Homework 1027

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1. 第一题

   由题可得：$H(X) = -(0.2\log 0.2 + 0.25\log 0.25 + 0.19\log 0.19 + 0.15\log 0.15 + 0.16\log 0.16 + 0.05\log 0.05) = 2.469$

   （1）由题可得：香农码编成为 $\begin{pmatrix} x_1 & x_2 & x_3 & x_4 & x_5 & x_6 \\ 010 & 00 & 011 & 110 & 101 & 11110 \end{pmatrix}$

   $\bar{L} = 0.7 \times 3 + 0.25 \times 2 + 0.05 \times 5 = 2.85 \ bits/symbol$

   $R = \frac{\bar{L}}{N}\log r = 2.85$

   $\eta = \frac{H(X)}{R} = \frac{2.469}{2.85} \times 100\% = 86.6\%$

   （2）由题可得：费诺码编成为 $\begin{pmatrix} x_1 & x_2 & x_3 & x_4 & x_5 & x_6 \\ 01 & 00 & 100 & 110 & 101 & 111 \end{pmatrix}$

   $\bar{L} = 0.55 \times 3 + 0.45 \times 2 = 2.55 \ bits/symbol$

   $R = \frac{\bar{L}}{N}\log r = 2.55$

   $\eta = \frac{H(X)}{R} = \frac{2.469}{2.55} \times 100\% = 96.8\%$

   （3）由题可得：霍夫曼码编成为 $\begin{pmatrix} x_1 & x_2 & x_3 & x_4 & x_5 & x_6 \\ 11 & 01 & 000 & 110 & 001 & 111 \end{pmatrix}$

   $\bar{L} = 0.55 \times 3 + 0.45 \times 2 = 2.55 \ bits/symbol$

   $R = \frac{\bar{L}}{N}\log r = 2.55$

   $\eta = \frac{H(X)}{R} = \frac{2.469}{2.55} \times 100\% = 96.8\%$

2. 第二题

   （1）$\begin{pmatrix} x_1 & x_2 & x_3 & x_4 & x_5 & x_6 \\ 0 & 10 & 11 & 12 & 20 & 21 \end{pmatrix}$

   （2）$\begin{pmatrix} x_1 & x_2 & x_3 & x_4 & x_5 & x_6 \\ 1 & 01 & 02 & 000 & 001 & 002 \end{pmatrix}$

   $\bar{L} = 0.32 \times 1 + 0.4 \times 2 + 0.28 \times 3 = 1.96 \ bits/symbol$

   $R = \frac{\bar{L}}{N}\log r = 3.11$

   $\eta = \frac{H(X)}{R} = \frac{1.96}{3.11} \times 100\% = 75.6\%$