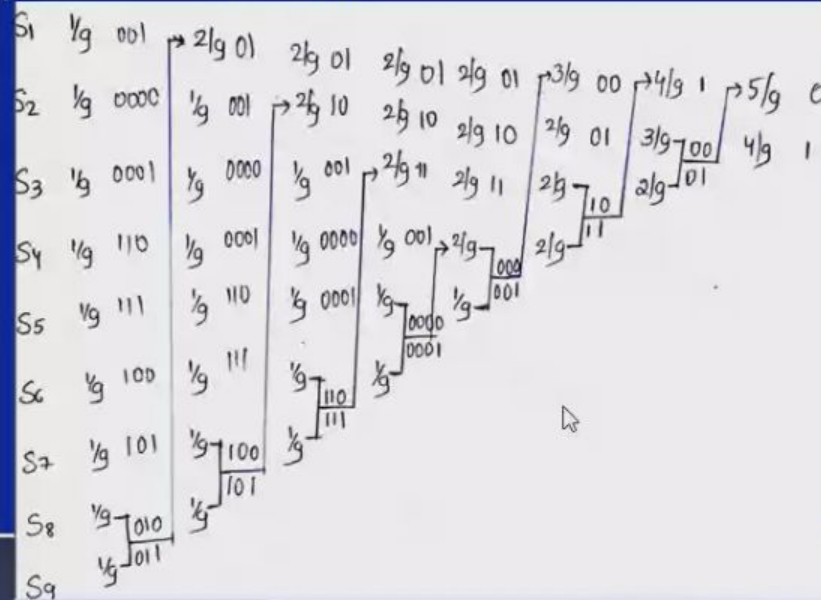- Ex.2: A source has 9 symbols and each occur with a probability of 1/9. Construct a binary Huffman code. Find efficiency and redundancy of coding.

- Solution:

- $q = r + \alpha(r-1)$

- $9 = 2 + \alpha(1) \quad \Rightarrow \quad \alpha = 7 \in Z$

S_1	1/9	001	→ 2/9 01	2/9 01	2/9 01	2/9 01	→3/9 00	→4/9 1	→5/9 0
S_2	1/9	0000	1/9 001	→2/9 10	2/9 10	2/9 10	2/9 01	3/9 ┌00	4/9 1
S_3	1/9	0001	1/9 0000	1/9 001	→2/9 11	2/9 11	2/9 ┌10	2/9 └01	
S_4	1/9	110	1/9 0001	1/9 0000	1/9 001	→2/9 ┌000	2/9 └11		
S_5	1/9	111	1/9 110	1/9 0001	1/9 ┌0000	1/9 └001			
S_6	1/9	100	1/9 111	1/9 ┌110	1/9 └0001				
S_7	1/9	101	1/9 ┌100	1/9 ┌110					
			└101	└111					
S_8	1/9 ┌010	1/9							
	└011								
S_9									

Symbols	Codes	Probabilities	Length
S_1	001	1/9	3
S_2	0000	1/9	4
S_3	0001	1/9	4
S_4	110	1/9	3
S_5	111	1/9	3
S_6	100	1/9	3
S_7	101	1/9	3
S_8	010	1/9	3
S_9	011	1/9	3

- $H(S) = \dfrac{9}{9} log_2 9$
- $H(S) = 3.17 \; bits/symbol$

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- $L = \sum_{i=1}^{9} P_i L_i =$
  $\frac{1}{9}(3+4+4+3+3+3+3+3+3)$
- $L = 3.22 \ bits/symbol$
- $\%\eta = \frac{H(S)}{L} * 100 = 98.45\%$
- Redundancy=100-% η=1.55%

- Ex. 3: Given the messages x_1, x_2, x_3, x_4, x_5 & x_6 with probabilities 0.4, 0.2, 0.2, 0.1, 0.07, 0.03. Construct binary and trinary code by applying Huffman encoding procedure. Also find efficiency and redundancy.

- Solution:

- Binary-Homework

- Trinary: $q = r + \alpha(r - 1)$

- 6=3+α(2)   =>   α=3/2 ;