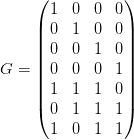
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| c1 = d1 ⊕ | d2 | c4 = d1 ⊕ | d2⊕ | d3 |
| c2 = d2 ⊕ | d3 | c5 = d1 ⊕ | d2 |  |
| c3 = d1 ⊕ | d3 | c6 = d1 ⊕ | d2⊕ | d3 |

1. Find the generator matrix *G* and parity-check matrix *H* for this code.
2. Find a 3 × 6 matrix that recovers the data bits from the codeword.
3. What is the error correcting capability of the code?

**Problem 6.25**: Error Correction?

It is important to realize that when more transmission errors than can be corrected, error correction algorithms believe that a smaller number of errors have occurred and correct accordingly. For example, consider a (7,4) Hamming code having the generator matrix



This code corrects all single-bit error, but if a double bit error occurs, it corrects using a single-bit error correction approach.

1. How many double-bit errors can occur in a codeword?
2. For each double-bit error pattern, what is the result of channel decoding? Express your result as a binary error sequence for the data bits.

**Problem 6.26:** Selective Error Correction

We have found that digital transmission errors occur with a probability that remains constant no matter how "important" the bit may be. For example, in transmitting digitized signals, errors occur as frequently for the most signifcant bit as they do for the least signifcant bit. Yet, the former errors have a much larger impact on the overall signal-to-noise ratio than the latter. Rather than applying error correction to each sample value, why not concentrate the error correction on the most important bits? Assume that we sample an 8 kHz signal with an 8-bit A/D converter. We use single-bit error correction on the most signifcant four bits and none on the least signifcant four. Bits are transmitted using a modulated BPSK signal set over an additive white noise channel.

1. How many error correction bits must be added to provide single-bit error correction on the most signifcant bits?
2. How large must the signal-to-noise ratio of the received signal be to insure reliable communication?