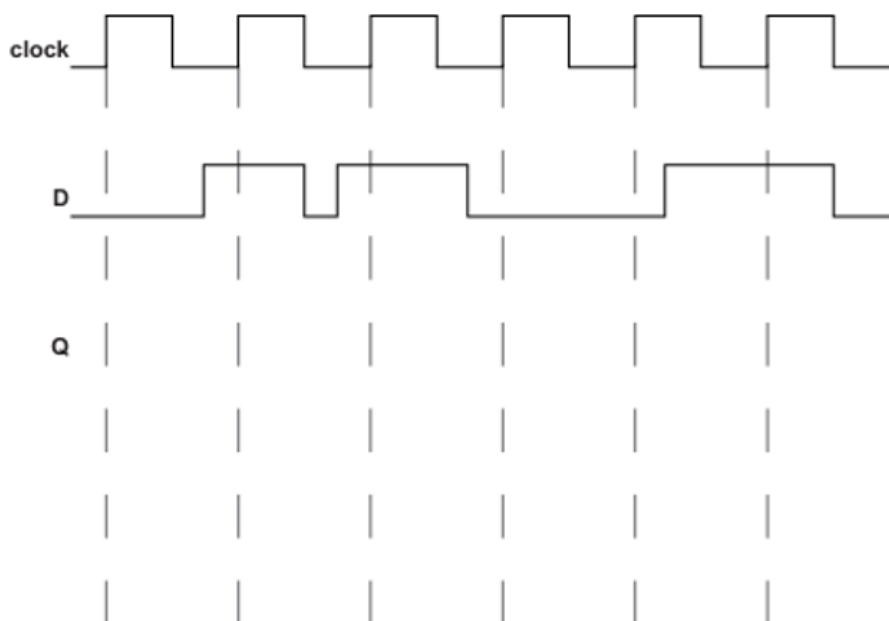
The component below is a D-Type flip flop.



a) State the purpose of a flip-flop.

[1 mark]

b) Draw the output of the flip-flop below.



[3 marks]

