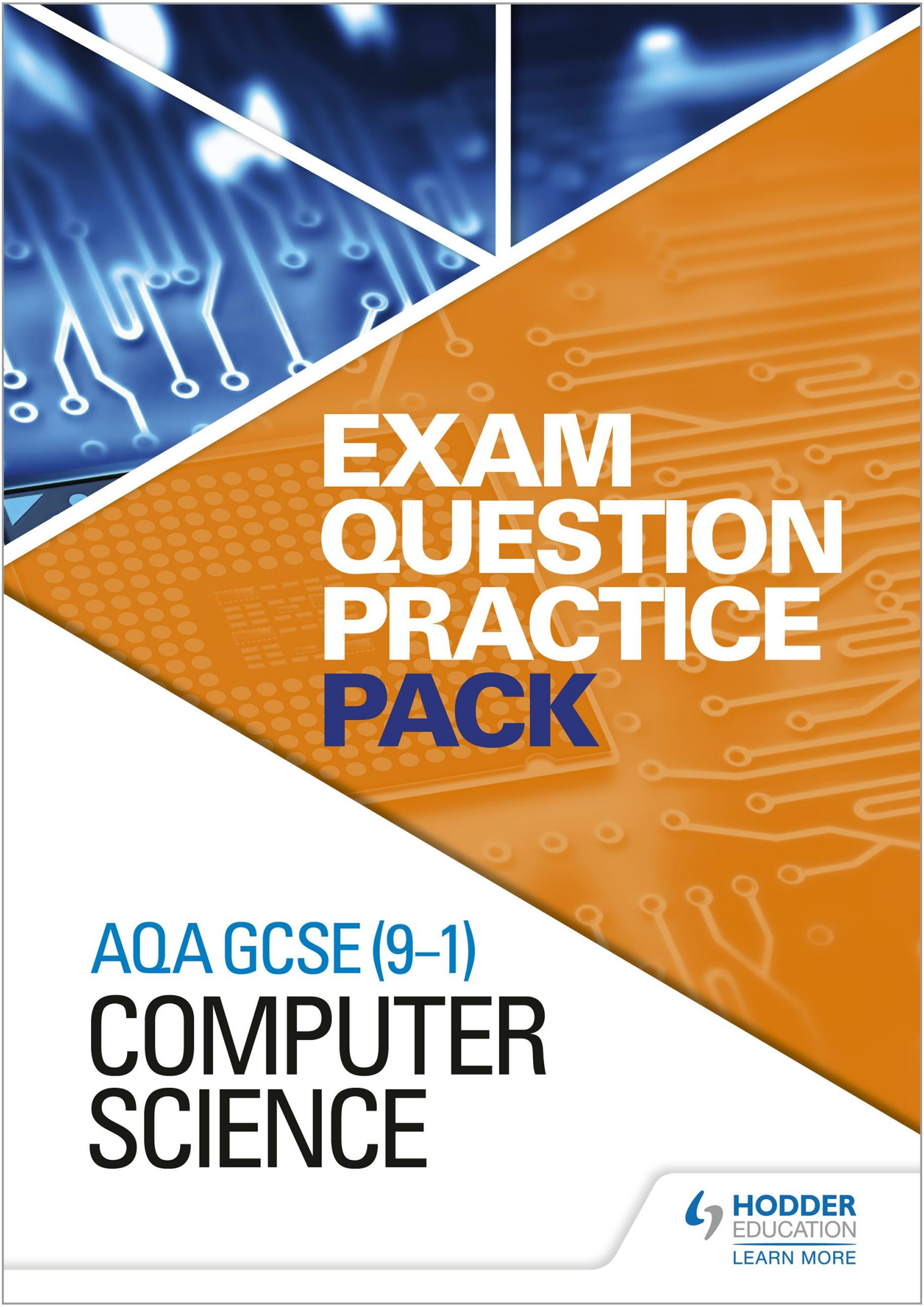

EXAM QUESTION PRACTICE PACK

AQA GCSE (9–1)

COMPUTER SCIENCE

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EXAM QUESTIONS

Paper 1 Computational thinking and problem solving

1.1 Fundamentals of algorithms

1 The design of algorithms is an important aspect of computer science.

(a) Explain what is meant by the term 'algorithm'. **(2 marks)**

.....

.....

(b) The design of an algorithm comes from the abstraction and decomposition of a given problem. Explain how both these methods are used to identify what algorithms should be designed so that a problem can be solved. **(4 marks)**

.....

.....

.....

.....

.....

(c) The pseudo code for a simple algorithm is outlined below:

```
1 a ← USERINPUT
2 b ← a * 2
3 OUTPUT b
```

Explain the steps in this algorithm. **(2 marks)**

.....

.....

Total: 8 marks

(Example student responses and mark scheme on p. 34)

2 An algorithm has been designed to control an automatic barrier on the entry to a car park.

(a) Shade three lozenges to identify the correct statements about a computer control system for a car park barrier similar to the one described above. **(3 marks)**

- **A** The motor controlling the barrier is an output device for the system. ⬭
- **B** A car under the barrier is an output device for the system. ⬭
- **C** A proximity sensor to detect a car is an input device for the system. ⬭
- **D** A flashing error light on the console is an input device for the system. ⬭
- **E** Checking the number of cars in the car park is a processing task in the system. ⬭
- **F** Fixing paper jams on the ticket dispenser is a processing task in the system. ⬭

(b) The following algorithm is used to track the number of cars in the car park (when full it holds 50 cars):

```
1 updateInputs()
2 WHILE (systemOn = True)
3  IF (carAtExit = True) THEN
4    WHILE (carAtExit ≠ False)
5      openExit()
6      updateInputs()
7    ENDWHILE
8    spaces = spaces – 1
9    closeExit()
10   ELSE IF (carAtEnt = True) AND (spaces < 50) THEN
11     ticketOut()
12     WHILE (carAtEnt ≠ False)
13       openEntrance()
14       updateInputs()
15     ENDWHILE
16     spaces = spaces + 1
17     closeEntrance()
18   ELSE IF (spaces = 50) THEN
19     carParkFull()
20   ENDIF
21 ENDWHILE
```

Note that the variables are global. The subroutine updateInputs() polls the physical sensors within the car park and updates the variables carAtExit, and carAtEnt and systemOn. For example, if a sensor detects there is a car at the exit barrier, the function will update the variable carAtExit to True. There are already 48 cars in the car park.

Complete the following trace table to show what happens when another three cars attempt to enter without any leaving (assuming the algorithm starts on line 3). **(5 marks)**

carAtExit	carAtEnt	spaces
FALSE	TRUE	48
	TRUE	

Total: 8 marks

(Example student responses and mark scheme on p. 36)

EXAMPLE RESPONSES AND MARK SCHEMES

The student responses

This section shows sample answers from two students. One set (A) is stronge, the other (B) weaker. The answers are followed by expert comments (shown by the icon e) that indicate where credit is due. In the weaker answers, they also point out areas for improvement, specific problems and common errors.

Paper 1 Computational thinking and problem solving

1.1 Fundamentals of algorithms

Example responses

Question 1

Student A

(a) An algorithm is an ordered set of instructions that, when followed, carries out a task that needs to be performed.

e **1 mark for identifying that it consists of instructions. 1 mark for confirming that following the steps completes the task that the algorithm was designed to complete. 2 marks**

(b) The process of abstraction allows an algorithm designer to focus on the important parts of the problem, removing the parts that are unimportant and that might make finding the solution more difficult. Decomposition is breaking a problem apart into smaller sub-tasks, which is helpful for the designer.

e **1 mark for explaining the removal of unrequired information about the problem, 1 mark for explaining that the solution is not as obvious with too much unnecessary information. 1 mark for explaining that decomposition is the breaking apart of a problem, but no second mark as the benefit hasn't been explained. 3 marks**

(c) The algorithm works by reading an inputted value provided by the user and the value doubled is output.

e **1 mark for identifying that input takes place, 1 mark for recognising that the input value is doubled and output. 2 marks**

Question 1

Student B

(a) An algorithm is a sequence that produces some output or action to solve a problem.

e **It is not clear what a sequence actually is, so no mark is awarded. 1 mark for identifying that an algorithm produces a solution to a problem. 1 mark**

(b) Abstraction is where simplifications are created for what you are designing. Decomposition is splitting a problem apart to smaller ones.

e **For abstraction, the mark is not awarded as it is not clear what simplification means in this context. For decomposition, 1 mark is awarded for explaining the breaking apart of a problem, but no second mark is gained for explaining the benefit of doing so. 1 mark**

(c) The algorithm works by multiplying an input by two.

e **1 mark for correctly identifying the process of the algorithm, but the student is not clear about input and/or output. 1 mark**

Question 1 mark scheme

(a) 1 mark for each of the following points:
- A sequence of steps/instructions…
- …that, when followed, completes a task.

(b) 1 mark for each of the following points about abstraction:
- Removing all the unnecessary information about the problem so that only the important aspects of the problem remain…
- …making the design of the solution clearer.

1 mark for each of the following points about decomposition:
- Breaking down a single large problem into several smaller parts…
- …so that each part is easier to design compared to the whole.

(c) 2 marks from:
- User inputs a value of their choice.
- Input is doubled.
- Doubled value is output.

Question 2

Student A

(a)
- **A** The motor controlling the barrier is an output device for the system. ●
- **B** A car under the barrier is an output device for the system. ○
- **C** A proximity sensor to detect a car is an input device for the system. ●
- **D** A flashing error light on the console is an input device for the system. ○
- **E** Checking the number of cars in the car park is a processing task in the system. ●
- **F** Fixing paper jams on the ticket dispenser is a processing task in the system. ○

e **1 mark for the system signals the motor to open or close the gate. 1 mark for cars need to be detected by the system. 1 mark for this will be tracked by the number of times the barrier opens and the position of the cars when it does. 3 marks**

(b)

carAtEx	t carAtEnt	spaces
FALSE	TRUE	48
	FALSE	
		49
	TRUE	
	FALSE	
		50
	TRUE	

e **FALSE = 1 mark — holds until car moves through; 49 = 1 mark — count updated; TRUE = 1 mark — next car arrives; FALSE = 1 mark — holds until car goes through; 50 = 1 mark — count updated. 5 marks**

Question 2

Student B

(a)
- **A** The motor controlling the barrier is an output device for the system. ●
- **B** A car under the barrier is an output device for the system. ●
- **C** A proximity sensor to detect a car is an input device for the system. ○
- **D** A flashing error light on the console is an input device for the system. ●
- **E** Checking the number of cars in the car park is a processing task in the system. ○
- **F** Fixing paper jams on the ticket dispenser is a processing task in the system. ○

e 1 mark for the system signals the motor to open or close the gate. The car is not part of the system. Light is an output device. **1 mark**

(b)

carAtExit	carAtEnt	spaces
FALSE	TRUE	48
		49
	FALSE	
	TRUE	
	FALSE	
		49
	TRUE	

e 49 = no mark — out of order as count adjusted after car drives through; FALSE = no mark — car drives off before changing the count; TRUE = 1 mark — next car arrives; FALSE = 1 mark — holds until car goes through; 49 = no mark — count not updated. **2 marks**

Question 2 mark scheme

(a) 1 mark for each correctly shaded lozenge.

A The motor controlling the barrier is an output device for the system. ●

B A car under the barrier is an output device for the system. ○

C A proximity sensor to detect a car is an input device for the system. ●

D A flashing error light on the console is an input device for the system. ○

E Checking the number of cars in the car park is a processing task in the system. ●

F Fixing paper jams on the ticket dispenser is a processing task in the system. ○

(b) 1 mark for correct entry.

carAtExit	carAtEnt	spaces
FALSE	TRUE	48
	FALSE	
		49
	TRUE	
	FALSE	
		50
	TRUE	

