In this lab, we develop the digital signal code for a basic, notional codec. A certain application needs to quantize analog signals varying between -3.5 volts and +3.5 volts (see figure). The proper sampling frequency has been determined, and the sensitivity requires that each sample be within 0.5 volts of any true analog signal (signal displayed as example only). You must provide a digital (binary) code, using the minimum number of bits necessary, to represent each voltage, in 0.5 volt increments, from -3.5 volts to 3.5 volts.

Diagram of analog signal varying between -3.5 volts and +3.5 volts, with blanks along vertical axis for binary signal code.

Description automatically generated

When the blank lines on the left of the figure are filled in with your digital code, the graph will be similar to (but not the same as) graphs in figure 3-20 of the text. To complete the assignment, **upload a Word (.docx) or Adobe (.pdf) file with answers to the 2 questions below, followed by a table or list indicating your digital code representation for each voltage level as your submission to this assignment in Blackboard**.

1. How many different voltage levels must be represented?

**15 different levels must be represented.**

1. How many bits are needed to represent *at least* this many levels (i.e., if the answer to question 1 is *N*, then you must find x, such that )?

**4 bits are needed to represent at least 15 levels**

|  |  |
| --- | --- |
| **-3.5V =** | **0001** |
| **-3.0V =** | **0010** |
| **-2.5V =** | **0011** |
| **-2.0V =** | **0100** |
| **-1.5V =** | **0101** |
| **-1.0V =** | **0110** |
| **-0.5V =** | **0111** |
| **+0.0V =** | **1000** |
| **+0.5V =** | **1001** |
| **+1.0V =** | **1010** |
| **+1.5V =** | **1011** |
| **+2.0V =** | **1100** |
| **+2.5V =** | **1101** |
| **+3.0V =** | **1110** |
| **+3.5V =** | **1111** |