

CS2700 Homework 2

Phillip Janowski (pajmc2@mail.umsl.edu)

October 30, 2018

Question 1.

5.10

For the Hamming code show in Figure 5.10, show what happens when a check bit rather than a data bit is in error ?

Position	12	11	10	9	8	7	6	5	4	3	2	1
Bits	D8	D7	D6	D5	C8	D4	D3	D2	C4	D1	C2	C1
Block	0	0	1	1	1	1	0	0	1	1	1	1
Codes			1010	1001		0111				0011		

Position	Code
Hamming	1111
10	1010
9	1001
7	0111
3	0011
XOR'd	1000

It detects that there is an error in position 8.

Question 2.

5.11

Position	12	11	10	9	8	7	6	5	4	3	2	1
Bits	D8	D7	D6	D5	C8	D4	D3	D2	C4	D1	C2	C1
Block	1	1	0	0		0	0	1		0		
Code	1100	1011					0101					

The check bits are in 8, 4, 2, and 1.

Check bit 8 calculated by values in bit numbers: 12, 11, 10 and 9

$$1 \oplus 1 \oplus 0 \oplus 0 = 0$$

Check bit 4 calculated by values in bit numbers: 12, 7, 6, and 5

$$1 \oplus 0 \oplus 0 \oplus 1 = 0$$

Check bit 2 calculated by values in bit numbers: 11, 10, 7, 6 and 3

$$1 \oplus 0 \oplus 0 \oplus 0 \oplus 0 = 1$$

Check bit 1 calculated by values in bit numbers: 11, 9, 7, 5 and 3

$$1 \oplus 0 \oplus 0 \oplus 1 \oplus 0 = 0$$

Thus, the check bits are: 0 0 1 0

Question 3.

5.12

Two check bits are wrong so the error is in the data

p2 and p4 are the two wrong bits so the corrupted bit is 6

00111001 should be 00011001

Question 4.

5.13

$$2^r \geq m + r + 1$$

$$2^r \geq 1024 + r + 1, r = 10$$

$$2^{10} \geq 1024 + 10 + 1$$

$$1024 \geq 1024 + 10 + 1 \text{ false}$$

$$2^{11} \geq 1024 + 11 + 1$$

$$2048 \geq 1036 \text{ true}$$

A minimum of 11 check bits needed for 1024-bit Hamming code error correction

Question 5.

6.5

(a) Average Seek Time

Because we start at track 0 of 30,000, the most we would have to traverse is 29,999 tracks

Average track number is $\frac{29,999}{2} = 14,999.5$

Average track seek time with a $\frac{100\text{tracks}}{1\text{ms}}$

$14,999.5/100 = 149.995 \text{ ms}$

(b) Average Rotational Latency

$\frac{7200\text{rev}}{\text{minute}} * \frac{\text{Minute}}{60\text{sec}} * \frac{\text{Second}}{1000\text{ms}} = 8.33\text{ms}$

Because the average track is in the middle of any two given tracks we divide by 2

$\frac{8.333}{2} = 4.166\text{ms}$

(c) Transfer time per sector

$\frac{600\text{sectors}}{\text{track}} \text{ or } \frac{600\text{sectors}}{\text{revolution}} \rightarrow \frac{8.333\text{ms}}{\text{revolution}} * \frac{\text{revolution}}{600\text{track}} = 0.01389\text{ms}$

(d) Average Total Satisfy Time

$149.995 + 4.166 + 0.01389 = 154\text{ms}$

Question 6.

6.7

(a) Transfer time sector 1 on track 8 to sector 1 on track 9

$\frac{60,000}{360} \rightarrow 16.67\text{ms}$

$\frac{16.67}{32\text{tracks}} = .52\text{ms}$

$16.7 * \frac{31}{32} = 16.2\text{ms}$ rotational delay

$.52 + 16.2 + .52 = 17.24\text{ms}$

(b) Transfer all sectors from track 8 to track 9

The write will start on the 5th sector of track 9

$.52\text{ms} * 4 = 2.08\text{ms}$

$16.7 * 2 + 2.08 = 35.48\text{ms}$