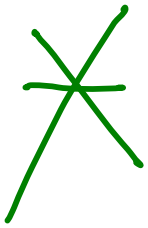


VARIABLE LENGTH CODE

$M = 4$

s_0	0
s_1	1
s_2	0 0
s_3	1 1

codeword for s_0 is a prefix of codeword for s_2

Variable Length code.

Different symbols have different number of bits

NOT uniquely Decodable.

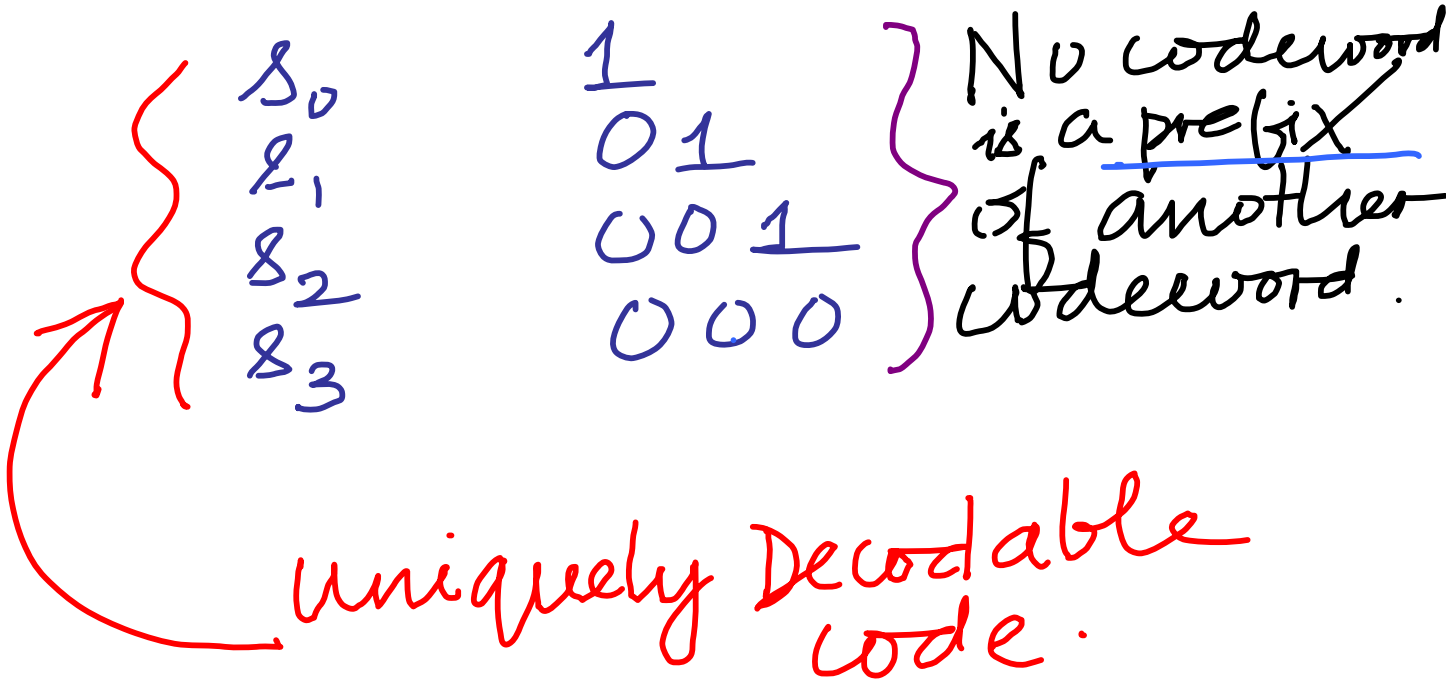
0 0 0

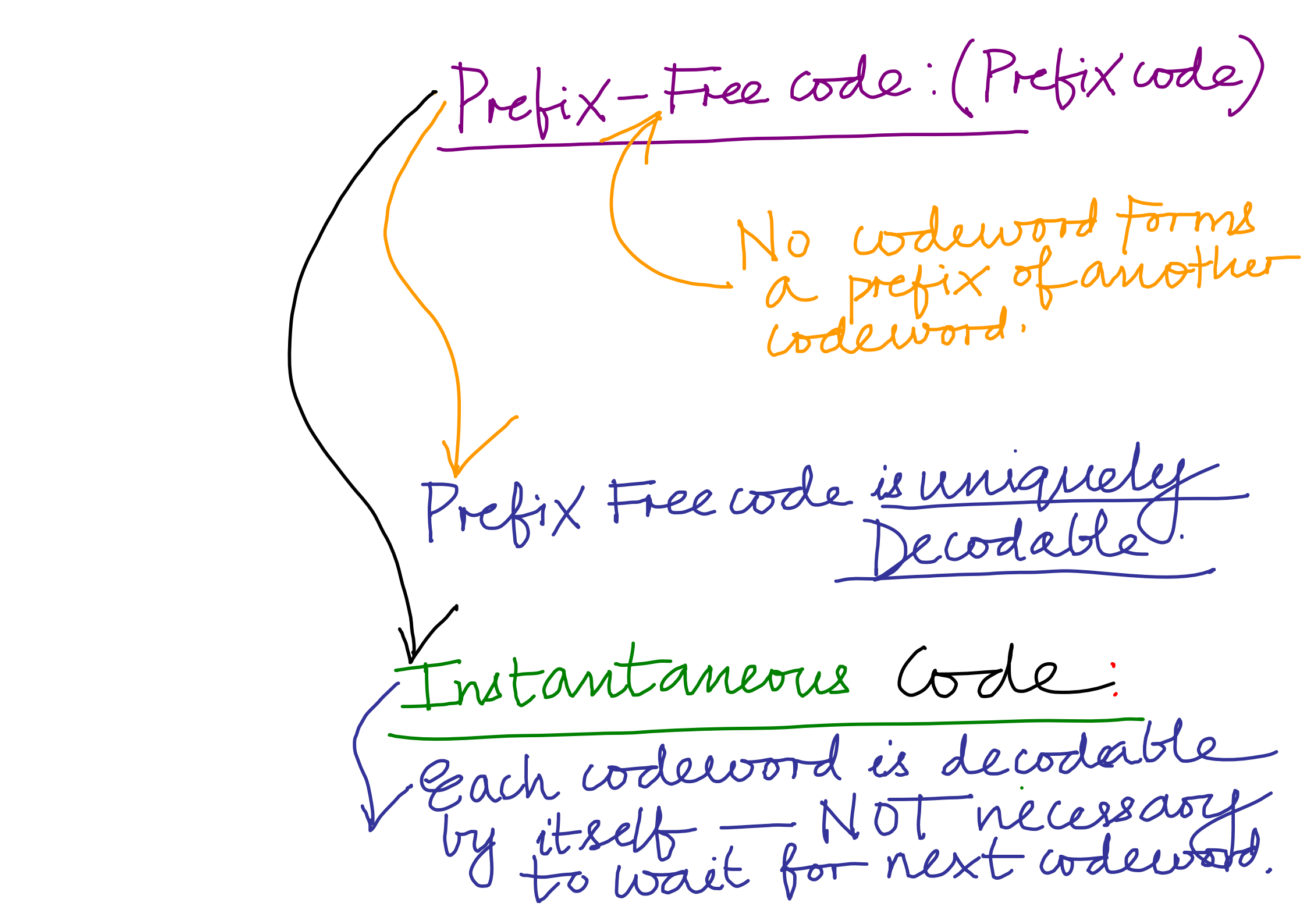
x_0 x_2

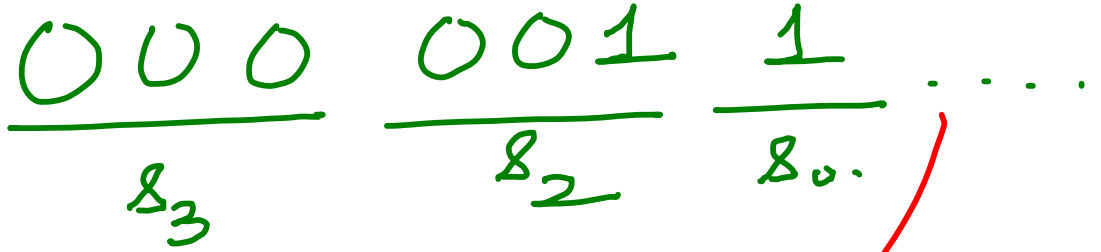
x_2 x_0.

$\Rightarrow$ Coded symbol sequence cannot be perfectly recovered.

UNIQUELY DECODABLE CODES




Prefix-Free code: (Prefix code)
No codeword forms a prefix of another codeword.
Prefix Free code is uniquely Decodable.
Instantaneous Code:
Each codeword is decodable by itself — NOT necessary to wait for next codeword.



NOT necessary to wait until next codeword.

Prefix Free code $\iff$ Instantaneous code.

"Uniquely Decodable".

AVERAGE CODE LENGTH & COMPRESSION

Let symbol s_i — l_i bits

Ex: s_1 — 000
$l_1 = 3$ bits

Let the probability of occurence

$$Pr(X = s_i) = p_i$$

Average code length
or average codeword length

$$= \sum_{i=0}^{M-1} p_i l_i$$

$$L = \sum_{i=0}^{M-1} p_i l_i$$

Average code length

We would like to minimize average length as well as develop fundamental insights into the code design process.

What is the minimum possible average code length for a given source?