CS2700 Homework 2

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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
$2^r \geq m + r + 1$
$2^r \geq 1024 + r + 1, r = 10$
$2^10 \geq 1024 + 10 + 1$
$1024 \geq 1024 + 10 + 1$ false
$2^11 \geq 1024 + 11 + 1$
$2048 \geq 1036$ true
A minimum of 11 check bits needed for 1024-bit Hamming code error correction

Question 5.

6.5

(a) Average Seek Time

Becuase 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 $\frac{100 tracks}{1 ms}$
$14,999.5/100 = 149.995$ ms

(b) Average Rotational Latency
$\frac{7200 rev}{minute} * \frac{Minute}{60 sec} * \frac{Second}{1000 ms} = 8.33 ms$
Because the average track is in the middle of any two given tracks we divide by 2
$\frac{8.333}{2} = 4.16\overline{6} ms$

(c) Transfer time per sector
$\frac{600 sectors}{track}$ or $\frac{600 sectors}{revolution} \rightarrow \frac{8.333 ms}{revolution} * \frac{revolution}{600 track} = 0.01389 ms$

(d) Average Total Satisfy Time
$149.995 + 4.1660.01389 = 154 ms$

Question 6.

6.7

(a) Transfer time sector 1 on track 8 to sector 1 on track 9
$\frac{60{,}000}{360} \rightarrow 16.67 ms$
$\frac{16.67}{32 tracks} = .52 ms$
$16.7 * \frac{31}{32} = 16.2 ms$ rotational delay
$.52 + 16.2 + .52 = 17.24 ms$

(b) Transfer all sectors from track 8 to track 9
The write will start on the 5th sector of track 9
$.52 ms * 4 = 2.08 ms$
$16.7 * 2 + 2.08 = 35.48 ms$