CAMBRIDGE IGCSE (0478)

Module D: Data transmission

Workbooklet · 6 parts · 122 marks

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MODULE D DATA TRANSMISSION · D1

Packets and packet switching

Original practice questions · 20 marks · ~25 minutes · Cambridge 0478 syllabus 2.1.1

Name _____ Date _____

Instructions. Answer all questions in the spaces provided. The marks for each part are shown in brackets [ ]. The total for this worksheet is **20 marks**.

1

Total: 4 marks

An architecture firm sends a large drawing file over the internet to a building contractor. The file is broken down into packets to be transmitted.

(a) Identify the **three** parts of a packet of data. **[3]**

1

2

3

(b) Tick (✓) **one** box to show which part of a packet contains the actual data being sent. **[1]**

Part of packet	Tick (✓) one
Packet header	
Payload	
Trailer	

2

Total: 3 marks

(a) The packet header contains **three** items of information. Identify the **three** items. **[3]**

1

2

3

3 Total: 4 marks

The building contractor's computer receives all the packets of the drawing file.

(a) Explain why each packet header contains a packet number. **[2]**

(b) Explain why each packet header contains the destination address. **[2]**

4 Total: 6 marks

(a) The architecture firm's drawing file is sent to the building contractor using packet switching. Describe how the file is sent and received. **[6]**

5 Total: 3 marks

(a) Tick (✓) **one** box in each row to show whether each statement about packet switching is true or false. **[3]**

Statement	True (✓)	False (✓)
All the packets of one file must take the same route		
A router controls the route a packet takes		
The packets are reordered as soon as the first packet arrives		

Total for this worksheet: 20 marks

MODULE D DATA TRANSMISSION · D2

Serial, parallel and duplex

Original practice questions · 20 marks · ~25 minutes · Cambridge 0478 syllabus 2.1.2

Name _____ Date _____

Instructions. Answer all questions in the spaces provided. No calculator. The marks for each part are shown in brackets [ ]. The total for this worksheet is **20 marks**.

1

Total: 4 marks

A computer sends data to another device along a cable.

(a) Describe how data is sent using **serial** data transmission. **[2]**

(b) Describe how data is sent using **parallel** data transmission. **[2]**

2

Total: 4 marks

(a) Tick (✓) **one** box in each row to show the method of data transmission each link uses. **[4]**

Link	Simplex	Half-duplex	Full-duplex
A temperature sensor sends readings to a monitoring computer. No data is ever sent back to the sensor.			
Two security guards use handheld radios. Only one can talk at a time; then the other replies.			
Two offices hold a video call. Both can speak and be heard at the same time.			
A link carries data in both directions, but only one direction at a time.			

3 **Total: 4 marks**

A farm sends readings from a sensor in a field to an office computer 300 metres away by cable. It uses **serial** data transmission.

(a) Explain why serial data transmission is suitable for this link. **[3]**

(b) Give **one** disadvantage of serial data transmission. **[1]**

4 **Total: 6 marks**

Inside a printing machine, a control unit is joined to a print head by a cable 30 cm long. Large amounts of data are sent to the print head, and the print head sends status data back to the control unit at the same time. The cable uses **parallel full-duplex** data transmission.

(a) Explain why parallel data transmission is suitable for this cable. **[2]**

(b) Explain why full-duplex data transmission is suitable for this cable. **[2]**

(c) Give **two** disadvantages of parallel data transmission. **[2]**

1 .....

2 .....

5 **Total: 2 marks**

(a) Give **one** advantage of half-duplex data transmission compared with full-duplex. **[1]**

(b) Give **one** advantage of full-duplex data transmission compared with half-duplex. **[1]**

Total for this worksheet: 20 marks

MODULE D DATA TRANSMISSION · D3

The USB interface

Original practice questions · 20 marks · ~25 minutes · Cambridge 0478 syllabus 2.1.3

Name _____ Date _____

Instructions. Answer all questions in the spaces provided. No calculator. Where a question gives a context, refer to it in your answer. The marks for each part are shown in brackets [ ]. The total for this worksheet is **20 marks**.

1

Total: 2 marks

(a) State what the letters USB stand for. **[1]**

(b) Tick (✓) **one** box to show the method of data transmission that USB uses. **[1]**

Method	Tick (✓) one
Parallel	
Serial	

2

Total: 4 marks

A graphic designer connects a new drawing tablet to their desktop computer using a USB connection.

(a) Explain how data is sent from the drawing tablet to the computer using the USB connection. **[2]**

(b) Describe what happens when the drawing tablet is plugged into the computer for the first time. **[2]**

3 **Total: 3 marks**

A library connects a wired keyboard to the computer on its help desk using a USB connection.

(a) Give **two** benefits of using a USB connection for the keyboard. **[2]**

1

2

(b) Give **one** drawback of using a USB connection for the keyboard. **[1]**

4 **Total: 4 marks**

(a) Tick (✓) **one** box in each row to show whether each statement about USB is true or false. **[4]**

Statement	True (✓)	False (✓)
A USB connection sends several bits at the same time down several wires		
A device can be powered through its USB connection		
The user must always install the device driver for a USB device by hand		
A USB connection is backward compatible		

5 **Total: 2 marks**

A technician at a printing company says: "A USB connection is always faster than a parallel connection over a short distance."

(a) Explain why the technician is wrong. **[2]**

6 **Total: 5 marks**

An architecture office buys new desks. Each desk has a computer with a wired mouse, a wired webcam and an external storage drive, all connected using USB.

(a) Explain why USB is a suitable interface for the office to use. Include at least **one** drawback in your answer. **[5]**

Total for this worksheet: 20 marks

MODULE D DATA TRANSMISSION · D4

Parity checks and checksums

Original practice questions · 21 marks · ~25 minutes · Cambridge 0478 syllabus 2.2.1, 2.2.2

Name _____ Date _____

Instructions. Answer all questions in the spaces provided. No calculator. In every byte on this worksheet the parity bit is the left-most (most significant) bit. The marks for each part are shown in brackets [ ]. The total for this worksheet is **21 marks**.

1

Total: 4 marks

A farm sends sensor readings along a long cable to an office computer.

(a) Interference on the cable can cause errors in the data. Identify **two** different ways the data can be affected. **[2]**

1 _____

2 _____

(b) Explain why the office computer needs to check the data for errors after it is received. **[2]**

_____

_____

_____

2

Total: 6 marks

(a) The farm uses **even** parity. Complete the parity bit for each byte. **[3]**

Parity bit	Data bits						
	1	0	1	0	0	1	1
	0	1	1	1	0	1	1
	0	0	0	0	0	0	0

(b) A different system uses **odd** parity. Tick (✓) **one** box in each row to show whether an error is detected in each received byte. **[3]**

Received byte	Error detected (✓)	No error detected (✓)
`11010010`		
`01110110`		
`10000000`		

3 **Total: 2 marks**

An engineer says: "If a byte passes its parity check, it must have arrived with no errors."

(a) Explain why the engineer is wrong. **[2]**

4 **Total: 5 marks**

The farm sends four bytes and a parity byte as a parity block, using **even** parity. One bit changed during transmission. This is the block that is received.

	Col 1 (parity bit)	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8
Byte 1	0	1	1	0	1	0	0	1
Byte 2	1	0	1	1	1	0	1	1
Byte 3	1	1	0	0	0	1	1	1
Byte 4	0	0	1	0	1	1	1	0
Parity byte	0	0	1	1	1	1	1	1

(a) Identify the byte number and the column number of the bit that changed. **[2]**

Byte number .....

Column number .....

(b) Write the correct value of the byte that contained the error. **[1]**

Correct byte: .....

(c) Describe how the parity byte was created before the block was sent. **[2]**

5 **Total: 4 marks**

The office computer also sends a weekly report file to a head office. A checksum is used to check the file for errors.

(a) Describe how a checksum is used to detect errors in the file after transmission. **[4]**

Total for this worksheet: 21 marks

MODULE D DATA TRANSMISSION · D5

Echo checks, check digits and ARQ

Original practice questions · 20 marks · ~25 minutes · Cambridge 0478 syllabus 2.2.2 (echo check), 2.2.3, 2.2.4

Name _____ Date _____

Instructions. Answer all questions in the spaces provided. No calculator. The marks for each part are shown in brackets [ ]. The total for this worksheet is **20 marks**.

1

Total: 5 marks

A weather station sends its readings to a central computer. The station uses an echo check.

(a) Describe how the echo check is used to detect errors in the readings after transmission. **[4]**

(b) Give **one** drawback of using an echo check. **[1]**

2 **Total: 4 marks**

A garden centre gives each plant a 5-digit code. The first four digits identify the plant and the fifth digit is a check digit. The check digit is calculated like this:

- multiply the four digits, from left to right, by the weights 5, 4, 3 and 2
- add the four results together
- divide the total by 11 and find the remainder
- the check digit is 11 minus the remainder (a remainder of 0 gives a check digit of 0).

(The codes used in this question never give a check digit of 10.)

(a) Calculate the check digit for the plant digits **3 7 1 9**. Show your working. **[2]**

Working:

Check digit: .....

(b) An employee types the code **3 7 9 1 2**. Use the method to show whether the computer accepts this code. Show your working. **[2]**

Working:

Accepted / rejected: .....

3 **Total: 4 marks**

(a) Describe how a check digit is used to detect an error when a code is entered into a computer. **[2]**

(b) Identify **two** examples of where a check digit is used. **[2]**

1

2

4 **Total: 4 marks**

A ticket office sends booking data to a print centre. It uses an automatic repeat query (ARQ).

(a) Describe how ARQ is used to establish that the booking data is received without error. **[4]**

5 **Total: 3 marks**

(a) Tick (✓) **one** box in each row to show which method each statement describes. **[3]**

Statement	Echo check	Check digit	ARQ
The sender compares the data it sent with a copy sent back by the receiver.			
It detects an error made when data is typed in.			
If no acknowledgement arrives before a set time, the data is sent again.			

Total for this worksheet: 20 marks

MODULE D DATA TRANSMISSION · D6

Encryption

Original practice questions · 21 marks · ~25 minutes · Cambridge 0478 syllabus 2.3.1, 2.3.2

Name _____ Date _____

Instructions. Answer all questions in the spaces provided. The marks for each part are shown in brackets [ ]. The total for this worksheet is **21 marks**.

1

Total: 4 marks

An online shop sends customers' order details across the internet to its warehouse.

(a) Give **one** reason why the order details are encrypted before they are transmitted. **[1]**

(b) State the name given to the data after it has been encrypted. **[1]**

(c) Explain why encryption does **not** stop the order details being intercepted, but still protects them. **[2]**

2 **Total: 5 marks**

(a) Complete the sentences about symmetric encryption, using words from the list. Not all words are used. **[5]**

algorithm · cipher · different · intercepted · plain · private · same · sent

The data before encryption is called ..... text.

An encryption ..... and a key are used to turn it into ..... text.

Symmetric encryption uses the ..... key to encrypt and to decrypt the data.

The key has to be ..... to the receiver, so it could be intercepted.

3 **Total: 4 marks**

A design agency sends confidential drawings to a printing company. The printing company has a public key and a private key. The data is sent using asymmetric encryption.

(a) Identify the key the design agency uses to encrypt the drawings. **[1]**

(b) Identify the key that is used to decrypt the drawings. **[1]**

(c) Explain why it does not matter if someone else obtains the printing company's public key. **[2]**

4 **Total: 4 marks**

(a) Tick (✓) **one** box in each row to show whether each statement applies to symmetric encryption, asymmetric encryption, or both. **[4]**

Statement	Symmetric	Asymmetric	Both
Uses a public key and a private key			
Turns plain text into cipher text			
The one key used must be shared with the receiver			
The key used to decrypt the data is never sent to the sender			

5 **Total: 4 marks**

An accountancy firm is choosing between symmetric and asymmetric encryption to send clients' records to a partner office.

(a) Describe how the records would be encrypted and decrypted using asymmetric encryption. **[4]**

Total for this worksheet: 21 marks