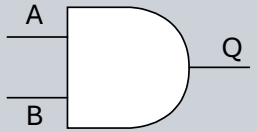
GCSE Computer Science Knowledge Organiser
SLR 2.4 Boolean Logic:
Logic Gates, Logic Diagrams and Truth Tables

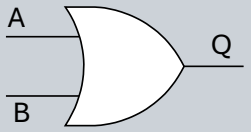
Key Terminology	BCS Definition
Logic diagram	"A method of expression Boolean logic in a diagram using a set of standard symbols that represent the various logic gates – AND, NOT, OR, NAND, etc."
Logic gate	"A symbol in a logic diagram that represents a single gate – e.g., AND, OR, NOT."
Logic gate: AND	"Techniques and methods that make code easier to debug, update and maintain."
Logic gate: OR	"Accepts two inputs and produces one output. At least one input must be TRUE (1) for the output to be TRUE (1) – otherwise, the output will be FALSE (0)."
Logic gate: NOT	"Accepts one input and produces one output. If the input is TRUE (1), the output will be FALSE (0). If the input is FALSE (0), the output will be TRUE (1)."
Truth table	"A notation used in Boolean algebra to define the output of a logic gate or logic circuit for all possible combinations of inputs."

AND (^)



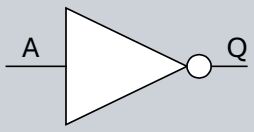
Input (A)	Input (B)	Output (Q)
0	0	0
1	0	0
0	1	0
1	1	1

OR (V)



Input (A)	Input (B)	Output (Q)
0	0	0
1	0	1
0	1	1
1	1	1

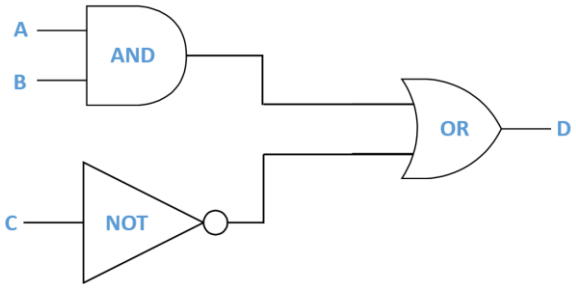
NOT (¬)



Input (A)	Output (Q)
0	1
1	0

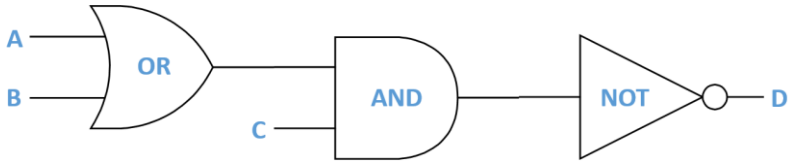
Combining Boolean operators

Boolean operators can be combined to create more complex circuits and tackle various problems. These combined operators can then be represented using Boolean expressions.



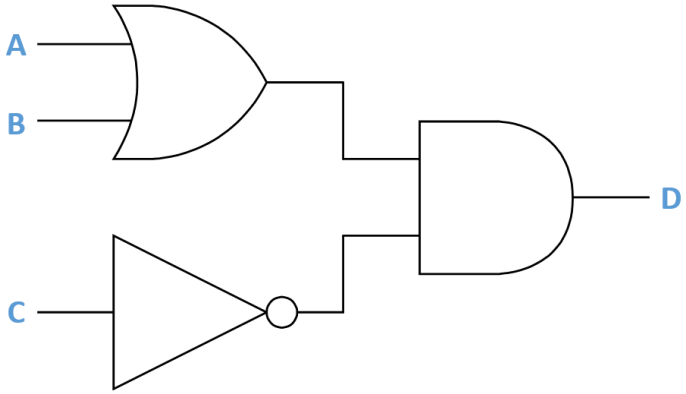
Boolean expression:

D = (A AND B) OR NOT C



Boolean expression:

D = NOT (C AND (A OR B))
D = NOT ((A OR B) AND C)



Boolean expression:

D = (A OR B) AND NOT C
D = NOT C AND (A OR B)

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SLR 2.4 Boolean Logic:
Applying Logical Operators in truth tables to solve problems

Key Terminology	BCS Definition
Logic diagram	"A method of expression Boolean logic in a diagram using a set of standard symbols that represent the various logic gates – AND, NOT, OR, NAND, etc."
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Logic gate: AND	"Techniques and methods that make code easier to debug, update and maintain."
Logic gate: OR	"Accepts two inputs and produces one output. At least one input must be TRUE (1) for the output to be TRUE (1) – otherwise, the output will be FALSE (0)."
Logic gate: NOT	"Accepts one input and produces one output. If the input is TRUE (1), the output will be FALSE (0). If the input is FALSE (0), the output will be TRUE (1)."
Truth table	"A notation used in Boolean algebra to define the output of a logic gate or logic circuit for all possible combinations of inputs."

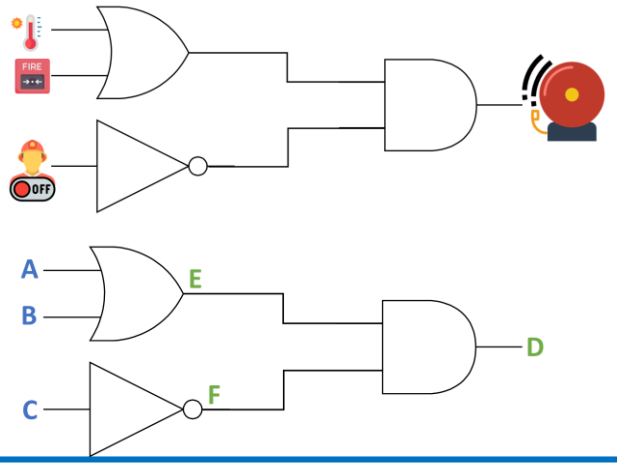
Combining Logic Operators

Logic gates can be combined to help find the solution to real world problems. Using a Truth table can help find when an output will occur.

The Problem:

A fire alarm goes off if either:

- the temperature inside the building rises above 60o Celsius; or
- someone smashes the glass panel on the alarm.
- A fire officer should be able to manually shut off the fire alarm regardless of why it went off.



1. First list the inputs

A	B	C

2. Then add each gate and their rules

A	B	C	A OR B *E*	NOT C *F*	E AND F *D*

3. Calculate the possible outcomes for each combination of your inputs

A	B	C	A OR B *E*	NOT C *F*	E AND F *D*
0	0	0			
1	0	0			
0	1	0			
0	0	1			
0	1	1			
1	0	1			
1	1	0			
1	1	1			

4. Then calculate the results after the first set of gates

5. Finally using the answer from above calculate the result for the last gate.

A	B	C	A OR B *E*	NOT C *F*	E AND F *D*
0	0	0	0	1	0
1	0	0	1	1	1
0	1	0	1	1	1
0	0	1	0	0	0
0	1	1	1	0	0
1	0	1	1	0	0
1	1	0	1	1	1
1	1	1	1	0	0

The alarm will only ring where there is a 1 in the final column