



### Data Communication Tutorial 03 Analog to Digital Conversion

1. Analog phone channel is a low pass signal having 4KHz band width.
  - a. sketch the frequency domain of that signal
  - b. determine the minimum sampling rate to digitize that channel
  - c. determine the required bit rate assuming used 8, 32, 64, 256 different levels for quantization
  
2. Sketch the quantization boundaries and quantization levels assuming the signal level (0v to 20v), and number of quantization levels is 8.
  
3. The following table shows the samples of an analog signal, determine the quantization levels and quantization error/sample then construct the binary stream of that signal

#	1	2	3	4	5	6	7	8	9
reading	6.1	7.5	16.2	19.7	11	5.5	11.3	9.4	6

4. Analog channel is a band pass signal having 4KHz band width, centered in 10KHz.
  - a. sketch the frequency domain of that signal
  - b. determine the minimum sampling rate to digitize that channel
  - c. determine the required bit rate assuming used 8, 32, 64, 256 different levels for quantization
  
5. An analog signal is digitized using delta modulation, sketch the generated stair signal of the following binary stream, assuming delta=0.5 volt.  
 Data= 1 1 1 1 0 1 0 0 1 1 0 0 0 1 1 1 1 0 0 1.
  
6. An analog signal is digitized using delta plus code modulation, sketch the generated stair signal of the following binary stream, assuming the

symbol	Delta level
2	00
1	01
-1	10
-2	11

Data= 00 01 01 00 10 01 11 01 01 11 00 00 11 10 00 11 01 10