marshall cavendish education

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Cambridge IGCSE™ Computer Science Brochure

Beyond Basics, Reimagine Education

Marshall Cavendish Education Cambridge IGCSE™ Computer Science is a comprehensive two-year programme designed to support learners with their study of the Cambridge IGCSE and IGCSE (9-1) Computer Science syllabuses (0478/0984).

This IGCSE Computer Science series encapsulates the Cambridge Approach into a suite of accessible and appro achable learning materials that support blended learning.

It encourages active and inquiry-based learning which helps learners to develop 21st century skills. It is also designed to support learners for whom English is not their first language by using simple and concise language in its content.

Through the engaging chapter openers, colourful illustrations and infographics that convey bite-sized concepts, our series promotes visual learning and delivers an engaging learning experience. Overall, this series enables learners to develop necessary skills to embrace the rapidly changing technological landscape and become future problem solvers.

Why choose

MCE Cambridge **IGCSE™** Computer Science

1 **Reduce learning obstacles and achieve proficiency in concepts**

2 **Build learners' confidence by linking theory to real-life applications**

3 **Prepare learners for the future by equipping them with 21st century competencies**

4 **Enhance teaching and learning effectiveness with digital resources**

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Student's Book

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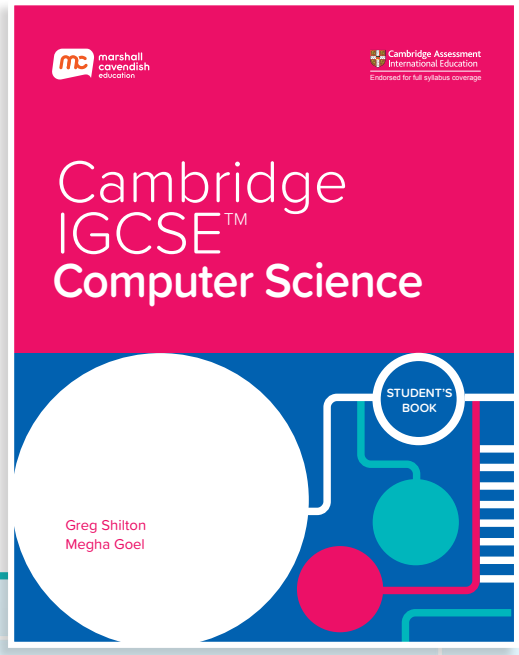

Workbook

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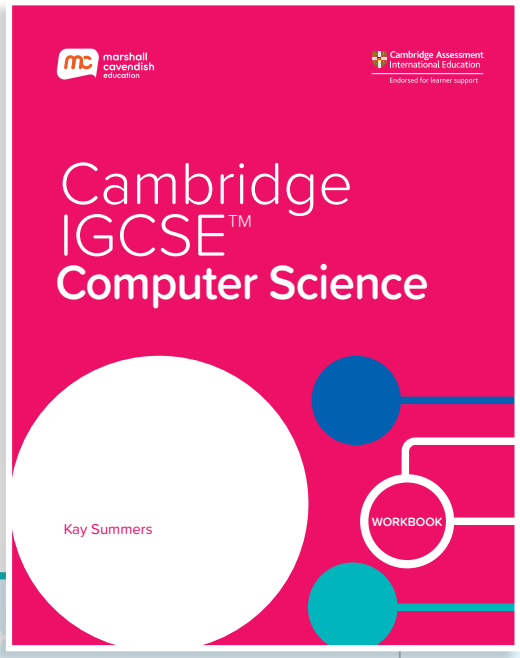

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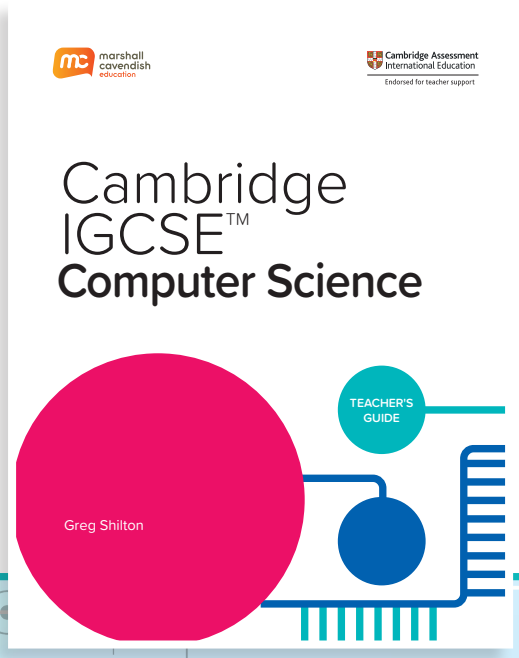
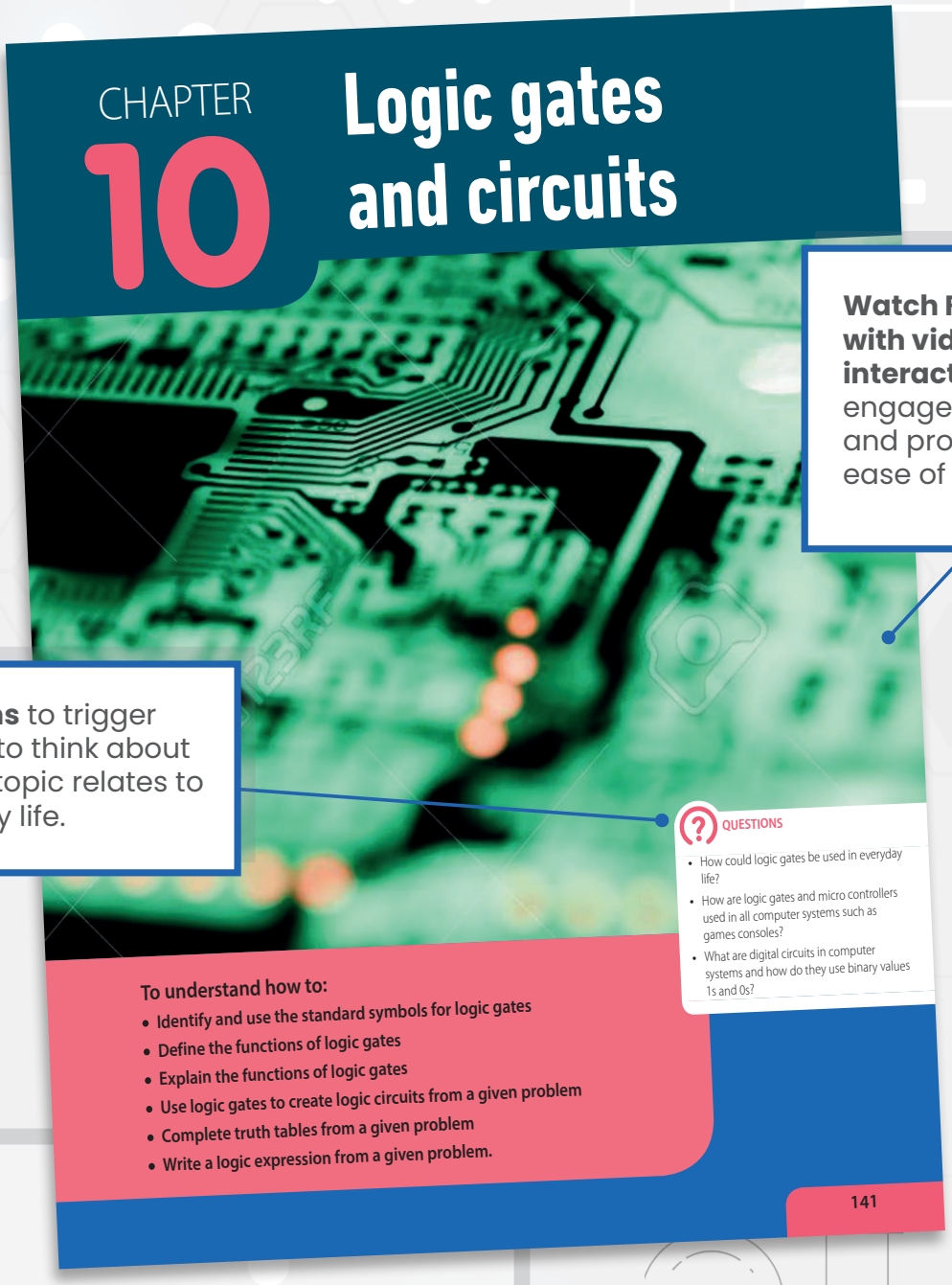


Additional Digital Resources

- Enhanced eBooks
  - Ability to annotate, save and submit work
- Digital Teacher's Guide
- Editable Resources:
  - Scheme of Work*
  - Lesson Plans
  - PowerPoint Slides*
  - Coding Instructions*

**These resources will not go through the Cambridge International endorsement process.*

With its **clear and simple language**, this series cater to learners for whom English may not be their first language. The **highly-visual** and **clearly-organised content** is also designed to guide learners of various learning readiness to master the syllabus. In addition, the use of technology helps to **enrich and enhance learning**.



Watch Feature with videos and interactives to engage learners and promote ease of learning.

Questions to trigger learners to think about how the topic relates to their daily life.

Clear learning objectives are aligned to the syllabus. Provide a clear overview of what learners have to learn.

Visuals related to real-world examples of the topic.

Definition to explain key terms in each chapter to help learners to remember better.

Word Alert provides the commonly used vocabulary in the series.

Bite-sized information to guide learners in learning concepts better.

DEFINITION

Logic gates: the basic units of a digit circuit that control the flow of electronic signals.

WORD ALERT

Combination: a joining of different parts or qualities

Arithmetic: Use of numbers to calculate an outcome

Equivalent: The same equal meaning

HELPFUL NOTES

Be careful not to confuse the Boolean operator '+' with '+', which means 'plus' in normal math.

LINK

Consolidate your understanding by completing Exercise 1 in the Workbook.

7.1 Logic gates

Logic gates are the basic building units of any digital circuit. Today, these circuits are used in almost every computer system. From elevators, to washing machines, logic gates are used all around you.

▲ Digital circuit used to open electronic door.

This chapter will explore the types and function of common logic gates.

There are a number of different types of logic gate, with different logic rules. The combination of several logic gates forms a circuit, which allows for the design and performance in modern computers. The gates receive binary data, apply a Boolean operation, and then output a binary result.

Boolean operations

The word 'Boolean' comes from Boolean algebra, which is the basis of computer arithmetic and especially logic gates. There are only two Boolean values: True and False. They have equivalents in normal language and in binary notation.

Boolean expressions can compare data of any type as long as both parts of the expression have the same data. In computer science, Boolean expressions can be used in programming and produce Boolean values when evaluated. Boolean values are either true or false:

Boolean value	Binary value	Synonyms		
True	1	On	Yes	Positive
False	0	Off	No	Negative

There are also three logical operators: NOT, AND and OR. The Boolean Operators for these are AND '·', OR '+', and NOT '¯', which is written above the letter.

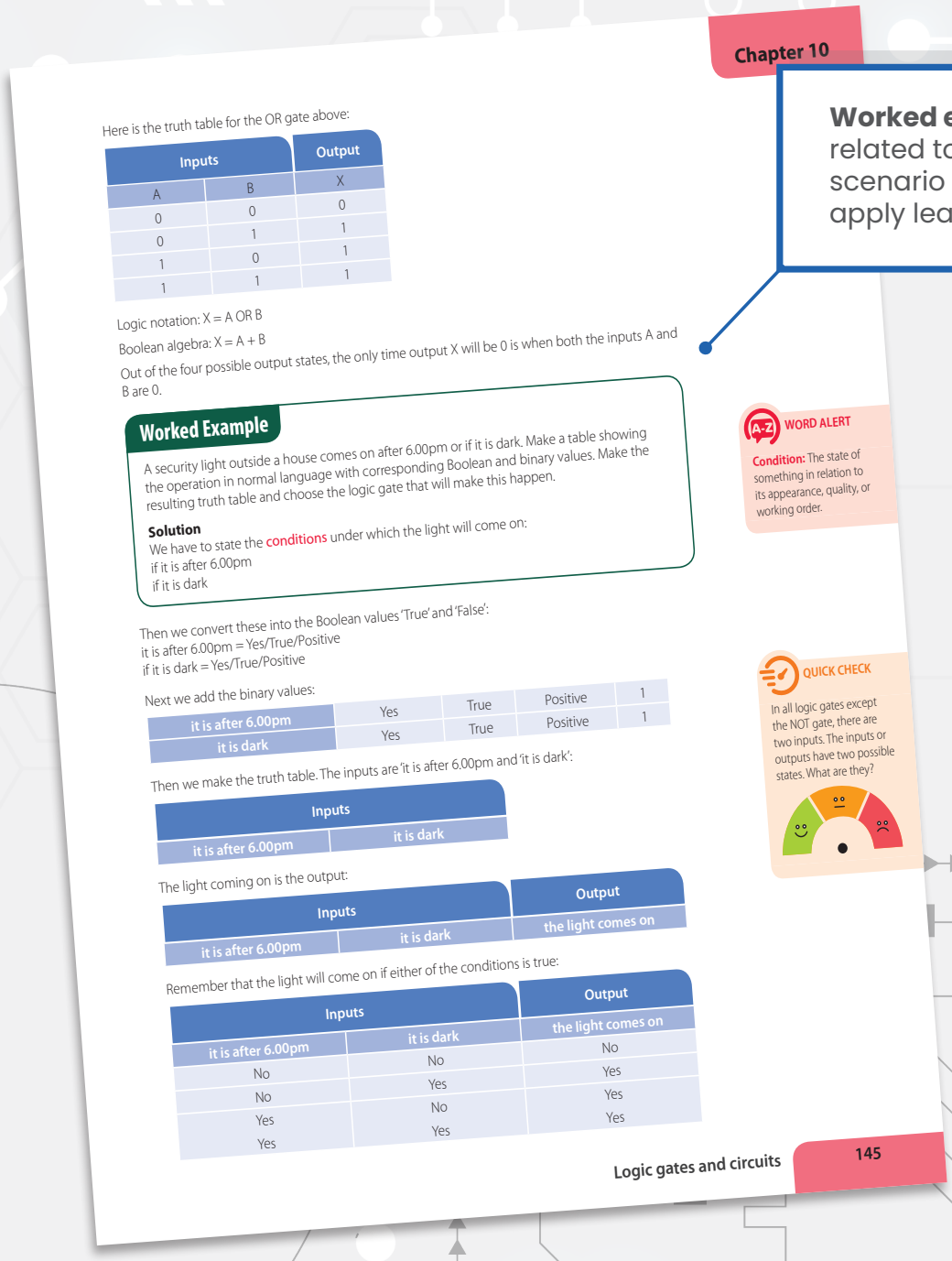
$\bar{A}$ means NOT A

A · B means A AND B

A + B means A OR B

Logic gates, use both Boolean values and operators.

This series create opportunities for learners to **engage** in their learning, as they **make the connection** between the theory they learn in the classroom to real-world scenarios through the various worked examples and activities in the book.



Chapter 10

Here is the truth table for the OR gate above:

Inputs		Output
A	B	X
0	0	0
0	1	1
1	0	1
1	1	1

Logic notation: X = A OR B

Boolean algebra: X = A + B

Out of the four possible output states, the only time output X will be 0 is when both the inputs A and B are 0.

Worked Example

A security light outside a house comes on after 6.00pm or if it is dark. Make a table showing the operation in normal language with corresponding Boolean and binary values. Make the resulting truth table and choose the logic gate that will make this happen.

Solution

We have to state the conditions under which the light will come on:
if it is after 6.00pm
if it is dark

Then we convert these into the Boolean values 'True' and 'False':
it is after 6.00pm = Yes/True/Positive
if it is dark = Yes/True/Positive

Next we add the binary values:

it is after 6.00pm	Yes	True	Positive	1
it is dark	Yes	True	Positive	1

Then we make the truth table. The inputs are 'it is after 6.00pm and 'it is dark':

Inputs	
it is after 6.00pm	it is dark

The light coming on is the output:

Inputs		Output
it is after 6.00pm	it is dark	the light comes on

Remember that the light will come on if either of the conditions is true:

Inputs		Output
it is after 6.00pm	it is dark	the light comes on
No	No	No
No	Yes	Yes
Yes	No	Yes
Yes	Yes	Yes

WORD ALERT

Condition: The state of something in relation to its appearance, quality, or working order.

QUICK CHECK

In all logic gates except the NOT gate, there are two inputs. The inputs or outputs have two possible states. What are they?

Logic gates and circuits 145

Worked example related to real-life scenario for learners to apply learnt concepts.

Worked Example

We use Boolean logic all the time. Look at this situation using Boolean operators:

You have decided that you will do extra study if you are falling behind at school. You also decide that you will do extra study even when you are not behind if your friend asks you to study together. Express this using Boolean operators.

Solution

To express this formally and logically we need two pieces of information to make our decision and another piece to represent the result of the decision. We can name our information like this:

Information needed to make decision

(behind at school) = TRUE if fall behind. If not, FALSE.

(friend asks you to study) = TRUE if friend asks you to study. If not, FALSE.

Result

(do extra study) = TRUE if we decide to do extra study. If not, FALSE.

Our logical expression is then:

(do extra study) = (behind at school) OR (NOT (behind at school)) AND (friend asks you to study)

This expression uses the three Boolean operators: NOT, AND, OR.

WORD ALERT

Formally: Officially / Explicitly

Activity

1 Write a logical expression like the example above for this given scenario.
There are two methods of getting to your part time job on time. You can get the bus but only if you wake up before 9.00am. If you wake up after this time you will need to ask your parents to take you in the car. If you wake up before 9.00am but your parents offer to take you, then you will always say yes as it is easier.

2 Draw the Boolean Algebra symbols for the following:
- **a)** A NOT B
- **b)** A AND B
- **c)** A OR B

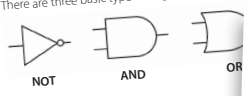
Activity with real-life scenarios for learners to apply the theory they have learnt.

HELPFUL NOTES

In all logic gates except the NOT gate, there are two inputs. The inputs or outputs have two possible states: a value of 1 or a

Types of logic gate

There are three basic types of logic gate that will be examined in this chapter: NOT, AND, and OR.



The left side of the logic gate is referred to as

We can use a truth table to show the function truth table. These truth tables display all poss

complicated variations of the circuits, or to draw all known logic gates on individual cards and create their own combined logic gates to test a friend. For example, one student may combine an AND and a NOT gate. This would then require the friend to create the truth table for all the possible combinations, including the intermediate inputs.

Activity

Support only those students that require help by explaining that the name 'NOR' tells us that this is an OR gate and a NOT gate, so the missing gate is an OR gate. The intermediate outputs at P are simply those of a normal inclusive-OR gate:

0 = neither A nor B is true

1 = A is true

1 = B is true

1 = A and B are true

The NOT gate then reverses this:

0 = neither A nor B is true but is reversed by the NOT gate so 1

1 = A is true but is reversed by the NOT gate so 0

1 = B is true but is reversed by the NOT gate so 0

1 = A and B is true but is reversed by the NOT gate so 0

Challenge more able students to express the circuit in a logic statement or Boolean algebra.

Workbook

Exercise 4 LINK PAGE 3

Ask students to complete Exercise 4 in the workbook by completing the truth tables with inputs and intermediate and final outputs.

AO1: Demonstrate knowledge and understanding of the principles and concepts of computer science

AO2: Apply knowledge and understanding of the principles and concepts of computer science to a given context

AO3: Provide solutions to problems by evaluating computer systems

Answers: All answers to questions in the Workbook are available at resource.marshallcavendish.com/teacher.

Students can check the answers to Let's Practice at resource.marshallcavendish.com/student. xxxxx xxxxxx

Logic circuits with more than two inputs

Take students step-by-step through the two parts of the circuit to obtain the intermediate outputs and then use these to calculate the inputs and output of the last gate. Encourage them to fill out a truth table for each stage as they go.

Ask students to check with their peers to verify the initial inputs, intermediate outputs and final outputs.

Worked example

Make sure the students understand the scenario and can explain it back to you before starting.

Activity

1 Ask students to follow exactly the same steps as the worked example and the presentation in their book. This problem is slightly more challenging as it is abstract – there is no real-life scenario to accompany it.

2 Writing a logic statement may seem a little daunting. Support only those students that need it by helping them to work backwards from X.

Workbook

Exercise 5 LINK PAGE 4

Ask students to complete Exercise 5 in the workbook by completing the truth tables with inputs, intermediate and final outputs.

AO1: Demonstrate knowledge and understanding of the principles and concepts of computer science

AO2: Apply knowledge, and understanding of the principles and concepts of computer science to a given context

AO3: Provide solutions to problems by evaluating computer systems

Answers LINK PAGE 000

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Writing logic circuit statements

Students have already seen logic circuit statements in the previous section, where the intermediate outputs were expressed as P = (A = 1 AND B = 0) and Q = (C = 1 AND B = 0). Revise this and go on to explain that in the previous example the final statement would be:

X = (A = 1 AND B = 0) AND (C = 1 AND B = 0).

Prepare Learners for the Future by Equipping them with 21st Century Competencies

Through the **inquiry-based** approach, learners are encouraged to continually ask questions and reflect on their understanding. This encourages **active learning** and promotes **self-directed learning.**

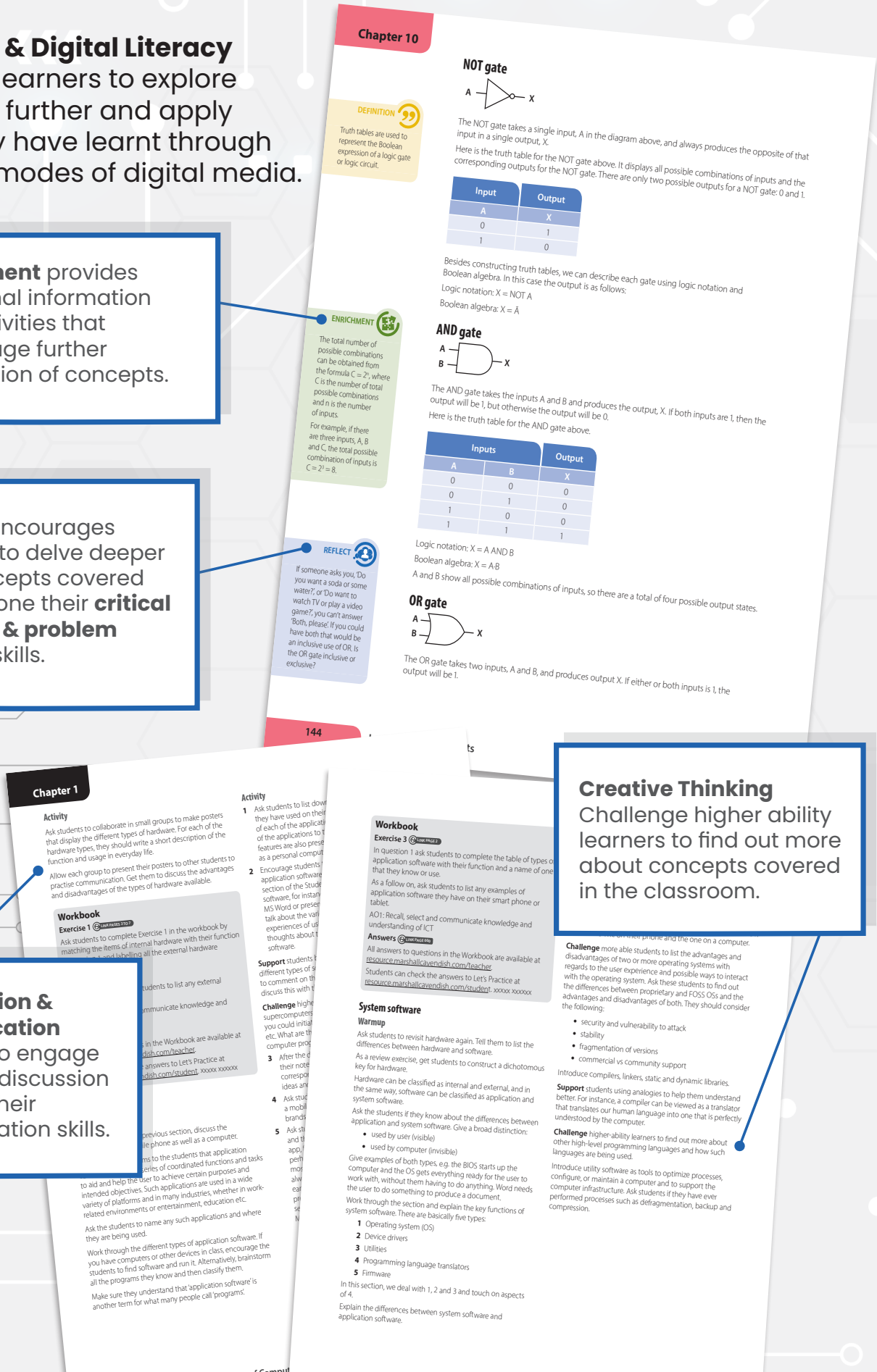
Curiosity & Digital Literacy prompts learners to explore concepts further and apply what they have learnt through different modes of digital media.

Enrichment provides additional information and activities that encourage further exploration of concepts.

Reflect encourages learners to delve deeper into concepts covered and to hone their **critical thinking & problem solving** skills.

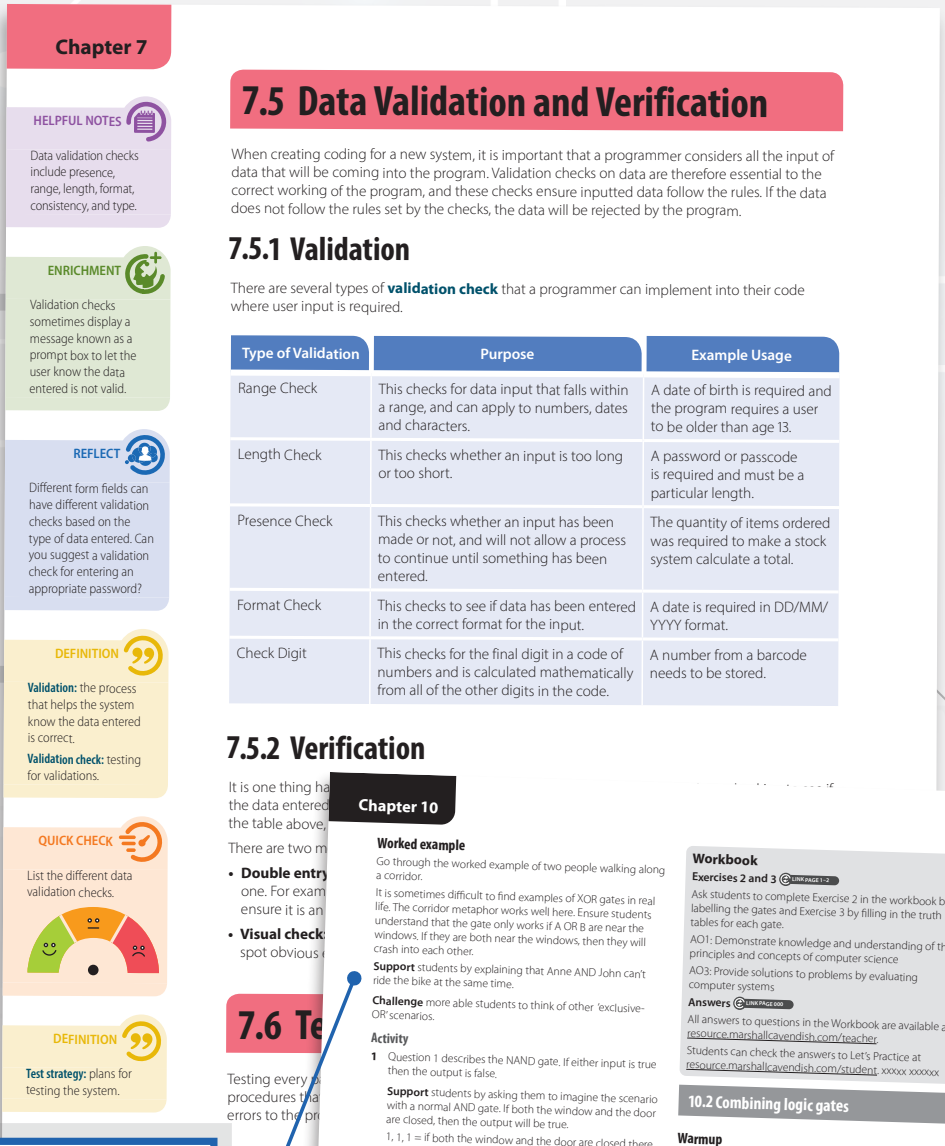
Collaboration & Communication Activities to engage learners in discussion and hone their communication skills.

Creative Thinking Challenge higher ability learners to find out more about concepts covered in the classroom.



Teachers' development is supported through the comprehensive Teacher's Guide to aid in **effective lesson planning and delivery** in the classroom.

Layout and sidebar features within Student Book designed to aid non-specialist teachers.



Chapter 7

HELPFUL NOTES

Data validation checks include presence, range, length, format, consistency, and type.

ENRICHMENT

Validation checks sometimes display a message known as a prompt box to let the user know the data entered is not valid.

REFLECT

Different form fields can have different validation checks based on the type of data entered. Can you suggest a validation check for entering an appropriate password?

DEFINITION

Validation: the process that helps the system know the data entered is correct.

Validation check: testing for validations.

QUICK CHECK

List the different data validation checks.

DEFINITION

Test strategy: plans for testing the system.

7.5 Data Validation and Verification

When creating coding for a new system, it is important that a programmer considers all the input of data that will be coming into the program. Validation checks on data are therefore essential to the correct working of the program, and these checks ensure inputted data follow the rules. If the data does not follow the rules set by the checks, the data will be rejected by the program.

7.5.1 Validation

There are several types of **validation check** that a programmer can implement into their code where user input is required.

Type of Validation	Purpose	Example Usage
Range Check	This checks for data input that falls within a range, and can apply to numbers, dates and characters.	A date of birth is required and the program requires a user to be older than age 13.
Length Check	This checks whether an input is too long or too short.	A password or passcode is required and must be a particular length.
Presence Check	This checks whether an input has been made or not, and will not allow a process to continue until something has been entered.	The quantity of items ordered was required to make a stock system calculate a total.
Format Check	This checks to see if data has been entered in the correct format for the input.	A date is required in DD/MM/YYYY format.
Check Digit	This checks for the final digit in a code of numbers and is calculated mathematically from all of the other digits in the code.	A number from a barcode needs to be stored.

7.5.2 Verification

It is one thing ha
the data entered
the table above,

There are two m

- **Double entry**
one. For exam
ensure it is an
- **Visual check**
spot obvious

7.6 Te

Testing every
procedures tha
errors to the pr

rithm Design

Chapter 10

Worked example

Go through the worked example of two people walking along a corridor.

It is sometimes difficult to find examples of XOR gates in real life. The corridor metaphor works well here. Ensure students understand that the gate only works if A OR B are near the windows. If they are both near the windows, then they will crash into each other.

Support students by explaining that Anne AND John can't ride the bike at the same time.

Challenge more able students to think of other 'exclusive-OR' scenarios.

Activity

1 Question 1 describes the NAND gate. If either input is true then the output is false.

Support students by asking them to imagine the scenario with a normal AND gate. If both the window and the door are closed, then the output will be true.

1, 1, 1 = if both the window and the door are closed there is current to the alarm

1, 0, 0 = if only the window is closed there is no current to the alarm

0, 1, 0 = if only the door is closed there is no current to the alarm

0, 0, 0 = if both the window and the door are open there is no current to the alarm

But in this case the output is reversed:

1, 1, 0 = if both the window and the door are closed there is no current to the alarm

1, 0, 1 = if only the window is closed there is current to the alarm

0, 1, 1 = if only the door is closed there is current to the alarm

0, 0, 1 = if both the window and the door are open there is current to the alarm

(The solutions can be found in the Teacher Guide portal online and at the back of the Teacher's Guide.)

2 The tables represent the XNOR and NAND gates.

Workbook

Exercises 2 and 3 LINK PAGE 1-2

Ask students to complete Exercise 2 in the workbook by labelling the gates and Exercise 3 by filling in the truth tables for each gate.

AO1: Demonstrate knowledge and understanding of the principles and concepts of computer science

AO3: Provide solutions to problems by evaluating computer systems

Answers LINK PAGE 000

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10.2 Combining logic gates

Warmup

Revise how an AND or OR gate followed by a NOT makes a NAND gate and explain that we can also represent this as a logic circuit, as there is more than one gate involved.

Logic circuits

Guide the students through breaking down logic circuits into two parts and show how the truth tables of logic gates in the previous sections relate to logic circuits. Allow students to review and reflect on the previous exercises and see how circuits are simply chains of two gates. Each stage has its own output that feeds into the next stage. Help students with the construction of the truth tables with two or more possible inputs by introducing the intermediate inputs in the truth table – make sure they understand the significance of the intermediate column in the table. Explain how we try to give a truth table for the entire circuit without the intermediate outputs, so we can remove these once we have worked them out.

Worked example

Go through the truth table for the logic circuit.

Support students by taking them though the steps. For example, inputs A and B have an output, but it is not the final output of the circuit. So, we begin again at 'P'. P inputs into the last gate, resulting in X. It is useful to show:

- the initial inputs
- the intermediate output
- the final output

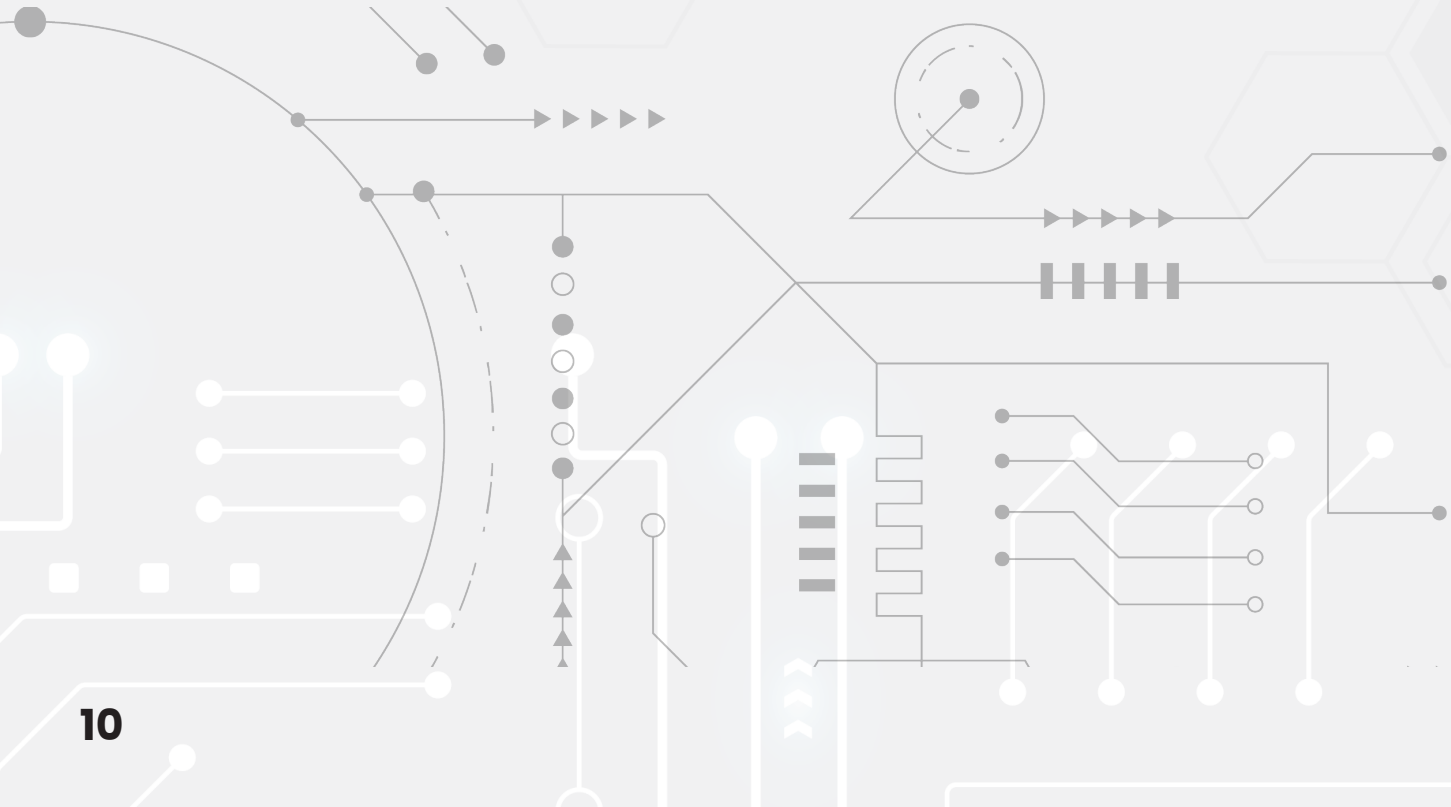
Challenge higher-ability students to try out more

4 Boolean Logic

Support and **Challenge** cater to diverse mix of learners with differing learning needs and help teachers to scaffold learners' learning in class.

Step-by-step lesson notes to aid in sequencing lessons in an engaging and meaningful manner.

Table of Contents



You may also be interested in:

Marshall Cavendish Education Cambridge IGCSE™ ICT series is a comprehensive two years programme designed to support learners with their study of the Cambridge IGCSE and IGCSE (9-1) ICT syllabuses (0417/0983).

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Marshall Cavendish Education Cambridge IGCSE ICT series promotes visual learning and delivers an engaging learning experience. Difficult concepts are scaffolded and broken down to convey bite-sized concepts, with worked examples supports new learners.

To nurture a 21st century practical problem solver, this series includes real-life scenario-based problems and situations for learners to apply scientific and technological concepts learnt to practical aspects beyond the confines of the classroom.

Through engaging chapter openers, the friendly and concise language used, and the visual approach by means of colourful illustrations and infographics to simplify learning concepts, our package delivers an engaging and enjoyable learning experience. This enables learners to develop necessary skills to embrace the rapidly changing technological landscape and become future thinkers and problem solvers.

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MCE Cambridge IGCSE™ Computer Science

- Reduce learning obstacles and achieve proficiency in concepts
- Build learners' confidence by linking theory to real-life applications
- Prepare learners for the future by equipping them with 21st century competencies
- Enhance teaching and learning effectiveness with digital resources

Series architecture

- Student's Book
- Workbook
- Teacher's Guide
- e-book
- Additional Digital Resources*

**These resources will not go through the Cambridge International endorsement process.*

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