Chapter 6 The Link Layer & LANs

6.1

bit pattern	parity bit
1 1 1 0	1
0 1 1 0	0
1 0 0 1	0
1 1 0 1	1
1 1 0 0	0

6.5 1010101010 0000 / 10011 = 1011 0111 00 with remainder 0100

$\therefore R = 0100$

6.6 a) The result is 1000100011 with remaider 0101

$\therefore R = 0101$

b) The result is 1011111111 with remainder 0001

$\therefore R = 0001$

c) The result is 0101101110 with remainder 0010

$\therefore R = 0010$

6.7. a) Suppose the error is at ith bit where i is greater or equals to 0 and is smaller or equals to $d+r-1$.

the data we receive is $D_{receive} = D * 2^r$ XOR $R + 2^i$

And we can see that the remaider of dividing K by G is not 0

If G contains more than 2 1s, the single bit error can always be detected.

b) No. Since G can be devided by 11_2 whereas odd number 1's sequence cannot be divided by 11_2. Thus odd number bit of errors can't be detected using G.

6.8 a) $\because E(p) = Np(1-p)^{N-1}$

$$E'(p) = N(1-p)^{N-1} - Np(N-1)(1-p)^{N-2}$$
$$= N(1-p)^{N-2}\left[(1-p) - p(N-1)\right]$$

Let $E'(p) = 0$, $1-p-p(N-1) = 0$

$\therefore p^* = \frac{1}{N}$

b) $$E(p^*) = N\frac{1}{N}\left(1-\frac{1}{N}\right)^{N-1}$$
$$= \left(1-\frac{1}{N}\right)^{N-1}$$
$$= \frac{\left(1-\frac{1}{N}\right)^{N}}{1-\frac{1}{N}}$$

$\because \lim_{N\to\infty} 1-\frac{1}{N} = 1$, $\lim_{N\to\infty}\left(1-\frac{1}{N}\right)^{N} = \frac{1}{e}$

$\therefore \underset{N\to\infty}{E(p^*)} = \frac{1}{e}$