MODULE D DATA TRANSMISSION · D5

Echo checks, check digits and ARQ: mark scheme

20 marks · Cambridge 0478 syllabus 2.2.2 (echo check), 2.2.3, 2.2.4

How to use. Any N from the points listed, up to the max shown. **/** separates alternative words; **//** separates alternative answers. Words in (brackets) are not needed for the mark. Every check-digit sum was checked by program. In Question 2 a correct final answer with no working earns 1 mark only, because the question says "Show your working" and the working is a mark point.

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) 0478 2.2.2	The weather station / sender sends the data to the central computer / receiver The receiver sends a copy of the data (it received) back to the sender The sender compares the data sent back with the original data (it sent) If they match, no error is detected // the data is assumed correct If they do not match, an error is detected ... ... and the data is sent again	**4**	Any 4 from. The comparison must be made by the sender: "the receiver compares" does not earn the comparison mark.
1(b) 0478 2.2.2	The data is sent twice // doubles the amount of data transmitted / transmission time The error may have happened on the way back, so correct data may be resent // it cannot tell whether the error was on the way there or back The same error could (in theory) happen in both directions and not be noticed	**1**	Any 1 from.
2(a) 0478 2.2.3	Working: 3×5 + 7×4 + 1×3 + 9×2 = 15 + 28 + 3 + 18 = 64; 64 ÷ 11 = 5 remainder 9 (1) Check digit = 11 − 9 = **2** (1)	**2**	1 mark for a correct total of 64 or the remainder 9 shown; 1 mark for 2. The answer 9 (the remainder) scores the working mark only. Full code is 37192.
2(b) 0478 2.2.3	Working: 3×5 + 7×4 + 9×3 + 1×2 = 15 + 28 + 27 + 2 = 72; 72 ÷ 11 = 6 remainder 6, so check digit should be 11 − 6 = 5 (1) 5 does not match the typed check digit 2 // rejected (1)	**2**	1 mark for working giving 72 (or the expected check digit 5); 1 mark for "rejected" with that reason. "Rejected" with no working: 1 mark. Allow comparison with 37192 from (a) (digits 1 and 9 swapped) for the working mark. "Accepted": 0.

QUESTION	ANSWER	MARKS	GUIDANCE
3(a) 0478 2.2.3	The check digit is calculated from the other digits (and added to the code) When the code is entered, the computer recalculates the check digit from the entered digits and compares it with the check digit entered If they are different, an error is detected // the code must be re-entered	**2**	Any 2 from. Do not credit a description of parity or a checksum.
3(b) 0478 2.2.3	ISBN // international standard book number Bar code (on products) Product codes // ID / account / membership numbers // vehicle identification numbers	**2**	Any 2 from. Do not credit a brand name.
4(a) 0478 2.2.4	The receiver / print centre checks the data for errors (on arrival) If no error is found, it sends a positive acknowledgement (to the sender) If an error is found, it sends a negative acknowledgement ... ... and the sender sends the data again The sender starts a timer // a timeout when it sends the data If no acknowledgement is received before the timeout, the data is sent again This repeats until a positive acknowledgement is received // (a set number of times)	**4**	Any 4 from. "Acknowledgement" alone without positive/negative or the condition is too vague.
5(a) 0478 2.2.2, 2.2.3, 2.2.4	Row 1: Echo check Row 2: Check digit Row 3: ARQ	**3**	1 mark per correct row. A row with more than one tick scores 0.

Total: 20 marks