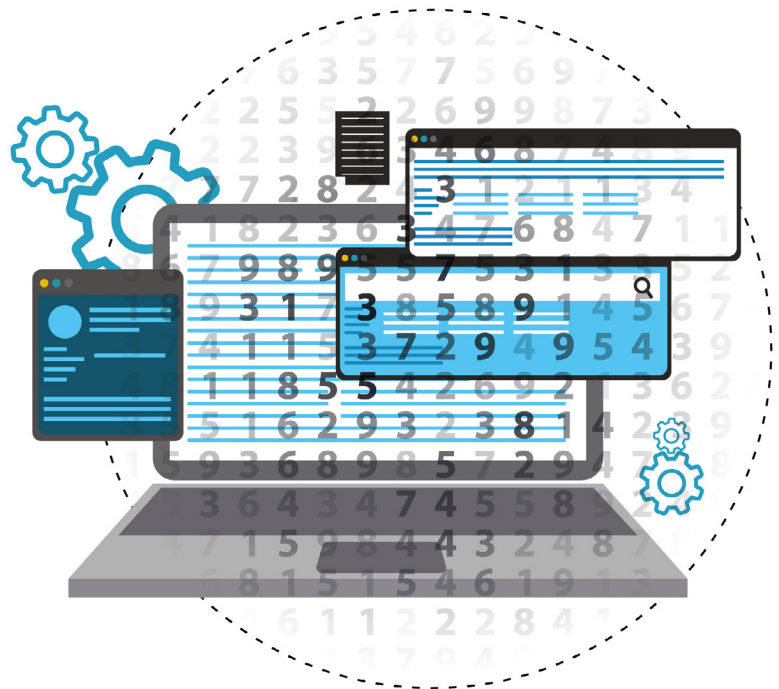# Specimen Paper Answers – Paper 1

Cambridge International AS & A Level Computer Science 9618

For examination from 2021

Contents

Introduction

The main aim of this booklet is to exemplify standards for those teaching Cambridge International AS & A Level 9618/01, and to show examples of very good answers. We have selected questions from Specimen Paper 1, for examination from 2021. There are five questions in the paper and candidates must answer all of the questions and sub-questions.

In this booklet, we have provided answers for all the questions along with examiner comments. These exercises require candidates to complete calculations, describe characteristics of computer installations, design and use a relational database, explain the operation of a control system and manipulate logic gates and logic expressions. The mark scheme provides the answers required to gain the marks.

Each response is accompanied by a brief commentary explaining the strengths and weaknesses of the answers.

Each question is followed by an example of a high grade answer with an examiner comment on performance. Comments are given to indicate where and why marks were awarded, and how additional marks could have been obtained. In this way, it is possible to understand what candidates have done to gain their marks and how they could improve.

The mark schemes for the Specimen Papers are available to download from the School Support Hub at www.cambridgeinternational.org/support

2021 Specimen Paper 1 Mark Scheme

Past exam resources and other teacher support materials are available on the School Support Hub www.cambridgeinternational.org/support

Assessment overview

Paper 1 – Theory Fundamentals

Written paper, 1 hour 30 minutes, 75 marks

Externally assessed

Candidates may not use calculators.

Paper 1 will assess sections 1 to 8 of the syllabus content

The number of questions is not fixed. The questions have different mark allocations, and some questions consist of a series of sub-questions. Candidates must answer all questions and sub-questions.

50% of the AS Level

25% of the A Level

Assessment objectives
The assessment objectives (AOs) are:

AO1: Demonstrate knowledge and understanding of the principles and concepts of computer science, including abstraction, logic, algorithms and data representation.

AO2: Apply knowledge and understanding of the principles and concepts of computer science, including to analyse problems in computational terms.

Question 1

Question 1(a)

1   (a) State **one** difference between a **kibibyte** and a **kilobyte**.

....

.... [1]

Specimen Paper Response
A kibibyte is 1024 bytes, whereas a kilobyte is 1000bytes.

Examiner comment:
The candidate has correctly stated the values of both a kibibyte and a kilobyte, and has satisfied the first mark point.

Total marks awarded: 1 out of 1

Question 1(b)

(b) Give the number of bytes in a **mebibyte**.

.... [1]

Specimen Paper Response
*1024 * 1024*

Examiner comment:
The candidate's answer matches the second alternative on the markscheme.

The use of calculators is not permitted on this paper, so unless the numbers are very straightforward and candidates are asked to show their working, leaving the answer as an expression is acceptable.

Total marks awarded: 1 out of 1

Question 1(c)(i)

(c) (i) Complete the following binary addition. Show your working.

$$1\ 0\ 0\ 1\ 1\ 0\ 1\ 0$$

$$+\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 1$$

[2]

Specimen Paper Response

```
    1  0  0  1  1  0  1  0
 +  1  1  1  1  0  1  1  1
 ───────────────────────────
 1  1  0  0  1  0  0  0  1
```

Examiner comment:

The candidate has provided the correct answer so achieves the answer mark. However, there is no evidence of any working out, so the working mark is not awarded.

Total marks awarded: 1 out of 2

Question 1(c)(ii)

(ii) Describe the error that occurred when you added the binary numbers in **part (c)(i)**.

....

....

....

.... [2]

Specimen Paper Response
Overflow has occurred. There is an extra bit in the answer.

Examiner comment:
The candidate has correctly named the error, so is awarded the first mark.

The question asks for a description of the error, so there is a need for further expansion of what is meant by overflow. The candidate has provided a statement that does not match the markscheme exactly, but which is close enough to be awarded the second mark.

Total marks awarded: 2 out of 2

Question 1(d)

(d) Complete the binary subtraction. Show your working.

$$0\ 1\ 1\ 0\ 0\ 1\ 1\ 1$$

$$-\underline{0\ 0\ 1\ 1\ 0\ 0\ 1\ 0}$$

[2]

Specimen Paper Response
Find the two's complement of the number being subtracted:

1	1	0	0	1	1	0	1	*One's complement*
					+		1	

1 1 0 0 1 1 1 0 Two's complement

Then add:

```
    0  1  1  0  0  1  1  1
 +  1  1  0  0  1  1  1  0
(1) 0  0  1  1  0  1  0  1
```

Examiner comment:

The candidate has provided the correct answer so achieves the answer mark.

The candidate has also shown how the subtraction was being carried out – finding the two's complement of the second number and then adding that to the first number. This is the evidence of the working out and so the second mark is also given.

Total marks awarded: 2 out of 2

Question 2

Question 2(a)

2   Yvette runs a company that books walking holidays for groups of people. She has a website that customers use to book the holidays.

(a)   The website has a URL and an IPv6 address.

Describe, using an example, the format of an IPv6 address.

....

....

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.... [4]

Specimen Paper Response

An IPv6 address uses 128 bits. ❶ *It uses hexadecimal digits.* ❷ *An example is 3F2E:1500:4532:0000:0400:A8CD:FF35:48A0* ❸

Examiner comment:

❶ The candidate has given a valid answer, although it is not on the mark scheme, 1 mark awarded.

❷ The second sentence is correct, but is not enough for the second mark point.

❸ The example is correct, 1 mark awarded.

Total marks awarded: 2 out of 4

Question 2(b)

(b) An IP address can be static or dynamic. Describe static and dynamic IP addresses.

Static ....

....

....

....

Dynamic ....

....

....

....

[4]

Specimen Paper Response

A static IP address is the same each time you connect to the Internet, ❶ *whereas a dynamic IP address will be different every time you connect.* ❷ *Using a static IP address means that other people can always find you by using just your IP address.* ❸

Examiner comment:

❶Connecting to the Internet is enough as an alternative to re-joining a network, so the first mark point for a static address is covered, and the candidate states that the address is the same, that is, it does not change, so the second mark point is also covered. Maximum of 2 marks given for the static IP address.

❷The candidate has stated that a dynamic address changes, so has covered the second mark point for a dynamic address, but has not said what sort of connection it is so there is not enough for the first mark point in this section. 1 mark given for dynamic IP address.

❸The statement is correct, but it applies to a static IP address and the maximum number of marks for a static address have already been given.

Total marks awarded: 3 out of 4

Question 2(c)(i)

(c) Yvette's company has a LAN (Local Area Network) that has hybrid topology.

    (i) Describe the characteristics of a LAN.

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....

....

.... [2]

Specimen Paper Response

A LAN covers a small geographical area, usually within one building or one site. ❶ *It allows the sharing of expensive devices such as printers and scanners.* ❷

Examiner comment:

❶The first sentence matches the first mark point, 1 mark awarded.

❷The second sentence, however, is a benefit of using a LAN, and does not describe a characteristic of a LAN, so does not answer the question.

Total marks awarded: 1 out of 2

Question 2(c)(ii)

(ii) The LAN has a range of different topologies. One subnetwork connects four computers and one server set up as a star topology.

Describe how packets are transmitted between two of the computers in this subnetwork.

....

....

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....

....

.... [3]

Specimen Paper Response

The sending computer collects the data and breaks it down into packets. ❶ *The identification of the receiving computer is added to each packet.* ❷ *The packets are then transmitted along the dedicated line from the computer to the server.* ❸ *The server decides which computer is to receive the packets based on the information in the packet header* ❹ *and transmits the data along the dedicated line from the server to the receiving computer.* ❺

Examiner comment:

❶ There is no mark for this statement, the information is given in the question.

❷ This sentence matches the first marking point, 1 mark awarded.

❸ This sentence matches the second marking point, 1 mark awarded.

❹ This sentence is enough for the third marking point, 1 mark awarded.

❺ This sentence matches the fourth marking point, but the candidate has already been awarded the maximum number of marks for the question.

Total marks awarded: 3 out of 3

Question 2(d)(i)

(d) The LAN has both wired and wireless connections.

    (i) Ethernet cables connect the computers to the server.

        Identify **three** other hardware components that might be used to set up the LAN.

        1 ....

          ....

        2 ....

          ....

        3 ....

          .... [3]

Specimen Paper Response
    1. *Network Interface Cards*
    2. *Router*
    3. *Workstations*

Examiner comment:
The first two hardware components are correct, so gain one mark each. However, 'workstation' is an alternative word for 'computer', which is given in the question.

Total marks awarded: 2 out of 3

Question 2(d)(ii)

    (ii) Describe how Carrier Sense Multiple Access/Collision Detection (CSMA/CD) manages collisions during data transmission.

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        ....

        ....

        ....

        ....

        .... [3]

Specimen Paper Response
The system listens to the communication line. ❶ *If the line is free a workstation is able to transmit data.* ❷ *If two workstations transmit at the same time there will be a collision.* ❸ *If this happens the transmissions are*

halted and each workstation waits a random amount of time before trying to re-transmit. ❹

Examiner comment:

❶ The first statement matches the first mark point, 1 mark awarded.

❷ This sentence matches the second marking point, 1 mark awarded.

❸ This is a description of what is meant by a collision and matches the third marking point, 1 mark awarded.

❹ This sentence is also correct, but the maximum number of marks has already been reached.

Total marks awarded: 3 out of 3

Question 3

Question 3(a)(i)

3   Mehrdad has a holiday company database that includes:

  • data about holidays, such as the location, date, duration (in days)
  • data about the customers and the holidays they have booked.

(a)   Mehrdad has **normalised** the database, which has three tables.

  (i)   Draw an entity–relationship (E–R) diagram for the **normalised** tables.

[3]

Specimen Paper Response
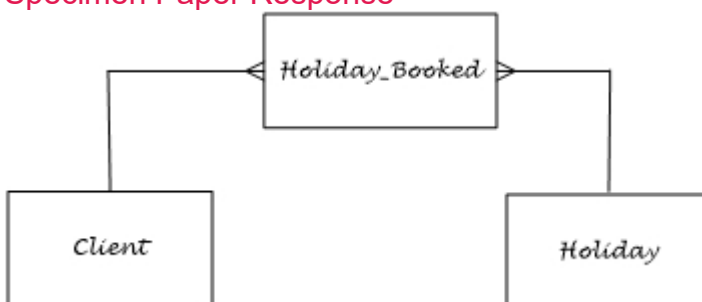
Examiner comment:

The candidate has used three suitable names for the tables, and is awarded the first mark.

There are two correct one-to-many relationships shown, so the other two marks are also given.

Total marks awarded: 3 out of 3

Question 3(a)(ii)

(ii) Complete the table to identify the primary key and foreign key(s) for each of the tables you identified in **part (a)(i)**. If the table has no foreign key(s), write 'None'.

Table name	Primary key	Foreign key

[3]

Specimen Paper Response

Table Name	Primary Key	Foreign Key
Client	ClientID	
Holiday	HolidayID	
Holiday_Booked	BookingID	ClientID HolidayID

Examiner comment:

The candidate has given three appropriate primary keys, so the first mark is given.

The candidate has not written 'None' in the Foreign Key column where required, so the second mark is not given.

The candidate has correctly identified the two foreign keys in the Holiday_Booked table and the names match the primary keys, so the third mark is awarded.

Total marks awarded: 2 out of 3

Question 3(a)(iii)

(iii) Explain why the holiday database is in Third Normal Form (3NF).

....

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.... [2]

Specimen Paper Response

The database is in 3NF because there are no non-key dependencies. All the fields in each table depend only on the primary key.

Examiner comment:

The candidate has stated that there are no non-key dependencies which is enough to satisfy the second bullet point on the markscheme. However, the candidate's second sentence is a re-wording of the first point so no second mark is given as the first bullet point on the markscheme is not stated.

Total marks awarded: 1 out of 2

Question 3(b)(i)

(b) The holiday company has several members of staff. The database has two additional tables to store data about the staff.

```
STAFF(StaffID, FirstName, SecondName, DateOfBirth, Role, Salary)

SCHEDULE(ScheduleID, StaffID, WorkDate, Morning, Afternoon)
```

The following table shows some sample data from the table SCHEDULE.

ScheduleID	StaffID	WorkDate	Morning	Afternoon
210520-1	BC	21/05/2020	TRUE	TRUE
210520-2	JB	21/05/2020	TRUE	FALSE
220520-1	BC	22/05/2020	FALSE	TRUE
220520-2	LK	22/05/2020	TRUE	FALSE

(i) Write an SQL script to display the first name and second name of all staff members working on 22/05/2020.

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.... [4]

Specimen Paper Response

SELECT FirstName, SecondName ❶
FROM STAFF, SCHEDULE ❷
WHERE WorkDate = '22/05/2020' ❸
AND STAFF.StaffID = SCHEDULE.StaffID; ❹

Examiner comment:

❶ The candidate has written a correct SQL statement to select the appropriate fields, 1 mark awarded.

❷ The correct tables have been used in the FROM clause, 1 mark awarded.

❸ The correct join has been made between the tables with the AND clause, 1 mark awarded.

❹The correct criteria has been applied in the WHERE clause, 1 mark awarded.

Total marks awarded: 4 out of 4

Question 3(b)(ii)

(ii) Write an SQL script to count the number of people working on the morning of 26/05/2020.

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....

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.... [3]

Specimen Paper Response

SELECT COUNT(StaffID) ❶
FROM SCHEDULE ❷
WHERE WorkDate = '26/05/2020'
AND Morning = TRUE; ❸

Examiner comment:

❶ The candidate has selected and counted an appropriate field, 1 mark awarded.

❷ The correct table has been used, 1 mark awarded.

❸ Both the criteria have been correctly applied, 1 mark awarded.

Total marks awarded: 3 out of 3

Question 4

Question 4(a)

4   A cake factory uses machines to make cakes .

   (a) Complete the following descriptions of types of system. Write the correct missing term in the spaces.

   The factory uses a .... system to record data such as the number

   of cakes being produced each hour.

   When the data collected from sensors are analysed and used as

   .... it is a .... system. One example

   of this system, used in the factory, is to maintain a constant temperature in the ovens. It uses

   a .... to measure the values.   [4]

Specimen Paper Response

The factory uses a *monitoring* system to record data such as the number of cakes being produced each hour.

When the data collected from sensors are analysed and used as *feedback* it is a *control* system. One example of this system, used in the factory, is to maintain a constant temperature in the ovens. It uses a *temperature sensor* to measure the values.

Examiner comment:

The candidate has given four very acceptable terms to complete the paragraphs.

Total marks awarded: 4 out of 4

Question 4(b)

(b) Cake mixture is mixed in a large pot. A conveyer belt moves the cake tins beneath the pot. The conveyer belt stops and a set quantity of the cake mixture fills the cake tin. The conveyer belt then moves and another cake tin is positioned beneath the pot.

Explain how the control system will ensure the correct amount of mixture is placed in the cake tins.

--- [5]

Specimen Paper Response

When a sensor detects a cake tin in the correct position a signal will be sent to the microprocessor ❶. The microprocessor will then send signals to actuators to stop the conveyor belt and start releasing the cake mixture into the tin. ❷ A pressure sensor continually records the weight of the tin and sends the data to the microprocessor. ❸ The microprocessor compares the weight with a pre-set value ❹ and when the pre-set value is reached the microprocessor sends signals to the actuators to stop releasing the cake mixture and to start the conveyor belt. ❺

Examiner comment:

❶The candidate has correctly identified that a message (signal) will be sent to the microprocessor when the tin is in the correct position which is mark point 2. 1 mark awarded.

❷The candidate has covered both mark points 3 and 4 in the single sentence, two marks awarded.

❸Mark points 5 and 6 are both covered in this sentence. 2 marks awarded.

❹Is enough for mark point 7, a mark would be awarded here, but the candidate has already reached the maximum.

❺The remaining mark points are covered in the final few lines, marks would again have been awarded, but the candidate has reached the maximum.

Total marks awarded: 5 out of 5

Question 4(c)(i)

(c) The cake factory has servers that store its confidential recipes and control the factory machines.

 (i) Describe the implications of a hacker gaining access to the cake factory's servers.

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.... [4]

Specimen Paper Response

If a hacker got access to the servers they could steal data. ❶ *They could also interfere with the control process.* ❷

Examiner comment:

❶The candidate has correctly identified that a hacker could steal data from the company which covers the first mark point. 1 mark awarded.

❷The candidate has not matched the wording of the mark scheme exactly, but this statement is just enough to be awarded one mark covering mark points 4, 5 and 6.

Total marks awarded: 2 out of 4

Question 4(c)(ii)

(ii) Explain how the company could protect its data against hackers.

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.... [4]

Specimen Paper Response

The company could encrypt their data so that even if a hacker accessed the data it would not be able to be understood. ❶ *They could also set up a firewall which would monitor communications and block any incoming or outgoing traffic that did not conform to certain rules.* ❷ *The company could also ensure that passwords were not easily guessed.* ❸

Examiner comment:

❶ The candidate has correctly stated that encryption would protect against hackers, the candidate has further explained that encryption makes data incomprehensible even if it is accessed illegally. 2 marks awarded.

❷ The candidate has also identified a firewall as a valid security measure and has explained the operation of a firewall. 2 marks awarded.

❸ Passwords not easily guessed corresponds to strong passwords which is also worthy of a mark, however the candidate has reached the maximum.

Total marks awarded: 4 out of 4

Question 4(d)(i)

(d) The machines have a counter to record the number of cake tins filled. Each time a cake tin is filled, the counter is increased by 1. The value is stored in an 8-bit register, the current value is shown.

0	0	0	0	1	0	0	1

(i) Show the value of the binary number after another five cake tins have been filled.

[1]

Specimen Paper Response

0	0	0	0	1	1	1	0

Examiner comment:

The candidate has identified the need to add five to the value stored in the register and has correctly carried out the binary addition.

Total marks awarded: 1 out of 1

Question 4(d)(ii)

(ii) The following table shows some assembly language instructions for a processor which has one general purpose register, the Accumulator (ACC).

Instruction		Explanation
Op code	Operand	
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left hand end.

At the end of each day, the register is reset to 0.

Write the assembly language statement to reset the register to 0.

-- [2]

Specimen Paper Response

AND #0

Examiner comment:

The candidate has correctly identified that an AND operation is needed, so satisfying the first mark point, and has provided the correct operand, so the second mark is also awarded.

Total marks awarded: 2 out of 2

Question 4(d)(iii)

(iii) A two-place logical shift to the left is performed on the binary number shown in part (d).

Show the result of this logical shift.

[1]

Specimen Paper Response

0	0	1	0	0	1	0	0

Examiner comment:

The candidate has correctly completed a logical shift of two places left to the binary value given in the question.

Total marks awarded: 1 out of 1

Question 4(d)(iv)

(iv) State the mathematical result of a one-place logical shift to the right on a binary number.

-- [1]

Specimen Paper Response

Division by 2.

Examiner comment:

The candidate has provided the correct answer.

Total marks awarded: 1 out of 1

Question 4(e)

(e) The factory servers run software that makes use of Artificial Intelligence (AI).

Explain how the use of AI can help improve the safety and efficiency of the factory.

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.... [3]

Specimen Paper Response

Machine learning means that machines in the factory can learn from things that go wrong ❶ and modify their operation so that the same problem does not occur again. ❷ It also means that machines can learn how to be more efficient. ❸

Examiner comment:

❶ This covers the first mark point. 1 mark awarded.

❷ The candidate has also expanded on the first statement by saying that the actions can be modified, which is the second mark point. 1 mark awarded.

❸ The final sentence covers the fourth mark point. 1 mark awarded.
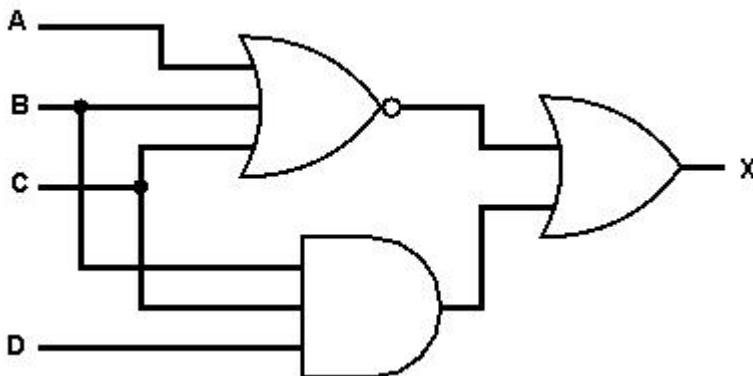
Total marks awarded: 3 out of 3

Question 5

Question 5(a)

5   (a)   Draw a logic circuit diagram for the logic expression:

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

[4]

Specimen Paper Response

Examiner comment:

The candidate has recognised that the first part of the expression, NOT (A OR B OR C), can be implemented with a single three-input NOR gate. This satisfies both of the first two mark points, so 2 marks are awarded for this gate.

The candidate has also recognised that the second part of the expression, B AND C AND D, can be implemented with a single three-input AND gate, so the third mark point is achieved.

The output from these two gates is correctly used as input to an OR gate satisfying the fourth mark point.

Total marks awarded: 4 out of 4

Question 5(b)

(b) Complete the truth table for the logic expression:

$$X = (A \text{ XOR } B) \text{ OR NOT } (A \text{ OR } B \text{ OR } C)$$

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

Specimen Paper Response

A	B	C	Working Space	X
0	0	0		1
0	0	1		0
0	1	0		1
0	1	1		1
1	0	0		1
1	0	1		1
1	1	0		0
1	1	1		0

Examiner comment:

Each pair of values in the column for X is correct, so the candidate has completely satisfied the requirements of the mark-scheme.

Total marks awarded: 4 out of 4