Communications and Information Engineering Program
Communications Theory and Systems
CIE 431 - Spring 2019
Term Project - Part II

DUE DATE: APRIL 6, 2019 AT 11:55 PM

Consider the system shown in Fig. 1

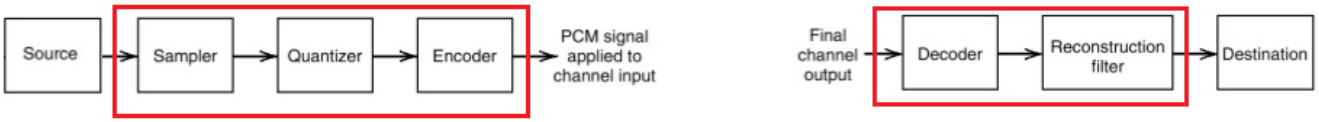

Fig. 1

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, electronically, 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) 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

   This will be used to test your system with arbitrary parameters and for arbitrary input signals
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
5) A .pdf file of the whole report, including the figures, properly labeled and titled. The report should also include your comments.

Instructions

1) This is an **team** project, teams can be composed of $2-4$ students.
2) All team members are accountable for all project parts.
3) Team reports (including source codes, figures or comments) are not to be shared with others, neither before nor after submission. However, in person discussions are encouraged.
4) Any copied reports, either fully or partially, will receive 0 points. This applies to both the original and the copy.
5) No late submissions are allowed.
6) In submission, you have to submit .m files separately. In addition, the figure should be submitted in .fig format and should be included in the .pdf report. Reports should be comprehensive and readable on their own.
7) The .pdf report is the main document to be evaluated, *i.e.* no credit is given for the source codes. However, source codes are to be checked against plagiarism.
8) Grading will depend on:
   - Completeness and correctness of deliverables (as per the .pdf report): 50%
   - Clarity of figures, and proper labeling (as per the .pdf report): 40%
   - Report writing and organization: 10%