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|  Teaching Resources |
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| 2. 2. Logical operationsSpecification coverage 2.2.1 **Logical operators –** Use of AND, OR, NOT and XOR logical operators, combinations of these, and their application in appropriate truth tables to solve problems.2.2.2 **Boolean logic** – Simplify Boolean expressions using Boolean identities and rules. |
| Teaching Suggestion |
| 2.2.1 Logical operators1. Presentation – an image of two switches connected to a bulb with the rule ‘To turn on the bulb both switches need to be turned on’. Put 4 scenarios on the white board for the learners to decide if the bulb comes on or not. The rule can then be changed to ‘To turn on the bulb, only one of the switches needs to be turned on’. 2. Explain to the learners that the opening task has covered the two logical operators And and Or. Explain to the learners that ‘on’ can be represented by 1 and ‘off’ by 0. 3. Show the learners how to create an And truth table to show both rules when switch 1 is called A and switch 2 is called B.4. Learners to create a truth table for the Or rule.5. Show an image of one switch connected to the bulb with the rule. ‘To turn on the bulb, the switch needs to be turned off’. Put both scenarios on the white board for the learners to decide if the bulb comes on.6. Explain to the learners that this operation can be called a Not operation. 7. Show the learners how to create a Not truth table. 8. Show an image of two switches connected to a bulb with the rule. ‘To turn on the bulb, switches A and B need to be different i.e. if switch A is on and switch B is off the bulb will turn on’.9. Explain to the learners that this operation can be called an Xor operation.10. Learners to create an Xor truth table.**Extended work**Learners to create a truth table for more complicated scenarios:A and B and CA or B or C**2.2.2 Boolean logic** Simplify Boolean expressions using Boolean identities and rules.1. Learners will need to learn the notation form for Not, And, Or and Xor. It can be written as a table with an example using an Interactive Quiz for reinforcement e.g.A And B = A.BA Or B = A+BOr A = A Or B = A BC and B = C.B2. Learners will need to go through every rule for Boolean expressions and test them using a truth table. If the learners don’t know how to count in binary, doing this task first will help them e.g. for two inputs we can count like this:

|  |  |
| --- | --- |
| A | B |
| 0 | 0 |
| 0 | 1 |
| 1 | 0 |
| 1 | 1 |

For 3 inputs:

|  |  |  |
| --- | --- | --- |
| A | B | C |
| 0 | 0 | 0 |
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 0 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |
| 1 | 1 | 1 |

3. The teacher will need to go through every rule for Boolean expressions with the learners to prove that they work. 4. The work can be reinforced by using a worksheet that goes through each rule’s truth table using different letters. Doing this work using an interactive quiz would be very beneficial to the learners as they receive instant feedback e.g. Moodle, Google Forms.With distributive laws, the learners should be shown how to distribute and factorize Boolean expressions.5. The learners will need to complete a task to simplify Boolean expressions without a truth table – a ‘cheat sheet’ can be used here to show all the rules. Doing this work using an interactive quiz would be very beneficial to the learners as they receive instant feedback e.g. Moodle, Google Forms.6. The learners will need to complete a task asking them to simplify more challenging Boolean expressions i.e. where 3 rules need to be used to simplify - A.B+A.B. |
| Suggested Educational Resources |
| 2.2.1 Logical operators1. Truth table worksheet with the logical operators AND, OR, NOT and XOR.2. Interactive quiz – true or false truth table – Moodle, Kahoot etc.**2.2.2 Boolean logic – simplify Boolean expressions using Boolean identities and rules.**1. Truth table worksheet with all rules for simplifying Boolean expressions.2. Worksheet for simplifying Boolean expressions without a truth table using different letters.3. Worksheet for simplifying Boolean expressions using 3 rules. |

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