Credit Hours System
Communications and Computer Engineering
Communications I (ELCN 306)
Project - PCM Implementation

Consider the system shown in Fig. 1

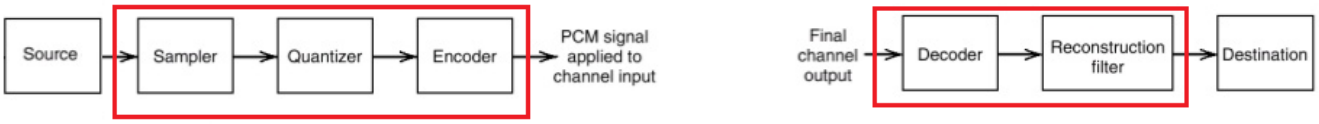

Fig. 1

It is required to build a Matlab Simulator for the system block and to study different systems employing various samplers, quantizers and encoders.

Description

1) Each of the system blocks (Sampler, Quantizer, Encoder, Decoder, Reconstruction Filter) should be implemented as a separate function.
2) Your 'Sampler' function should allow the use of an arbitrary source signal, $m(t)$, and a user-input sampling frequency f_s
3) Your 'Quantizer' function should have the option that the user chooses between
   - Uniform mid-rise quantizer, where the user specifies the number of levels, L and the peak quantization level, m_p
   - Non-Uniform μ-Law quantizer, where the user specifies μ, L and m_p
4) Your 'Encoder' function should allow the user to choose between
   - Unipolar NRZ signaling
   - Polar NRZ signaling
   - Manchester signaling
5) Your 'Decoder' and 'Reconstruction Filter' functions should follow the parameters inserted to the 'Encoder'/'Quantizer' and 'Sampler' functions, respectively.

Testing your System Simulator

Test your overall system for the input signal $m(t)$ and the following cases

$$m(t) = 5\cos(2\pi f_m t), \qquad \text{where } f_m = 10$$

	Case 1	**Case 2**	**Case 3**	**Case 4**
Sampler	$f_s = 40$	$f_s = 20$	$f_s = 20$	$f_s = 15$
Quantizer	$\mu = 0, L = 8, m_p = 5$	$\mu = 0, L = 32, m_p = 5$	$\mu = 100, L = 32, m_p = 5$	$\mu = 0, L = 16, m_p = 5$
Encoder	Unipolar NRZ	Polar NRZ	Manchester	Unipolar NRZ

Deliverables

Deliver the following in printed format

1) Source codes (.m files) of each of the 5 functions
2) Source code of main script used for the 4 test cases. This main script should allow a user to enter the following:
   - Arbitrary signal $m(t)$
   - Arbitrary sampling frequency f_s
   - Arbitrary quantizer parameters μ, L and m_p
   - Arbitrary encoder signaling type

   It should be also used to output the following 5 figures
   - Plot the source input signal and the sampled signal on one figure
   - Plot the sampled signal and the quantized signal on one figure
   - Plot the output waveform from the encoder
   - Plot the source input signal and the destination output signal on one figure
   - Plot the frequency domain representation of the source input signal, the sampled signal and the destination output signal on 3 different subplots of one figure
3) For each of the 4 cases, submit the 5 figures generated as mentioned above
4) For each of the 4 cases, make a brief comment on your findings

Deliver, to the TA's email, the following in a .zip file

1) Source codes (.m files) of each of the 5 functions
2) Source code of main script (as well as any additional functions needed to properly run your codes). **This will be used to test your system with arbitrary parameters and for arbitrary input signals**

Instructions

- You can work this reports in teams of $3 \sim 5$ members per team.
- Write a full report including all the deliverables.
- A printed copy of the report should be handed by the due date.
- Late submissions are not allowed.
- **All team members should expect to be asked about all the report parts.**