

Solution to Homework Assignment 9

Solution to Problem 1:

(a)

$$\begin{aligned}
 H(X) &= - \sum_{i=1}^6 p_i \log_2 p_i = -(0.1 \log_2 0.1 + 0.2 \log_2 0.2 \\
 &\quad + 0.3 \log_2 0.3 + 0.05 \log_2 0.05 + 0.15 \log_2 0.15 + 0.2 \log_2 0.2) \\
 &= 2.4087 \text{ bits/symbol}
 \end{aligned}$$

(b) If the source symbols are equiprobable, then $p_i = \frac{1}{6}$ and

$$H_u(X) = - \sum_{i=1}^6 p_i \log_2 p_i = - \log_2 \frac{1}{6} = \log_2 6 = 2.5850 \text{ bits/symbol}$$

As it is observed the entropy of the source is less than that of a uniformly distributed source.

Solution to Problem 2:

Assignment Project Exam Help

https://tutorcs.com

WeChat: cstutorcs

Given $A = \{a_1, a_2, a_3, a_4, a_5, a_6\}$ & their probabilities are as follows:

$p(a_3) = 0.3$
 $p(a_2) = 0.2$
 $p(a_6) = 0.2$
 $p(a_5) = 0.15$
 $p(a_1) = 0.1$
 $p(a_4) = 0.05$

the descending order and build a Huffman tree as follow:

The above Huffman tree generates a codebook as

$a_1 = 1110$
 $a_2 = 00$
 $a_3 = 10$
 $a_4 = 1111$
 $a_5 = 110$
 $a_6 = 01$

Solution to Problem 3:

(a) Not a codeword since the last parity check equation does not hold.

(b) The decoded information bits are: 0011.

(c) The coded sequence for 0001 is 0001111. To receive 0011101, errors occur on the 3rd and 6th bits and do not occur on the other 5 bits. The probability is

$$0.02^2 \times 0.98^5 \approx 0.036\%.$$

Assignment Project Exam Help

<https://tutorcs.com>

WeChat: cstutorcs