a) If codeword is N bits long, N single-bit errors, N-1 paired double-bit errors, N-2 neighboring triple-bit errors, and N-4 far-bit errors, must have

\[
2^{N-1} \geq N + N-1 + N-2 + N-3 = 4N-6
\]

or

\[
2^{N-K} \geq 4^{N-5} \quad K = 16
\]

Try N = 23: \(2^{\frac{23}{3}} \approx 8.235 \approx 87\) \(\checkmark\) Need ECC bits

b) Now need a single-bit code: \(2^{N-1} \geq N\) at \(2^{N-1} \geq N+1\)

Try N = 21: \(2^{20} = 2^{2.2} \checkmark\)

Reduces number bits/sample (on CD) from 23 to 21, a savings of 10%. Interleaving and deinterleaving hardware easy to build.