1. Relative noise immunity.

3. Sampling too slowly. An analog signal must be sampled faster than the Nyquist rate to prevent aliasing.

4. A 5-bit quantizer has a smaller voltage resolution which can more accurately represent the signal’s voltage range. With a 5-bit quantizer, the voltage range is divided into $2^5 = 32$ partitions, as opposed to $2^3 = 8$ partitions for the 3-bit quantizer. The analog sample will be quantized to a value closer to its analog value.

5. The minimum sample frequency is called the Nyquist Rate, $f_N$, and is equal to 2 times the max frequency in the signal. Here, $f_N = 2(18.75 \text{ kHz}) = 37.5 \text{ kHz}$.

6. a. $q = \frac{(1 - (-1))}{2^3} = 0.25 \text{ V}$

   b. As shown below. $f_s = 1 \text{ kHz}$, so $T_s = 1/f_s = 1 \text{ msec}$.

   c. As shown below.

   d. As shown below.

   e. This is called “quantization error”, which is minimized by using more bits to represent each sample (larger value of $N$). For example, use a 4-bit quantizer vice a 3-bit quantizer.

7. a. $q = \frac{(2 - (-2))}{2^3} = 0.5 \text{ V}$

   b. As shown below. $f_s = 1.33333 \text{ MHz}$, so $T_s = 1/f_s = 0.75 \mu\text{sec}$.

   c. As shown below.

   d. As shown below.