

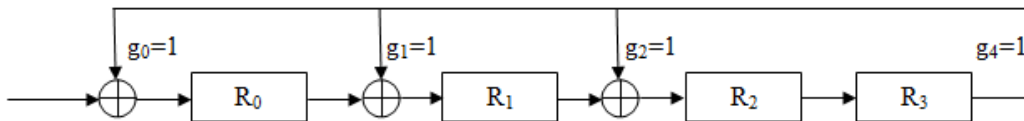
EE3009 Tutorial 11 (Solution)

Problem 1

- a) The CRC bit pattern is 1000.

$$\begin{array}{r}
 1000 \\
 10111 \overline{) 10110000} \\
 \underline{10111} \\
 00010 \\
 \underline{00000} \\
 00100 \\
 \underline{00000} \\
 01000 \\
 \underline{00000} \\
 1000
 \end{array}$$

- b) The generator has five bits 10111, so four redundant bits will be generated. Thus, four registers are needed.



Problem 2

- a) Let the first codeword be c_1 and consider another codeword c_2 . We denote the distance between these two codewords by $d(c_1, c_2)$. By definition, $d(c_1, c_2) \geq d_{\min}$.

Let the given bit string be x . Since we can always flip $d(c_1, x)$ bits to change c_1 into x , and then flip $d(x, c_2)$ bits to change x into c_2 , we must have

$$d(c_1, x) + d(x, c_2) \geq d(c_1, c_2).$$

Combining the above two results, we have

$$d(c_1, x) + d(x, c_2) \geq d_{\min}.$$

If $d(c_1, x) < d_{\min} / 2$, then we must have $d(x, c_2) > d_{\min} / 2$.

- b) If the number of errors is smaller than $d_{min} / 2$, then according to the result of part (a), the received bit string must be closer to the original codeword than to any other codewords.

Problem 3

Number of samples = 44 kHz * 20 sec = 880000

Each sample is represented by 16 bits = 2 bytes

Hence, the file size is 880000 * 2 = 1760000 bytes, or roughly 1.68 Mbytes

Problem 4

- a) Possible, since the Kraft's inequality is satisfied.
b) Impossible, since the Kraft's inequality is violated.