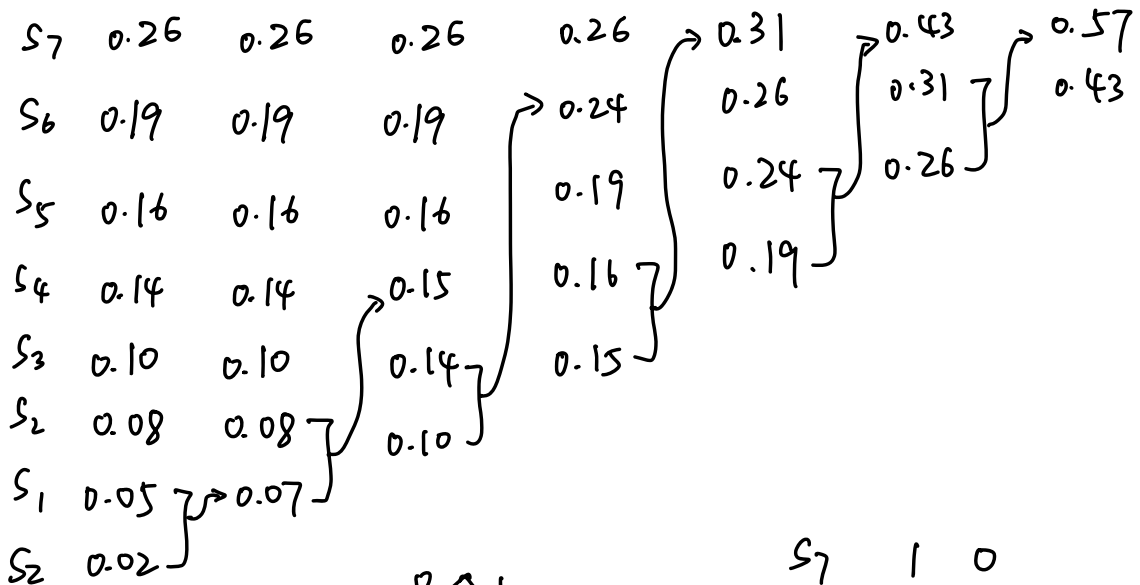
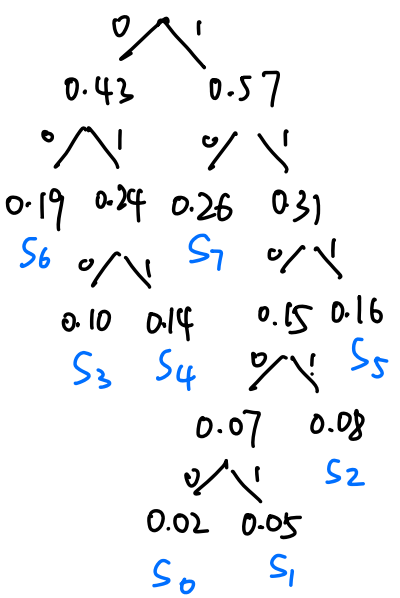
Exercise Huffman Coding 2.

Q: (i) Huffman

Solution





S_7	1	0			
S_6	0	0			
S_5	1	1	1		
S_4	0	1	1		
S_3	0	1	0		
S_2	1	1	0	1	
S_1	1	1	1	0	1
S_0	1	1	1	0	0

(ii) average number of bit/symbol

Ans: $= 2\times(0.26+0.19) + 3\times(0.16+0.14+0.10) + 4\times 0.08 + 5\times(0.05+0.02) = 2.77 < 8$

the Huffman codebook compression ratio is better

$$\text{ratio} = \frac{\text{uncompressed scheme}}{\text{compressed scheme}} = \frac{8}{2.77} = 2.88$$

(iii) entropy < 2.5 bits/symbol ?

$$\eta = H(S) = \sum_{i=1}^{n} p_i \log_2 \frac{1}{p_i} = -\sum_{i=1}^{n} p_i \log p_i$$

$$= -\left[0.02 \log_2 0.02 + 0.05 \log_2 0.05 + \cdots + 0.26 \log_2 0.26\right]$$

$$= 2.7333$$

No way, due to codeword compression ratio will not less than entropy