

10-19 Hamming code

x	y	e	Number of bit errors	$\hat{y} = y + e$	s	\hat{x}
0001	1101001	0001000	1	1100001	100	0001
1001	0011001	0000000	0	0011001	000	1001
1001	0011001	0000000	0	0011001	000	1001
1101	1010101	0000010	1	1010111	110	1101
0001	1101001	1001001	3	0100000	010	0000
1100	0111100	0000010	1	0111110	110	1100
1011	0110011	1000000	1	1110011	001	1011

$$y_1 = x_1 \oplus x_2 \oplus x_4$$

$$y_2 = x_1 \oplus x_3 \oplus x_4$$

$$y_3 = x_1$$

$$y_4 = x_2 \oplus x_3 \oplus x_4$$

$$y_5 = x_2$$

$$y_6 = x_3$$

$$y_7 = x_4$$

$$s_1 = \hat{y}_4 \oplus \hat{y}_5 \oplus \hat{y}_6 \oplus \hat{y}_7$$

$$s_2 = \hat{y}_2 \oplus \hat{y}_3 \oplus \hat{y}_6 \oplus \hat{y}_7$$

$$s_2 = \hat{y}_1 \oplus \hat{y}_3 \oplus \hat{y}_5 \oplus \hat{y}_7$$

$$\hat{x}_1 = \hat{y}_3$$

$$\hat{x}_2 = \hat{y}_5$$

$$\hat{x}_3 = \hat{y}_6$$

$$\hat{x}_4 = \hat{y}_7$$

10-20 Hamming code

x	y	e	Number of bit errors	$\hat{y} = y + e$	s	\hat{x}
0111	0001111	0000000	0	0001111	000	0111
1110	0010110	1100000	2	1110110	011	0110
1101	1010101	1110000	3	0100101	000	0101
1010	1011010	0000100	1	1011110	101	1010
1000	1110000	0010010	2	1100010	101	0110
1001	0011001	1000000	1	1011001	001	1001
0000	0000000	0100100	2	0100100	111	0101

$$y_1 = x_1 \oplus x_2 \oplus x_4$$

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$$s_2 = \hat{y}_1 \oplus \hat{y}_3 \oplus \hat{y}_5 \oplus \hat{y}_7$$

$$\hat{x}_1 = \hat{y}_3$$

$$\hat{x}_2 = \hat{y}_5$$

$$\hat{x}_3 = \hat{y}_6$$

$$\hat{x}_4 = \hat{y}_7$$