

Chapter – IX
Cascaded Encoders

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Chapter – VIII

Cascaded Encoders

9 Introduction

The six encoders are presented in six previous chapters. The principle of encoders are stated, verified through a microprocessor based system and analyzed. These are

1. Prime Position Encoding (PPE)
2. Triangular Encoding (TE)
3. Recursive Pair Parity Encoder (RPPE)
4. Modified Rotational Encoder (MRE)
5. Modified Johnson Encoder (MJE)
6. Bit Swap Encoder (BSE)

The first three encoders are symmetric in nature, while fourth and fifth are asymmetric and again last one (BSE) is symmetric, with reference to the encryption of a message. An encoder will be designated as symmetric, when the encoding process applied repeatedly on a string, generates the original string. The fourth and fifth have lost its symmetric character; the least significant bit of each byte in the string has been inverted before the transformation is applied. If this operation (lsb inversion) is excluded, then rotational and Johnson encoding are basically symmetric encoders. So the last two encoders have been transformed into the cascaded encoders due to adding of lsb inversion to overcome the shortcomings adhered to.

9.1 Cascading of Encoders

It is proposed that any two encoders, out of these six encoders, can be cascaded, one encoder followed by other, to have a cascaded encoder. There may be 28 encoders possible as shown in the table 9.1.

Table 9.1: Possible Cascaded Encoders

Number	Cascaded Encoder	Number	Cascaded Encoder
1	(1,2)	15	(2,1)
2	(1,3)	16	(3,1)
3	(1,4)	17	(4,1)
4	(1,5)	18	(5,1)
5	(1, 6)	19	(6,1)
6	(2,3)	20	(3,2)
7	(2,4)	21	(4,2)
8	(2,5)	22	(5,2)
9	(2,6)	23	(6,2)
10	(3,4)	24	(4,3)
11	(3,5)	25	(5,3)
12	(3,6)	26	(6,3)
13	(4,5)	27	(5,4)
14	(4,6)	28	(6,4)

Here, the encoders (4) and (5) are considered without lsb inversion and hence, symmetric. The encoder (1,2) indicates the encoder (1) followed by encoder (2) i.e. the output of the encoder (1) is connected to input of the encoder (2). The string is supplied as input to the encoder (1) and available at the output of the encoder (2), as shown in fig 9.1.

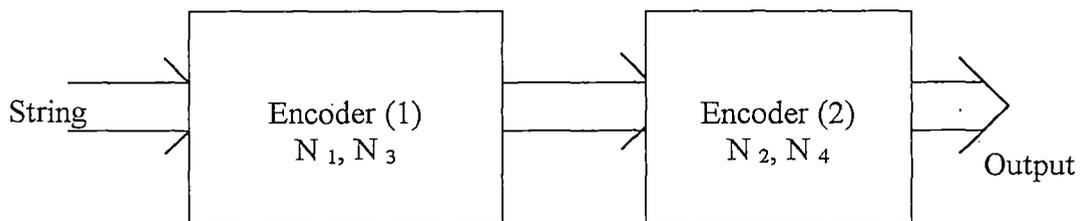


Fig 9.1: Principle of Cascaded Encoders

The encoded string is available from the output of second encoder. It is to mentioned that each of the encoders are symmetric, but the cascaded encoder as whole as a whole becomes asymmetric. The same encoding process under cascaded condition applying on a string, will not decode the original string. Hence, a separate encoding and decoding process are required.

a) Encoding:

Referring to fig 9.1, it is assumed that encoder (1) and encoder (2) need N_1 and N_2 operations respectively to get back a string. And it is also assumed that N_3 operation is applied and then it is sent to the encoder (2), where N_4 operation is applied and final output is available as the encoded string. N_1 and N_2 are known from the encoders selected and N_3 and N_4 are selected at the time of encoding by the user. N_3 and N_4 should be less than N_1 and N_2 respectively.

b) Decoding:

To decode the encoded string, it is first sent to the encoder (2) and is subjected to $(N_2 - N_4)$ operation and then sent to the encoder (1) for $(N_1 - N_3)$ operations.

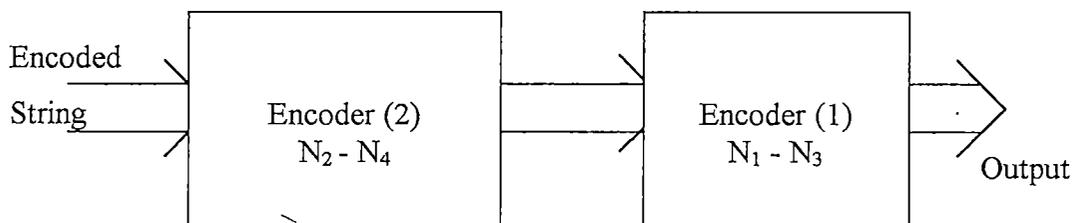


Fig 9.2: Decoding

The original string will be available from the output of the encoder (1).

9.2 Effect of Cascading

The cascading of encoders make the encoding more effective as far as security is concerned, as the complexity of the encoding may increase. But the encoding and the decoding will take much time in cascaded condition and will be asymmetric in character. Similarly three, four, five and six encoders may be cascaded for better security of a message.

9.3 Conclusion

The cascading makes the symmetric encoders into an asymmetric one. At the same time it may increase the complexity of the over-all encoder. The cascaded encoders may be useful where a better security of the message is demanded. The detailed study of cascaded encoders for which combination the security would be maximum is to be evaluated.