信息论 1008 作业

October 2022

1 第一题

1.1 香农编码

解:

x_i	$p(x_i)$	$p_\alpha(x_i)$	l_i	Binary	W
x_2	0.25	0.00	2	0.00000	00
x_1	0.20	0.25	3	0.01000	010
x_3	0.19	0.45	3	0.01110	011
x_5	0.16	0.64	3	0.10100	101
x_4	0.15	0.80	3	0.11001	110
x_6	0.05	0.95	5	0.11110	11110

$$\overline{L} = \sum_{i=1}^{6} p(x_i) l_i = 2.85$$

$$R = \frac{\overline{L}}{N} log_2 m = 2.85$$

$$H(X) = -\sum_{i=1}^{6} p(x_i) log_2 p(x_i) = 2.468$$

$$\eta = H(X)/R = 86.5\%$$

1.2 费诺编码

解:

x_i	$p(x_i)$	encode			W	l_i
x_2	0.25	0	0		00	2
x_1	0.20		1		01	2
x_3	0.19	1	0	0	100	3
x_5	0.16			1	101	3
x_4	0.15		1	0	110	3
x_6	0.05			1	111	3

$$\overline{L} = \sum_{i=1}^{6} p(x_i) l_i = 2.55$$

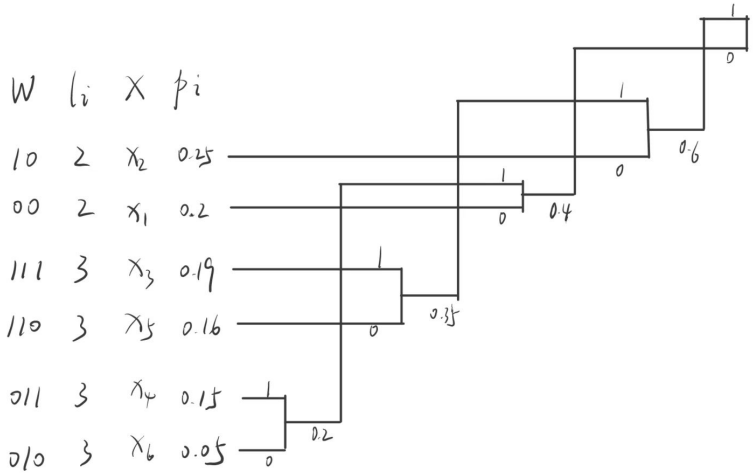
$$R = \frac{\overline{L}}{N} log_2 m = 2.55$$

$$H(X) = -\sum_{i=1}^{6} p(x_i) log_2 p(x_i) = 2.468$$

$$\eta = H(X)/R = 96.8\%$$

1.3 Huffman 编码

解:



$$\overline{L} = \sum_{i=1}^{6} p(x_i) l_i = 2.55$$

$$R = \frac{\overline{L}}{N} log_2 m = 2.55$$

$$H(X) = -\sum_{i=1}^{6} p(x_i) log_2 p(x_i) = 2.468$$

$$\eta = H(X)/R = 96.8\%$$

2 第二题

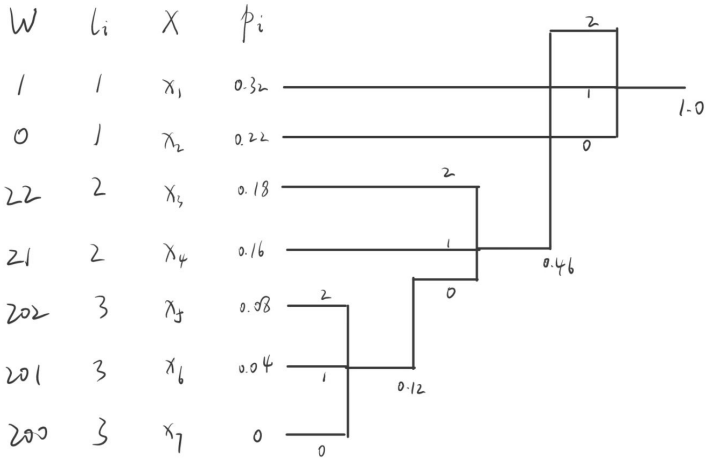
2.1 三元即时码

解:

x_i	x_1	x_2	x_3	x_4	x_5	x_6
W	0	1	20	21	220	221

2.2 三元 Huffman 码

解:



$$\overline{L} = \sum_{i=1}^{6} p(x_i) l_i = 1.58$$

$$R = \frac{\overline{L}}{N} log_2 m = 2.504$$

$$H(X) = -\sum_{i=1}^{6} p(x_i) log_2 p(x_i) = 2.35$$

$$\eta = H(X)/R = 93.8\%$$