

ECT-215 Homework #4 Solution Set

ERROR DETECTION & CORRECTION (SYLLABUS)

Scoring: 23 points total.

1. Define the following terms: (11 points)

- (a) Data Block: A group of data bytes transmitted together
- (b) BCC: Block Check Character
- (c) LRC: Longitudinal Redundancy Check, another name for BCC
- (d) Redundancy (what does it have to do with error detection?):
REDUNDANCY is repeated information. The redundant information may be encoded as a BCC, thus allowing error detection to occur.
- (e) Lateral Parity: A parity bit that is sent "beside" or "with" each transmitted character.
- (f) Longitudinal Parity: A parity "word" that is the result of the modulo-2 summation of all data in the block. It can also be considered to be the count of "even or odd" 1s in columns of transmitted data.
- (g) Checksum: Is the sum of all data in a block.
- (h) Cyclic Redundancy Check: A CRC is a BCC formed by dividing the data in a block by a fixed number called the generator polynomial, then using the remainder. The CRC is the remainder of the division.
- (i) Forward Error Correction (FEC): A FEC system includes enough redundant information in each block to allow certain errors to be corrected without retransmission of the damaged block.
- (j) ACK: Positive ACKnowledge; sent by receiver when block is good.
- (k) NAK: Negative acknowledge; sent by receiver to tell transmitter to re-transmit data block.

2. What is the primary difference between an ERROR DETECTING and a FORWARD ERROR DETECTING system? (2 points)

An ERROR-DETECTING system only computes the presence of an error. It responds to errors by retransmission of the data.

A FORWARD-ERROR-CORRECTING system, however, may be able to correct certain types of errors in damaged blocks without requiring the sender to transmit the same block again.

3. What is the advantage of a 2's complement checksum over a standard or "normal" checksum? (1 point)

The 2's complement checksum simplifies receiver hardware and software.

4. Calculate a normal 8-bit checksum for the following message:
(2 points for work, 1 point for correct answer)

"I THINK HOMER IS OK."

The Quote (") marks are NOT part of the data. Don't forget the blanks!

EXPRESS IN HEXADECIMAL. SHOW ALL WORK.

A table should be shown giving each letter of the message, and its ASCII value. The correct checksum is 26H.

5. Repeat exercise 4, but use EVEN LONGITUDINAL PARITY; FORM AN 8-BIT BCC.
(2 points for work, 1 point for correct answer)

EXPRESS IN HEXADECIMAL. SHOW ALL WORK.

A table should be shown giving each letter of the message, and its ASCII value. The correct result is 74H.

6. A CRC system has the following generator polynomial: (3 points total)

$$G(x) = X^3 + X + 1$$

- (a) How long will the BCC be, in bits? 3 Bits, as degree is 3. (1 point)

Long Divisions MUST be shown for answers (b) and (c):

- (b) Calculate the BCC for data A5H. The BCC is 101₂ (binary). (1 point)

- (c) Calculate the BCC for data E7H. The BCC is 111₂ (binary). (1 point)