eg: Source 'S' emitting four symbols which are encoded with binary coding

$S = \{ s_1, s_2, s_3, s_4 \}$ and $X = \{ 0, 1 \}$

Block code :

Source symbol	Code-A
S_1	00
S_2	01
S_3	10
S_4	11

The sequences 00, 01, 10 & 11 are called the "code-words" for source symbols s_1, s_2, s_3, s_4 respectively.

2. Non-Singular Code :

A block code is said to be "non-singular" iff all the code words are "distinct" and easily "distinguishable" from one another.

Consider code A ; it is non-singular.

eg: Consider $S = \{ s_1, s_2, s_3, s_4 \}$ with $X = \{ 0, 1 \}$. Let assign the code-words.

Source symbol	Code B
s_1	0
s_2	00
s_3	01
s_4	11

Code B appears non-singular, but not so. Second extension of these code words.

Source symbol	code B'	Source symbol	code B'
$s_1 s_1$	00	$s_3 s_1$	010
$s_1 s_2$	000	$s_3 s_2$	0100
$s_1 s_3$	001	$s_3 s_3$	0101
$s_1 s_4$	011	$s_3 s_4$	0111
$s_2 s_1$	000	$s_4 s_1$	110
$s_2 s_2$	0000	$s_4 s_2$	1100
$s_2 s_3$	0001	$s_4 s_3$	1101
$s_2 s_4$	0011	$s_4 s_4$	1111

codewords for $s_1 s_2$ and $s_2 s_1$ are same second extension of code B are not distinct and hence it become 'singular'

3. Uniquely Decodable codes:

A non-singular code is said to be "uniquely decodable" or "uniquely decipherable" if every codeword present in a long received sequence can be uniquely identified.

eg: Received a sequence at the receiver in the absence of noise; R = 001100.

① Code A is used:

Decoded as: $s_1\ s_4\ s_1$

→ It is the only possible way.

② Code B is used:

Decoded as: $s_2\ s_4\ s_2$ or

$s_1\ s_1\ s_4\ s_1\ s_1$ or

$s_1\ s_1\ s_4\ s_2$ or

$s_2\ s_4\ s_1\ s_1$

→ not uniquely decodable.

4. Instantaneous Codes:

A uniquely decodable code is said to be instantaneous if it is possible to recognize the end of any code word in any received sequence, with out reference to the succeeding symbols. There is no time delay in the process of decoding & decoding is instantaneous.

eg: Consider three codes: