MODULE D DATA TRANSMISSION · D4

Parity checks and checksums: mark scheme

21 marks · Cambridge 0478 syllabus 2.2.1, 2.2.2

How to use. One mark per creditworthy point up to the maximum shown. **/** separates alternative words; **//** separates alternative answers. Words in (brackets) are not needed for the mark. A correct answer with no working gets full marks. The 0478 syllabus does not set a particular checksum calculation, so Question 5 needs no calculation method; any valid description of the process is credited.

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) 0478 2.2.1	Any two from: data loss // bits / data missing data gain // extra bits / data added data change // bits changed / flipped (0 to 1 or 1 to 0)	**2**	max 2. Two different ways needed. Do not accept "data is stolen / intercepted" (a security issue, not a transmission error).
1(b) 0478 2.2.1	Any two from: (interference means) the data received may not be the same as the data sent to make sure the data is accurate / correct / not corrupted incorrect readings could otherwise be stored / used / acted on so that data with errors can be identified (and sent again)	**2**	max 2.
2(a) 0478 2.2.2	Row 1: 0 Row 2: 1 Row 3: 0	**3**	1 mark per row. Working: 1010011 has four 1s, so 0 (01010011); 0111011 has five 1s, so 1 (10111011, six 1s); 0000000 has no 1s, so 0 (zero counts as even).
2(b) 0478 2.2.2	11010010: Error detected 01110110: No error detected 10000000: No error detected	**3**	1 mark per correct row. Working: four 1s (even, fails odd parity); five 1s (odd); one 1 (odd). More than one tick in a row = 0 for that row.
3(a) 0478 2.2.2	Any two from: if two / an even number of bits change ... ... the number of 1s is still odd / even (as agreed) // the parity is still correct so the error is not detected bits could be swapped / transposed and the number of 1s is unchanged	**2**	max 2. "It cannot tell which bit is wrong" alone is not creditworthy here (that is about locating an error, not missing one).

QUESTION	ANSWER	MARKS	GUIDANCE
4(a) 0478 2.2.2	Byte 3 Column 6	**2**	1 mark each. Working: 1s in each row (bytes 1-4, parity byte) are 4, 6, **5**, 4, 6, so only byte 3 is odd; 1s in columns 1-8 are 2, 2, 4, 2, 4, **3**, 4, 4, so only column 6 is odd. The changed bit is where they cross.
4(b) 0478 2.2.2	11000011	**1**	Received 11000111: the column 6 bit changes from 1 back to 0. The corrected byte has four 1s (even) and column 6 then has two 1s (even). Correct answer only.
4(c) 0478 2.2.2	Any two from: the 1s in each column (of the four bytes) are counted a (parity) bit is set for each column ... ... so that each column has an even number of 1s these bits together form the parity byte	**2**	max 2. Must refer to columns, not rows. Do not accept "odd number of 1s": this block uses even parity.
5(a) 0478 2.2.2	Any four from: a value / checksum is calculated from the data (using an algorithm) before it is sent the checksum is sent with the data the receiving computer recalculates the checksum from the data received (using the same algorithm) the two checksums are compared if they are different / do not match, an error is detected if they are the same / match, no error is detected // the data is accepted (if there is an error) a request is sent to resend the data	**4**	max 4. No particular calculation method is required. Do not credit a description of a parity bit / counting 1s as the checksum.

Total: 21 marks