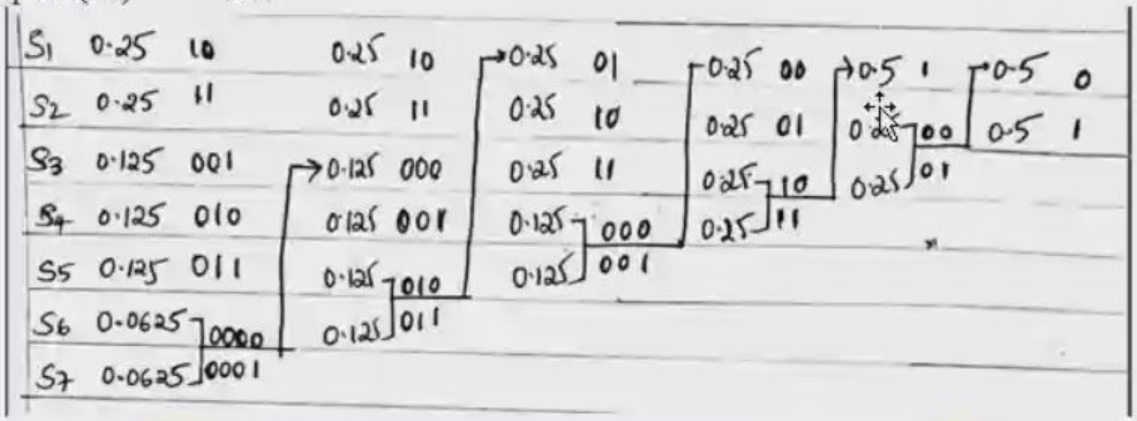
And also construct code tree.

Solution:

$q=r+\alpha(r-1) \quad \Rightarrow \alpha=5$



Symbols	Pi	Code	length
S1	0.25	10	2
S2	0.25	11	2
S3	0.125	001	3
S4	0.125	010	3
S5	0.125	011	3
S6	0.0625	0000	4
S7	0.0625	0001	4

H(S)=2.625 bits/symbol

L=2.625 bits/symbol

%η=H(s)/L=100%

$$\text{Channel efficiency} = \frac{I(X,Y)}{C}$$

$$= \frac{0.1686}{0.1887}$$

$$\therefore \quad \eta_{ch} = 89.35\%$$

Channel Redundancy $= \eta_{ch} = 10.65\%$

Problem : Consider a source with 8 alphabet A to H with respective probabilities of
0.22, 0.20, 0.18, 0.15, 0.10, 0.08, 0.05, 0.02.

i] Construct a binary compact code and determine the code efficiency.

ii] Construct a ternary compact code and determine efficiency of the code

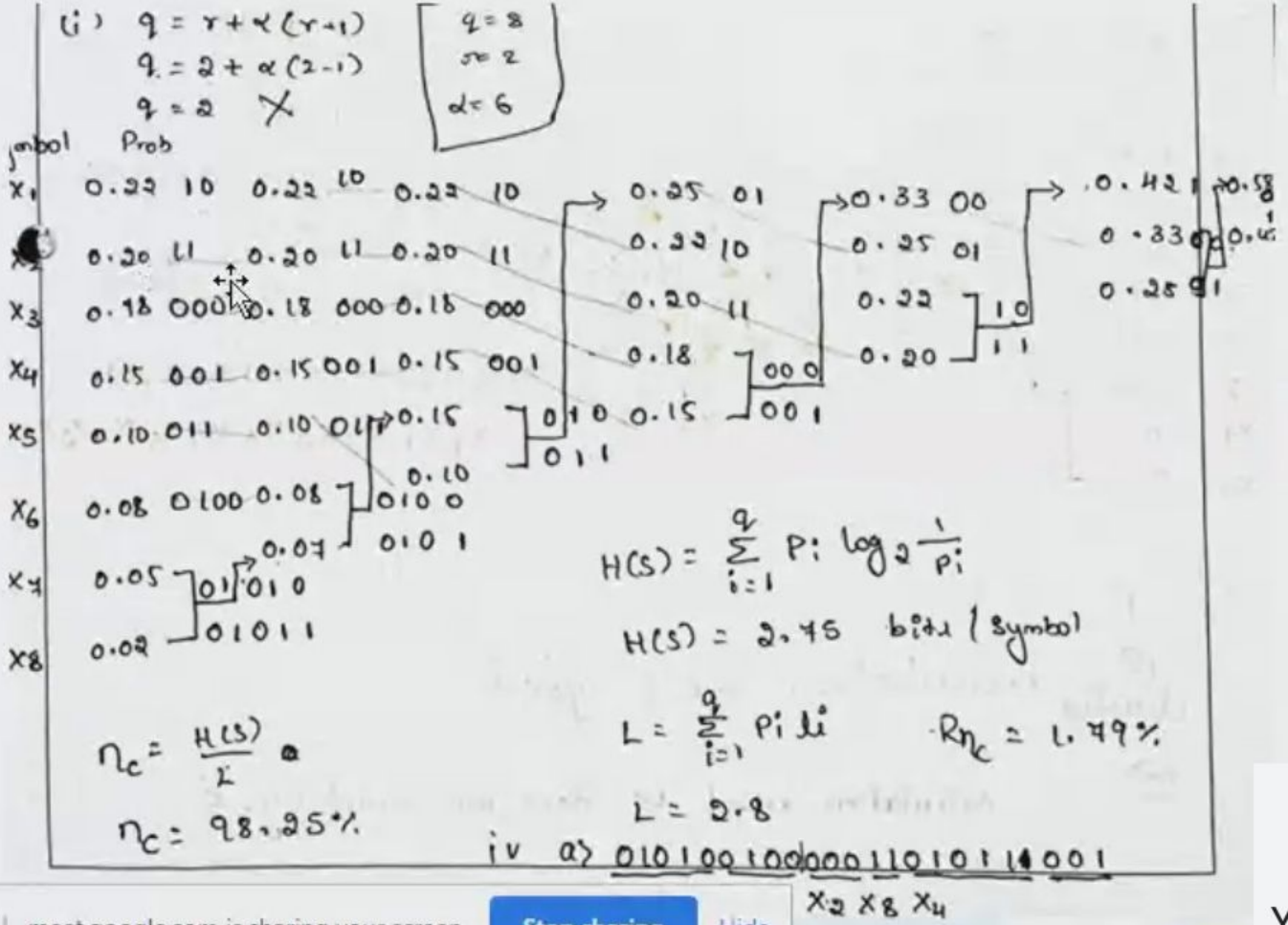
iii] Construct a quaternary compact code and determine the code efficiency. Compare and comment on the result. Draw code trees for all three cases.

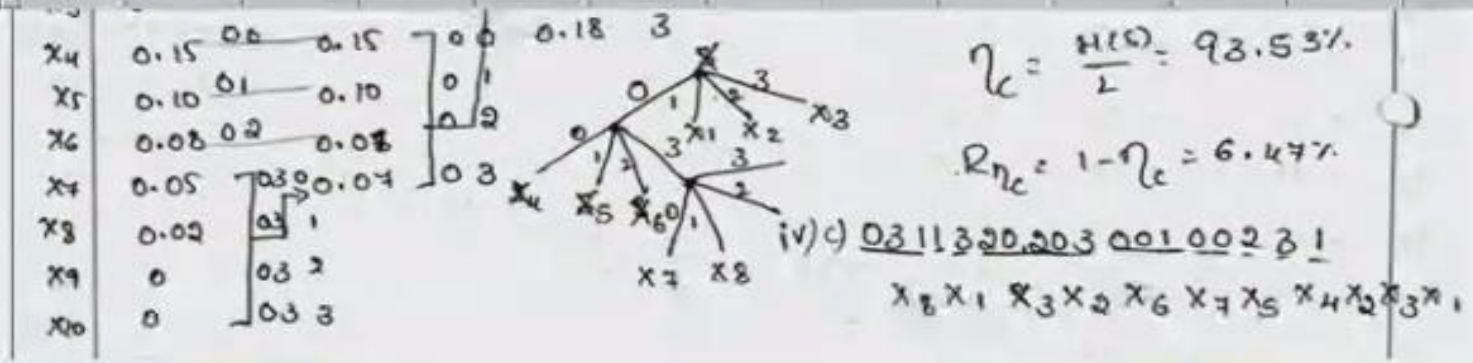
iv] Decode the messages using appropriate code trees

a) 0101001000001101011001…

b) 12111011020012002 ….

c) 031132020300100231 …..





$\eta_c = \frac{H(S)}{L} = 93.53\%$

$R_{\eta_c} = 1 - \eta_c = 6.47\%$

Problem : Consider a Zero memory source with S=[S1,S2,S3,S4,S5,S6,S7] and Probabilities P=[0.4,0.2,0.1,0.1,0.1,0.05,0.05]

i. Construct a binary Huffman code by placing the composite symbol as low as possible.
ii. Repeat (i) by moving a composite symbol as high as possible.
iii. In each of the cases (i) and (ii) above,
   - Compute the variances of the word lengths and comment on the result.
   - Find Efficiency and Redundancy.
iv. Considering Case(ii) table,
   - Write the code tree and decode the message 011101100110001000……
   - Determine probabilities of 0's and 1's.

Tips: Variance= $\sum_{i=1}^{i=q} P_i\ (l_i - L)^2$

Probability of 0's : $P(0) = \frac{1}{L}\sum_{i=1}^{i=q}(No.\ of\ 0's\ in\ the\ code\ for\ Si)\ P_i$

r 12