信息论 1013 作业

October 2022

1 第一题

解:

由题意得: 该编码需要满足两个条件,

a) $d(c) \geq 2v + 1 \geq 3$

b) 该编码平均长度 $\overline{L}$ 尽可能小

根据汉明码编码规则如下表示:

	d_3	d_2	p_3	d_1	p_2	p_1
2bit	110	101	100	011	010	001
$x_1(000)$	0	0	0	0	0	0
$x_1(100)$	1	0	1	0	1	0
$x_1(010)$	0	1	1	0	0	1
$x_1(001)$	0	0	0	1	1	1
$x_1(110)$	1	1	0	0	1	1
$x_1(101)$	1	0	1	1	0	1
$x_1(011)$	0	1	1	1	1	0
$x_1(111)$	1	1	0	1	0	0

编码结果如下:

before	000	100	010	001	110	101	011	111
after	000000	101010	011001	000111	110011	101101	011110	110100

2 第二题

2.1 using MLD decoding

$$\begin{aligned} p(000\ received \mid 001\ sent) &= p(0\ received \mid 0\ sent) * p(0\ received \mid 0\ sent) * p(0\ received \mid 1\ sent) \\ &= 0.1 * 0.1 * 0.5 \\ &= 0.005 \end{aligned}$$

$$
\begin{aligned}
p(000\ received \mid 011\ sent) &= p(0\ received \mid 0\ sent) * p(0\ received \mid 1\ sent) * p(0\ received \mid 1\ sent) \\
&= 0.1 * 0.5 * 0.5 \\
&= 0.025
\end{aligned}
$$

$p(000\ received \mid 001\ sent) < p(000\ received \mid 011\ sent)$

所以译码结果为 011

2.2 using MDD decoding

$d(000, 001) = 1$

$d(000, 011) = 2$

$d(000, 011) > d(000, 001)$

所以译码结果为 001