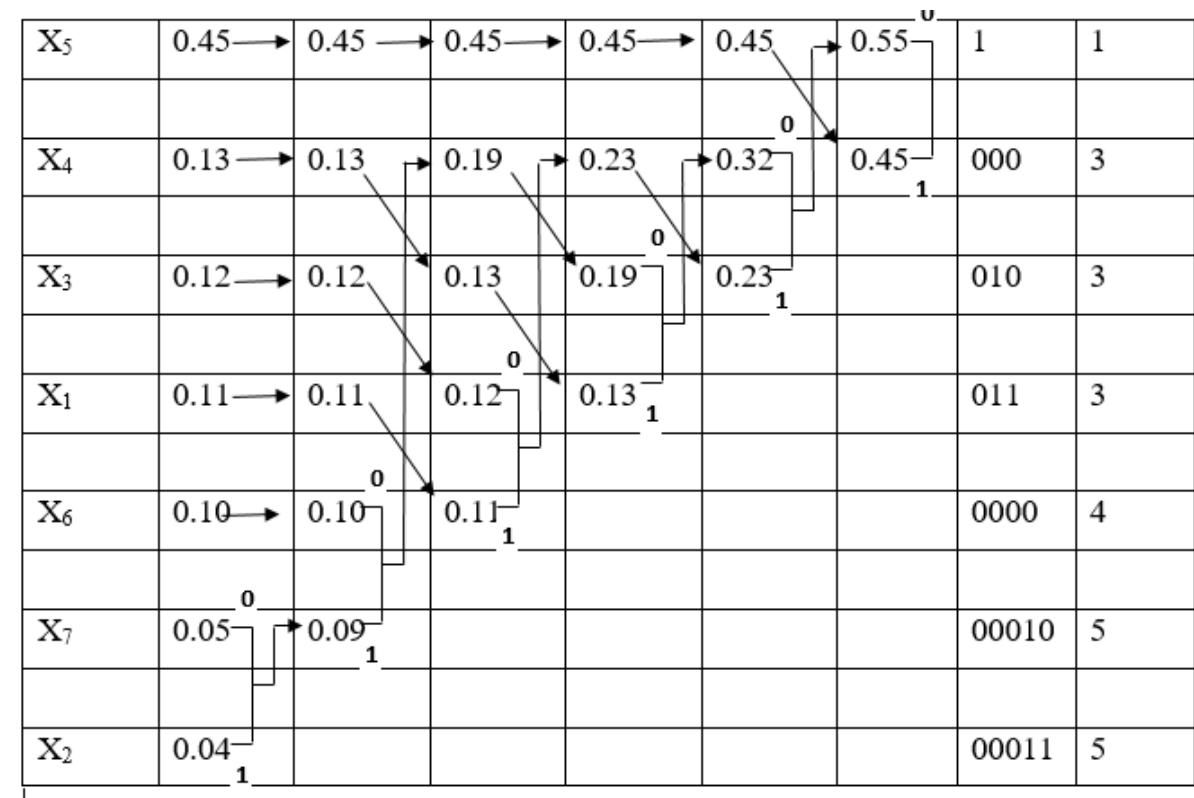


Tutorial Lecture 13

Q/ A symbols ($x_1, x_2, x_3, x_4, x_5, x_6$ and x_7), with a probabilities of (0.11, 0.04, 0.12, 0.13, 0.45, 0.1 and 0.05) respectively. Develop Huffman code to obtain the binary code for each symbol.

Solution:

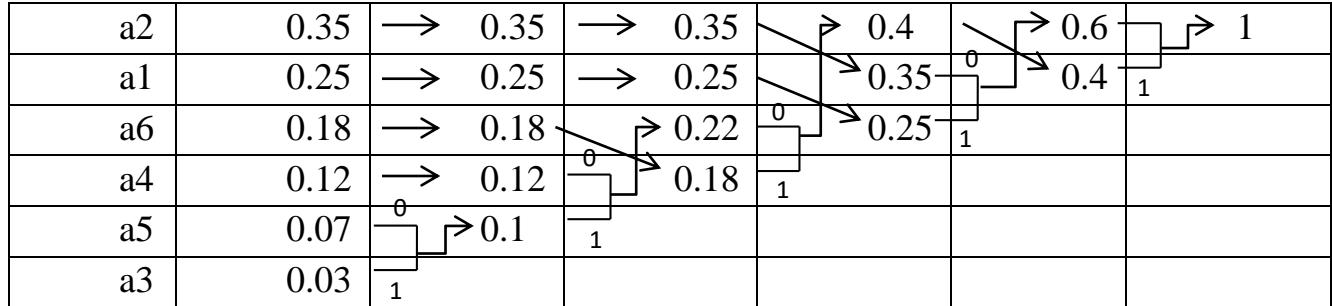


Q/ Given a source that produces the following symbols $\{a_1, a_2, a_3, a_4, a_5, a_6, a_7\}$ with probabilities $\{0.25, 0.35, 0.03, 0.12, 0.07, 0.18\}$ respectively,

- (a) Design Huffman code.
- (b) Calculate the code efficiency

Solution:

a-



A	Code	l_i
a2	00	2
a1	01	2
a6	11	2
a4	100	3
a5	1010	4
a3	1011	4

b.

$$\eta = \frac{H(x)}{L_c} \times 100$$

$$H(x) = \sum \log_2 P(x_i) \times P(x_i)$$

$$H(x) =$$

$$\frac{(0.35 \times \ln(0.35) + 0.25 \times \ln(0.25) + 0.18 \times \ln(0.18) + 0.12 \times \ln(0.12) + 0.07 \times \ln(0.07) + 0.03 \times \ln(0.03))}{\ln(2)} =$$

$$2.26279 \frac{\text{bits}}{\text{symbol}}$$

$$\begin{aligned}
L_C &= \sum_i l_i \times P(x_i) = \\
&= 2 \times (0.35 + 0.25 + 0.18) + 3 \times 0.12 + 4 \times (0.07 + 0.03) \\
&= 2.23 \frac{\text{bits}}{\text{message}} \\
\eta &= \frac{2.26279}{2.23} \times 100 = 97.75\%
\end{aligned}$$