

Past-paper walk-through

Methods of error detection ■ 2.2

eXercise

Questions in this set

- 0478/13 J25 Q7 ■ 10 marks
- 0478/12 N24 Q5 ■ 12 marks
- 0478/11 J24 Q9 ■ 20 marks
- 0478/12 J24 Q6 ■ 5 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 7

0478/13 J25 ■ Q7 ■ 10 marks

Data is sent from an employee's computer to a server. The data is correct when it is sent, but an error is detected when the data is received.

(a) Describe how an error can occur in the data during transmission.

[2]

Question 7

0478/13 J25 ■ Q7 ■ 10 marks

Data is sent from an employee's computer to a server. The data is correct when it is sent, but an error is detected when the data is received.

(b) Methods of error detection and correction can be added to make sure that errors are identified after data is transmitted.

Complete the statements about methods of error detection and correction.

Use terms from the list. Not all terms need to be used. You should only use each term once.

- acknowledgement
- automatic repeat query (ARQ)
- binary
- bit

Question 7

- byte
- calculation
- check digit
- checksum
- correct
- echo check
- error
- even
- incorrect
- negative
- number

Question 7

- odd
- positive
- timeout

A parity check is set to be ____ or _____. A parity ____ is added to each byte before transmission to make it match the set parity.

An ____ involves comparing the data sent to the data received back from the receiving device.

An ____ uses acknowledgement and _____. The acknowledgement system can be ____ or ____.

Solution 7

(a)

Mark scheme

- ■ It can suffer Interference/crosstalk.
- ■ ... that could have caused data loss/gained/changed.

Solution 7

(b) Mark scheme

- One mark for each correct term in the correct place.
- ■ odd/even
- ■ even/odd (must be opposite of MP1)
- ■ bit
- ■ echo check
- ■ automatic repeat query (ARQ)
- ■ timeout
- ■ positive/negative or negative/positive

Solution 7

- A parity check is set to be odd or even. A parity bit is added to each byte before transmission to make it match the set parity.
- An echo check involves comparing the data sent to the data received back from the receiving device.
- An automatic repeat query (ARQ) uses acknowledgement and timeout. The acknowledgement system can be positive or negative.

Question 5

0478/12 N24 ■ Q5 ■ 12 marks

A barcode scanning system uses a check digit to check for errors in data on input.

(a) Explain how the barcode scanning system operates to check for errors. [4]

(b)(i) Explain how the data is sent using serial simplex data transmission. [3]

(b)(ii) Explain why serial simplex is the most appropriate method of data transmission for this purpose. [3]

(b)(iii) The data is checked for errors after it has been transmitted to the stock control system.

Give **two** error detection methods that could be used for this purpose.

1. 2. [2]

Solution 5

(a) Mark scheme

- Any four from:
 - A check digit is calculated from/using the barcode data
 - ... using an algorithm // by example e.g. Modulo 11
 - ... and added to the barcode
 - When/after the barcode is scanned the check digit is recalculated ...
 - ... using the same algorithm
 - If the check digits do not match an error has occurred when scanning the barcode // If the check digits match no error has occurred when scanning the barcode

Solution 5

(b)(i)

Mark scheme

- ■ Bits are sent one at a time
- ■ Bits are sent down a single wire
- ■ Data is sent in one direction only

Solution 5

(b)(ii) Mark scheme

- Any three from:
 - The stock control system may be a long distance away
 - ... parallel should not be used in long distance transmission // Serial is more reliable for long distance transmission
 - The data does not need to be sent quickly
 - ... the increased speed of parallel is not needed
 - ... as only small amounts of data need to be sent
 - The bits are sent/arrived in order

Solution 5

- ■ ... the data will not be skewed // the data could be skewed if parallel was used
- ■ ... there will be no data collisions
- ■ There will be less interference/crosstalk (due to single wire)
- ■ ... there will be fewer errors in the data
- ■ No need for a reply/response from stock control system
- ■ ... half-duplex/full-duplex is not necessary as only one way transmission needed

Solution 5

(b)(iii)

Mark scheme

- Any two from:
 - (Odd/even) Parity check // Parity byte check // parity block check
 - Checksum
 - Echo check
 - (Positive/negative) ARQ // Automatic repeat query // Automatic repeat request

Question 9

0478/11 J24 ■ Q9 ■ 20 marks

A company owner has installed a new network. Data is correct before it is transmitted across the network.

The company owner is concerned that data might have errors after transmission.

(a) Explain how the data might have errors after transmission. [3]

(b)(i) Describe how the error detection system operates to check for errors. [8]

(b)(ii) Give **two** other error detection methods that could be used.

1. 2. [2]

(c)(i) Explain how the firewall operates to help protect the network. [5]

(c)(ii) Give **two** examples of malware that the firewall can help protect the network from.

1. 2. [2]

Solution 9

(a) Mark scheme

- Any three from:
 - ■
 - Data could be lost
 - ■
 - Data could be gained/added
 - ■
 - Data could be changed
 - ■

Solution 9

- Bits could be reassembled in the wrong order
- ■
- Interference could occur
- ■
- Crosstalk could occur
- ■
- Data collisions could occur
- ■
- Data packets could time out/reach their hop count
- ■

Solution 9

- Network could be infected with malware

Solution 9

(b)(i) Mark scheme

- Any eight from:
 - ■
- The 1s are counted (in each byte)
- ■
- Each byte has a parity bit
- ■
- If the number of 1s are odd the parity bit is 0 (otherwise it is 1)
- ■

Solution 9

- (The first packet of) data is sent and a timer is started
- ■
- The receiving device counts the number of 1s (in each byte)
- ■
- If the number of 1s are odd/data meets odd parity an acknowledgement is sent to say the data is error free ...
- ■
- ... the sender then sends the next packet of data ...
- ■
- ... and the timer is restarted

Solution 9

- ■
- If the number of 1s is even an acknowledgement is not sent
- ■
- If no acknowledgement is received within a set timeframe/before timeout ...
- ■
- ... the data packet is resent

Solution 9

(b)(ii) Mark scheme

- Any two from:
 - ■
 - Echo check
 - ■
 - Checksum
 - ■
 - Even parity check
 - ■

Solution 9

- Negative ARQ

Solution 9

(c)(i) Mark scheme

- Any five from:
 - ■
 - Criteria can be set (for traffic)
 - ■
 - ... such as a blacklist/whitelist (of IP addresses)
 - ■
 - It will examine traffic coming into the network
 - ■

Solution 9

- It will check that the traffic meets the set criteria
- ■
- ... and will reject it if it does not meet criteria
- ■
- Certain ports used by hackers can be blocked/closed

Solution 9

(c)(ii) Mark scheme

- Any two from:
- Example:
- ■
- Virus
- ■
- Worm
- ■
- Trojan horse

Solution 9

- ■
- Spyware
- ■
- Adware
- ■
- Ransomware

Question 6

0478/12 J24 ■ Q6 ■ 5 marks

The table contains statements about error detection methods.

Complete the table by giving the correct error detection method for each statement.

error detection method	statement
	An odd or even process can be used.
	A value is calculated from the data, using an algorithm. This happens before and after the data is transmitted.
	A copy of the data is sent back to the sender by the receiver.
	Acknowledgement and timeout are used.
	A value is appended to data that has been calculated using the data. This value is checked on data entry.

Question 6

[5]

Question 6

error detection method	statement
.....	An odd or even process can be used.
.....	A value is calculated from the data, using an algorithm. This happens before and after the data is transmitted.
.....	A copy of the data is sent back to the sender by the receiver.
.....	Acknowledgement and timeout are used.
.....	A value is appended to data that has been calculated using the data. This value is checked on data entry.

[5]

Solution 6

Worked steps

One mark for each correct method. The statements describe mechanisms, so match on the **mechanism**, not on the general idea that errors are found.

- **Parity check** (bit, byte or block) — an **odd or even** process: a parity bit is added so that the number of 1s in each byte is odd or even as agreed, and the receiver re-counts.
- **Checksum** — a **calculation is performed on the data** and sent with it; the receiver repeats the calculation and compares the two values.
- **Echo check** — the data is **sent back to the sender**, which compares it with what it sent.

Solution 6

Worked steps

- **Automatic Repeat reQuest (ARQ)** — the receiver **acknowledges** a good packet, and the sender **retransmits** anything not acknowledged within a **time-out**.
- **Check digit** — an **extra digit calculated from the others**, used on data entered by hand such as a barcode or ISBN.

The two words that identify each uniquely are worth holding: *odd/even* is parity, *calculation sent alongside* is a checksum, *sent back* is an echo, *acknowledgement and time-out* is ARQ, and *extra digit on an identifier* is a check digit.

The one to be careful with is parity versus checksum. Both compute something from the data; the difference is that parity adds **one bit per byte** to make a count odd or even, while a checksum computes **one value for the whole block**. [Mark scheme](#)

Solution 6

Worked steps

-
- One mark for each correct method.
 - error detection method statement parity (check/bit/byte/block)
 - An odd or even process can be used.
 - checksum
 - A value is calculated from the data using an algorithm. This happens before and after the data is transmitted.
 - echo check
 - A copy of the data is sent back to the sender by the receiver.

Solution 6

Worked steps

- automatic repeat query/request // ARQ
- Acknowledgement and timeout are used.
- check digit
- A value is appended to data that has been calculated using the data. This value is checked on data entry.