Find the Huffman Coding for the word "BABY"

Given: BABY

Total Symbol : 4

Symbol	Probability			
B	0.5 (2/4)	→	0.5	0
A	0.25 (1/4) 10			
Y	0.25 (1/4) 11	→	0.5	1

Symbol	Probability	Codeword	Length
B	0.5	0	1
A	0.25	10	2
Y	0.25	11	2

Length : $L = \sum_{k=0}^{N-1} P_k l_k$

$= (0.5 \times 1) + (0.25 \times 2) + (0.25 \times 2)$

$\boxed{L = 1.5 \text{ bits/Symbol}}$

Entropy : $H(S) = \sum_{k=0}^{N-1} P_k \log_2 P_k$

$= \sum_{k=0}^{3} P_k \log_2 P_k$

$= (0.5 \log_2 0.5) + (0.25 \log_2 0.25) + (0.25 \log_2 0.25)$

$$H(S) = 1.5 \text{ bits/Symbol}$$

Efficiency

$$\eta = \frac{H(S)}{L} = \frac{1.5}{1.5} \times 100$$

$$\eta = 100\%$$

16/8/18

(1) Perform histogram equalization of the image.

Given data:

$$\begin{bmatrix} 4 & 4 & 4 & 4 & 4 \\ 3 & 4 & 5 & 4 & 3 \\ 3 & 5 & 5 & 5 & 3 \\ 3 & 4 & 5 & 4 & 3 \\ 4 & 4 & 4 & 4 & 4 \end{bmatrix}$$

Solution:

Step 1:

Grey level (r_k)	0	1	2	3	4	5	6	7
Number of pixel (P_k)	0	0	0	6	14	5	0	0

Step 2: Find the running sum of the pixel.

0 0 0 6 20 25 25 25

Step 3: Normalization (scaling) the pixel.

$$\text{No of Grey level} \times \frac{\text{Running Sum}}{\text{Total no of pixel}} = \frac{0}{25} \times 7 + \frac{0}{25} \times 7 + \frac{0}{25} \times 7 + \frac{6}{25} \times 7 + \frac{20}{25} \times 7 + \frac{25}{25} \times 7 + \frac{25}{25} \times 7 + \frac{25}{25} \times 7$$

$$= 0 \quad 0 \quad 0 \quad 1.68 \quad 5.6 \quad 7 \quad 7 \quad 7$$

Step 4: Round off the value to nearest Grey level.

$$= 0 \quad 0 \quad 0 \quad 2 \quad 6 \quad 7 \quad 7 \quad 7$$

Step 5: Mapping the new Grey level

Grey value	0	1	2	3	4	5	6	7
New Grey value	0	0	0	2	6	7	7	7

Pixel value after Equalization:

$$\begin{bmatrix} 6 & 6 & 6 & 6 & 6 \\ 2 & 6 & 4 & 6 & 2 \\ 2 & 4 & 4 & 4 & 2 \\ 2 & 6 & 4 & 6 & 2 \\ 6 & 6 & 6 & 6 & 6 \end{bmatrix}$$

(2) Median filtered: