Practical 6

AIM:

Write a program to implement error detection and correction using HAMMING code concept. Make a test run to input data stream and verify error correction feature.

Algorithm:

Convert Text to Binary:

- Input: txt (text string)
- Process: Convert each character in txt to an 8-bit binary string and concatenate the results.
- Output: Binary representation of txt.

Calculate Number of Redundant Bits:

- Input: m (length of binary data)
- Process: Calculate the minimum number of redundant bits r required such that 2r≥m+r+12^r \geq m + r + 12r≥m+r+1.
- Output: r, the number of redundant bits.

Position Redundant Bits in Binary Data:

- Input: data (binary data without redundant bits) and r
- Process:
    - Insert 0 at positions 2i2^i2i (1, 2, 4, 8, ...) to reserve space for redundant bits.
    - Keep track of these positions in r_pos.
- Output: Binary data arr with placeholders for redundant bits and list r_pos of their positions.

Calculate Parity Bits:

- Input: arr (binary data with redundant bit placeholders) and r
- Process:

  - For each position 2i2^i2i, calculate parity by XOR-ing all bits covered by this position in binary (positions for which the bitwise AND with 2i2^i2i is non-zero).
  - Update each redundant bit placeholder in arr with the calculated parity value.
- Output: Binary data arr with calculated redundant (parity) bits.

Sender Output:

- Print the final binary data with redundant bits added.

Induce Error (Optional):

- Input: Binary data arr and error position pos
- Process: Flip the bit at position pos.
- Output: Corrupted binary data.

Detect and Fix Error:

- Input: Corrupted binary data data and r
- Process:
  - For each position 2i2^i2i, calculate parity as in step 4.
  - Sum up positions of incorrect parity bits to find the error position res.
  - If res is non-zero, flip the bit at this position to correct the error.
- Output: Corrected binary data and the error position.

Remove Redundant Bits:

- Input: Corrected binary data and r
- Process: Remove bits at redundant positions 2i2^i2i.
- Output: Original binary data without redundant bits.

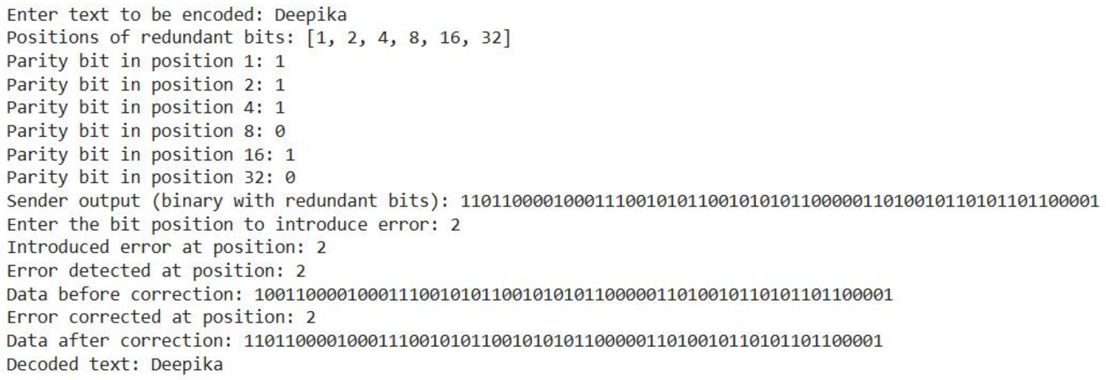
Convert Binary to Text:

- Input: Original binary data without redundant bits.
- Process: Split binary data into 8-bit chunks, convert each chunk to its ASCII character, and concatenate.
- Output: Decoded text.

Display Results:

- Display the encoded binary data, induced error, error detection, correction process, and decoded text.

Output;



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Enter text to be encoded: Deepika
Positions of redundant bits: [1, 2, 4, 8, 16, 32]
Parity bit in position 1: 1
Parity bit in position 2: 1
Parity bit in position 4: 1
Parity bit in position 8: 0
Parity bit in position 16: 1
Parity bit in position 32: 0
Sender output (binary with redundant bits): 11011000010001110010101100101010110000011010010110101101100001
Enter the bit position to introduce error: 2
Introduced error at position: 2
Error detected at position: 2
Data before correction: 10011000010001110010101100101010110000011010010110101101100001
Error corrected at position: 2
Data after correction: 11011000010001110010101100101010110000011010010110101101100001
Decoded text: Deepika
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