

Past-paper walk-through

Data storage and compression ■ 1.3

eXercise

Questions in this set

- 0478/11 N25 Q2 ■ 12 marks
- 0478/11 J25 Q1 ■ 4 marks
- 0478/13 N24 Q1 ■ 15 marks
- 0478/13 N24 Q2 ■ 24 marks
- 0478/13 J24 Q1 ■ 3 marks
- 0478/11 J23 Q2 ■ 10 marks
- 0478/12 M23 Q3 ■ 9 marks

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- **//** separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = “or words to that effect” – the wording need not match.

Question 2

0478/11 N25 ■ Q2 ■ 12 marks

An employee of a company sells houses. He sends images of the houses to his company.

(a) The employee compresses the image files using lossy compression before sending them. Lossy compression reduces the size of the image files.

Give **two** other reductions that lossy compression makes to the images.

1. 2.

[2]

Question 2

0478/11 N25 ■ Q2 ■ 12 marks

An employee of a company sells houses. He sends images of the houses to his company.

(b)(i) State the name of the device that reads the destination IP address. [1]

(b)(ii) Identify the part of the packet where the destination IP address is found. [1]

Question 2

0478/11 N25 ■ Q2 ■ 12 marks

An employee of a company sells houses. He sends images of the houses to his company.

(c) The IP address has an IPv6 format.

Give **three** characteristics of the IPv6 format.

1. 2. 3.

[3]

Question 2

0478/11 N25 ■ Q2 ■ 12 marks

An employee of a company sells houses. He sends images of the houses to his company.

(d) An echo check is used to check for errors after the image has been transmitted.

Draw and annotate a diagram to show how the echo check would detect any errors. **[3]**

Question 2

0478/11 N25 ■ Q2 ■ 12 marks

An employee of a company sells houses. He sends images of the houses to his company.

(e)(i) Tick (✓) one box to show the correct statement about symmetric encryption. **[1]**

A Encrypted text is known as plain text.

B The most secure form of encryption.

C The encryption key is shared with any device receiving the encrypted data.

D Two different keys are used.

(e)(ii) Give one other type of encryption that could be used.

[1]

Solution 2

(a)

Mark scheme

- Any two from:
 - Resolution // number of pixels
 - Colour depth // bit depth
 - Quality // detail
 - Metadata

Solution 2

(b)(i)

Mark scheme

- Router

(b)(ii)

Mark scheme

- (Packet) header

Solution 2

(c) Mark scheme

- Any three from:
 - It has 128 bits
 - Hexadecimal
 - Separated by colons
 - 8 groups of digits
 - Each group is 4 digits
 - Consecutive groups of 0s can be represented by :: once

Solution 2

(d) Worked steps

Draw the two devices — **sender** and **receiver** — with annotated arrows showing the data going out and coming back. Any three of:

- The **data is sent to the receiver**, and the receiver **sends a copy back** to the sender.
- The **sender compares** the returned copy with the data it originally sent.
- If they are **the same**, the transmission was successful.
- If they **differ**, an **error occurred** and the data is **sent again**.

Three arrows, all labelled: data out, copy back, and — on a mismatch — the retransmission.

Solution 2

Two limitations are worth one extra annotation each, and they are what distinguishes a good answer: an echo check **cannot tell where the error happened** (the fault may be in the copy coming back rather than in the original transmission), and it **doubles the traffic**, since everything is sent twice.

Solution 2

Compare it with the other checks if there is room: a **checksum** or **parity check** detects an error at the receiver without sending the data back, while an **echo check** returns the whole message. That is why an echo check is thorough and expensive.

Mark scheme

- Any three from:
- The diagram shows:
 - ■ (Data being sent to the receiver) and a copy sent back from the receiver to the sender
 - ■ Sending device comparing the original data and the copy
 - ■ If original data and copy don't match an error is detected

Solution 2

(e)(i)

Mark scheme

- C

(e)(ii)

Mark scheme

- Asymmetric
- 1 sender receiver data copy of data
- Compares original data with the copy sent back and if they don't match an error is detected

Question 1

0478/11 J25 ■ Q1 ■ 4 marks

The size of a file can be measured using different data storage units.

(a) Tick (✓) **one** box to show the smallest data storage unit.

[1]

A byte

B gibibyte (GiB)

C kibibyte (KiB)

D nibble

Question 1

0478/11 J25 ■ Q1 ■ 4 marks

The size of a file can be measured using different data storage units.

(b) State how many tebibytes (TiB) are equal to 2 pebibytes (PiB).

[1]

Question 1

0478/11 J25 ■ Q1 ■ 4 marks

The size of a file can be measured using different data storage units.

(c)(i) Give the name of the process that is used to reduce the size of a file. [1]

(c)(ii) One reason the size of a file may need reducing is so that it has a shorter transmission time.

Give **one** other reason why the size of a file may need reducing. [1]

Solution 1

A byte

B gibibyte (GiB)

C kibibyte (KiB)

D nibble



Answer: **D**

Question 1

0478/13 N24 ■ Q1 ■ 15 marks

Data can be measured using different units of storage.

(a) Tick (✓) **one** box to show which of the following is the largest unit of data storage.

[1]

A ☐ **tebibyte (TiB)**

B ☐ **pebibyte (PiB)**

C ☐ **mebibyte (MiB)**

D ☐ **gibibyte (GiB)**

Question 1

0478/13 N24 ■ Q1 ■ 15 marks

Data can be measured using different units of storage.

(b) A computer has primary storage.

Give **one** example of primary storage.

Explain the purpose of your chosen example.

Explanation

[3]

Question 1

0478/13 N24 ■ Q1 ■ 15 marks

Data can be measured using different units of storage.

(c)(i) Calculate the binary number for the denary number 175. Show all your working.

[2]

(c)(ii) Give the binary number for the given hexadecimal numbers.

15 2D 091

[3]

Question 1

0478/13 N24 ■ Q1 ■ 15 marks

Data can be measured using different units of storage.

(d) Binary integers can be added together.

Add the **two** binary integers using binary addition. Show all your working. Give your answer in binary.

$$\begin{array}{r} 1 1 1 0 0 1 1 \\ + 1 1 0 0 1 1 0 0 \\ \hline \end{array}$$

Question 1

[4]

Question 1

0478/13 N24 ■ Q1 ■ 15 marks

Data can be measured using different units of storage.

(e) Calculate the denary number for the two's complement binary integer 10001110.

Show all your working.

[2]

Solution 1

(b) Mark scheme

One mark for correct example. Two marks for matching explanation.

- **RAM**

- To store data/instruction that is **currently in use**
- To store software/programs that are **currently in use**
- For volatile storage // to store data **temporarily**
- To allow data to be **accessed** directly **by the CPU/processor** // To allow data to be **stored closer** to the **CPU/processor**

- **ROM**

- To **store** the BIOS

Solution 1

- To **store** the bootstrap/bootloader
- To **store** start-up instructions
- To **store** the firmware
- For non-volatile storage // to store data **permanently**
- To **store data/instructions** that **should not change** (unless needed)
- **Cache**
- To **store frequently** used instructions/data
- For volatile storage // to store data **temporarily**

Solution 1

(c)(i) Worked steps

Subtract place values from the largest that fits — 128, 64, 32, 16, 8, 4, 2, 1 — and write the sum out, because **one of the two marks is for the working**.

- $175 = 128 + 32 + 8 + 4 + 2 + 1$

- So 1010 1111

Check by adding the place values back: $128 + 32 + 8 + 4 + 2 + 1 = 175$. ✓

Solution 1

Keep it **eight bits**, with leading zeros if the number is small. The question asks for a binary number in a fixed-width register, and a six-bit answer is the right value in the wrong format.

Mark scheme

- One mark for valid working, for example:



$$128 + 32 + 8 + 4 + 2 + 1$$

- One mark for correct answer:

- 10101111

Solution 1

(c)(ii)

Mark scheme

- 0001 0101
- 0010 1101
- 0000 1001 0001

Solution 1

(d) Worked steps

Add column by column from the right, carrying at 2.

Four marks: **one per correct nibble**, **one for the method** — the carries written in — and **one for identifying the overflow**.

That last mark is the point of the question. Two 8-bit numbers can sum to nine bits, and the ninth has nowhere to go in an 8-bit register: label it **overflow** rather than dropping it or writing a nine-bit answer. The register keeps the low eight bits; the flag records that the result is wrong.

Show the carries. They are a mark of their own and they make a partly right answer markable. [Mark scheme](#)

Solution 1

- One mark for each correct nibble.
- One mark for method of working, for example: carries.
- One mark for identification of overflow.

■

■ 1

■ 1 1 1 0 0 0 1 1

■ + 1 1 0 0 1 1 0 0

■

■ 1 1 0 1 0 1 1 1 1

■

Solution 1

(e) Worked steps

The leading bit is 1, so 1000 1110 is negative. **Flip and add one:**

1 Invert: 0111 0001

2 Add one: 0111 0010

3 Read it: $64 + 32 + 16 + 2 = \mathbf{114}$

4 Restore the sign: $\mathbf{-114}$

Two marks: one for the **working**, one for the **denary answer** — and the question says *show all your working*, so both steps belong on the page.

Solution 1

The alternative is to give the top bit the place value **−128**: $-128 + 8 + 4 + 2 = -114$.

✓ Doing both is a one-line check on an answer that is otherwise easy to get sign-wrong.

Mark scheme

- One mark for correct working, for example: flip and add
- One mark for correct denary.
- −114

Question 2

0478/13 N24 ■ Q2 ■ 24 marks

An employee has a report that they need to email to their employer.
The employee compresses the report file before emailing it.

(a) State the effect the compression has on the report file.

[1]

Question 2

0478/13 N24 ■ Q2 ■ 24 marks

An employee has a report that they need to email to their employer.

The employee compresses the report file before emailing it.

(b) Give **two** benefits of compressing the report file before emailing it.

1. 2.

[2]

Question 2

0478/13 N24 ■ Q2 ■ 24 marks

An employee has a report that they need to email to their employer.

The employee compresses the report file before emailing it.

(c) The employee decides to use lossless compression to compress the file.

Explain why lossy compression is **not** suitable.

[3]

Question 2

0478/13 N24 ■ Q2 ■ 24 marks

An employee has a report that they need to email to their employer.

The employee compresses the report file before emailing it.

(d)(i) State what Unicode is an example of. [1]

(d)(ii) Give **two** advantages of the computer using Unicode instead of American standard code for information interchange (ASCII).

1. 2. [2]

(d)(iii) Give **one** disadvantage of the computer using Unicode instead of ASCII. [1]

Question 2

0478/13 N24 ■ Q2 ■ 24 marks

An employee has a report that they need to email to their employer.

The employee compresses the report file before emailing it.

(e)(i) Circle **three** items of data that can be found in the packet header.

- trailer
- originator's address
- payload
- interrupt
- input
- operating system
- destination address

Question 2

- antivirus
- packet number

[3]

(e)(ii) Each packet is sent along a different path from the employee's device to the employer's device.

Tick (✓) **one** box to show the name of this method of sending packets.

[1]

A packet networking

B packet circuiting

C packet switching

D packet transferring

(e)(iii) A hardware device is used to control the path that each packet takes.

Question 2

Give the name of this hardware device.

[1]

Question 2

0478/13 N24 ■ Q2 ■ 24 marks

An employee has a report that they need to email to their employer.

The employee compresses the report file before emailing it.

(f)(i) Explain how the echo check is used to check for errors in the email data. **[3]**

(f)(ii) In the checksum error detection method, two values are compared after transmission. If the values do **not** match, an error is detected.

Explain why the values **not** matching would show an error has occurred. **[2]**

Question 2

0478/13 N24 ■ Q2 ■ 24 marks

An employee has a report that they need to email to their employer.

The employee compresses the report file before emailing it.

(g)(i) Give **one** reason why the email data is encrypted. [1]

(g)(ii) Give **one** similarity between symmetric encryption and asymmetric encryption. [1]

(g)(iii) Give **two** differences between symmetric encryption and asymmetric encryption.

1. 2. [2]

Solution 2

(a)

Mark scheme

- The file size will be reduced

Solution 2

(b)

Mark scheme

Any two from:

- It will be under the file size limit for the email
- It will be uploaded/transmitted/downloaded faster
- It will take less storage space (on computer)
- It will use less data allowance (if mobile data used)
- Requires less bandwidth

Solution 2

(c)

Mark scheme

Any three from:

- Data will be **permanently** removed
- ...and that could be **important/necessary** data
- (The report will have text in it and) lossy is not suitable for **text files**
- ...as it will **damage/corrupt** the file
- The report may have images in it and the quality of these will be reduced

Solution 2

(d)(i)

Mark scheme

- Character set

(d)(ii)

Mark scheme

Any two from:

- It can represent **more characters**
- It can represent emojis/symbols
- It can represent more languages

Solution 2

(d)(iii)

Mark scheme

- Each character requires more **storage** space

Solution 2

(e)(i)

Mark scheme

- originator's address
- destination address
- packet number

(e)(iii)

Mark scheme

- Router

Solution 2

(f)(i)

Mark scheme

- A copy of the data is sent back to the employee's device/sender
- The employee's device/sender **compares** the data sent to the data received back
- If the **original and the copy** do not **match**, an error has occurred

Solution 2

(f)(ii)

Mark scheme

Any two from:

- The checksum is **calculated** from/using the **data**
- ...using the **same algorithm**
- ...so, if the values are different the **data must be different**

Solution 2

(g)(i)

Mark scheme

Any one from:

- To keep it secure
- The data is sensitive/confidential
- To make it meaningless

Solution 2

(g)(ii)

Mark scheme

Any one from:

- They both use a key
- They both scramble the data // both make the data meaningless
- They both turn plain text into cypher text

Solution 2

(g)(iii)

Mark scheme

Any two from:

- Symmetric uses one/public key whereas asymmetric uses two/public and private keys
- Symmetric can send the key with the data whereas asymmetric does not
- Symmetric decrypts the data using the same key whereas asymmetric decrypts the data using a different key
- Symmetric is less secure than asymmetric

Question 1

0478/13 J24 ■ Q1 ■ 3 marks

The size of a file can be measured in different units.

- (a) State how many bits there are in a byte. [1]
- (b) State how many kibibytes (KiB) there are in 2 mebibytes (MiB). [1]
- (c) Identify the unit of data that is equal to 4 bits. [1]

Solution 1

(a)

Mark scheme

■ 8

Solution 1

(b)

Mark scheme

■ 2048

Solution 1

(c)

Mark scheme

■ nibble

Question 2

0478/11 J23 ■ Q2 ■ 10 marks

- 2** A student has a sound file that is too large to be stored on their external secondary storage device. The student compresses the sound file to make the file size smaller.

The compression method used reduces the sample rate and the sample resolution of the sound file.

- (a)** State what is meant by the sample rate and sample resolution.

Question 2

[2]

- (b)** Identify which type of compression has been used to compress the sound file.

Question 2

- (c) The student sends the sound file to a friend. The file is transmitted across a network that uses packet switching.
 - (i) Identify **two** pieces of data that would be included in the header of each packet.

Question 2

[2]

- (ii) Explain how the file is transmitted using packet switching.

Solution 2

(a)

Mark scheme

- One mark for each correct definition:
 - ■
- The sample rate is the number of samples taken in a second/per time unit
- ■
- The sample resolution is the number of bits per sample
- 2

Solution 2

(b)

Mark scheme

- ■
- Lossy compression
- 1

Solution 2

(c)(i) Mark scheme

- Any two from:
- e.g.
- ■
- Destination/receivers (IP) address
- ■
- Packet number
- ■
- Originator's/senders (IP) address

Solution 2

■ 2

Solution 2

(c)(ii) Mark scheme

- Any five from:
 - ■
 - Data is broken/split/divided into packets
 - ■
 - Each packet (could) take a different route
 - ■
 - A router controls the route/path a packet takes
 - ■

Solution 2

- ... selecting the shortest/fastest available route/path
- ■
- Packets may arrive out of order
- ■
- Once the last packet has arrived, packets are reordered
- ■
- If a packet is missing/corrupted, it is requested again
- 5

Question 3

0478/12 M23 ■ Q3 ■ 9 marks

3 A new computer comes with primary and secondary storage.

(a) Data storage is measured using binary denominations.

Complete each conversion.

Question 3

Working space

[4]

Question 3

(b) Random access memory (RAM) is an example of primary storage.

Give **three** examples of data that is commonly stored in RAM.

Question 3

[3]

- (c) Describe the purpose of secondary storage.

Solution 3

(a)

Mark scheme

- One mark each:
- $8 \text{ bytes} = 16 \text{ nibbles}$
- $512 \text{ KiB} = 0.5 \text{ MiB}$
- $4 \text{ GiB} = 4096 \text{ MiB}$
- $1 \text{ EiB} = 1024 \text{ PiB}$
- 4

Solution 3

(b) Mark scheme

- Any three from:
 - ■
 - Currently running data
 - ■
 - Currently running (application) software
 - ■
 - Currently running instructions
 - ■

Solution 3

- Currently running parts of OS
- ■
- Currently running utility software
- 3

Solution 3

(c) Mark scheme

- Any two from:
 - ■
 - For non-volatile/permanent/long-term storage of files/data
 - ■
 - To store data that is not currently required by the CPU
 - ■
 - To store data to transfer it to another computer
- 2