Component 1: Logical Operations

Term	Definition
Propositional logic	• A proposition is a simply a statement. • Propositional statements when evaluated will result in either true or false. • Propositional logic considers the way statements interact with each other. • Propositional logic follows mathematical rules.

Logic statements

Most rules to simplify a logic statement are not dependent on the contents of the statement but on the structure of the statement.

Propositional logic uses symbols to represent logical links between propositions. A logic statement includes propositions linked connected by logical links.

Term	Definition	
Propositional logic symbols	Propositional logic uses symbols to represent logical links	
Symbol	Formal term	Informal term
.	Connection	AND
+	Separation	OR
$\bar{A}$	Negation	NOT
$\oplus$	Exclusive separation	XOR

Term	Definition
Truth table	A truth table is a mathematical table used to analyse a set of local statements.

Connection (AND)

"I am hungry and I have a sandwich"

For this logical statement to be true both propositions would have to be TRUE. The key word is AND.

If one proposition was false, then the whole statement would be false. Let's use A to represent "I am hungry" and B to represent "I have a sandwich".

A truth table for this can show all the possibilities using 1 for TRUE and 0 for FALSE.

A	B	A AND B
1	1	1
1	0	0
0	1	0
0	0	0

A AND B can be written using a symbol as A.B

Separation (OR)

"She has blue eyes or she has brown eyes"

Sometimes one proposition or another proposition of a logical statement is correct. The key word here is OR.

This time the logical statement will be true if at least one proposition is TRUE.

A	B	A OR B
1	1	1
1	0	1
0	1	1
0	0	0

A OR B can be written using a symbol as A + B

Negation (NOT)

"I am 16 years old"

To negate this proposition, "I am not 16 years old" we can use the negation operator. A truth table can show this:

A	$\bar{A}$
1	0
0	1

NOT A can be written using a symbol as $\bar{A}$.

Exclusive separation (XOR)

"She has blue eyes or she has brown eyes"

For exclusive separation only one proposition of a logical statement can be correct.

A truth table can show this:

A	B	A XOR B
1	1	0
1	0	1
0	1	1
0	0	0

A XOR B can be written using a symbol as $A \oplus B$

Zebras are black and white.
Pandas are black and white.
Therefore, some zebras are pandas