

Computer Network

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Aim : To Perform Cyclic Redundancy Check (CRC) for error detection

Theory :

The Cyclic Redundancy Check (CRC) is a technique used to detect errors in digital data. CRC is a hash function that detects accidental changes to raw computer data commonly Used in digital telecommunications networks and storage devices such as **Hard Disk Drivers**.

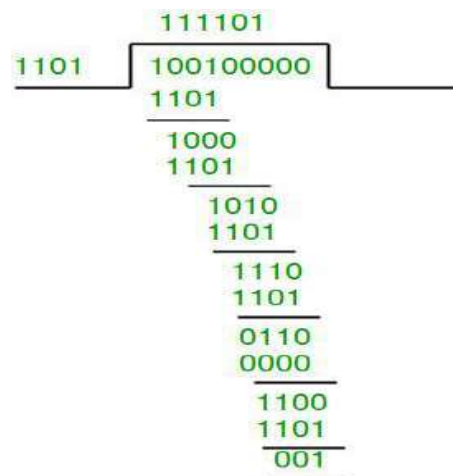
CRC uses generator polynomials which are available on both sender and receiver side .

An example generator polynomial is of the form like $x^3 + x + 1$. This generator polynomial represents key 1011.

n : Number of bits in data to be sent from sender side

k : Number of bits in the key obtained from the generator polynomial.

Example : Data = 100100, Generator Polynomial (Key) = $x^3 + x^2 + 1$ (1101)



The remainder is 001. Thus the data sent is **100100001**.

Code :

```
def xor_bits(a, b):
    return '0' if a == b else '1'

def main():
    data = input("Enter binary data (e.g., 1011001): ").strip()
    gen = input("Enter binary generator (e.g., 1011): ").strip()
    if not all(bit in '01' for bit in data) or not all(bit in '01' for bit
in gen) or len(gen) < 2:
        print("Invalid input! Use '0's and '1's. Generator must be at
least 2 bits.")
        return
    k = len(gen)
    fcs_len = k - 1

    # Append (k-1) zeros to the data for division
    temp_data_bits = list(data + '0' * fcs_len)

    for i in range(len(data)):
        if temp_data_bits[i] == '1':
            for j in range(k):
                temp_data_bits[i + j] = xor_bits(temp_data_bits[i + j],
gen[j])

    remainder = "".join(temp_data_bits[-fcs_len:])
    codeword = data + remainder
    print(f"\nOriginal Data: {data}")
    print(f"Generator:      {gen}")
    print(f"Calculated Codeword: {codeword}")

if __name__ == "__main__":
    main()
```

Output :

```
Enter binary data (e.g., 1011001): 1010101010
Enter binary generator (e.g., 1011): 11001

Original Data: 1010101010
Generator:      11001
Calculated Codeword: 10101010100010
```

Conclusion : CRC is a reliable and efficient technique for detecting errors in digital data. It helps ensure data integrity during transmission or storage by identifying changes using polynomial division.