Credit Hours System
Communications and Computer Engineering
Communications I (ELCN 306)
Final Assessment - Due May 31, 2020

DESCRIPTION

In this assessment, it is required to build a Matlab simulator for a Pulse Code Modulation system.

INSTRUCTIONS

1) You are required to implement the 5 system components, equally weighted.
2) You can work this assessment in teams of $3 \sim 5$ members per team.
3) Assessment reports (including final report, source codes, figures or comments) are **not to be shared with others**, neither before nor after submission.
4) **Any copied reports**, either fully or partially, will receive **0 points**. This applies to both the original and the copy. Students who have duplicate reports will be subject to **Academic penalty** for violating Academic Integrity rules.
5) **No late submissions** are allowed. This will be strictly enforced.
6) In submission, you have to submit **.m** files separately. In addition, **figures** should be submitted in **.fig** format and should be **included in the .pdf report**. Reports should be comprehensive and readable on their own.
7) Your codes should be commented and readable.
8) You can use Matlab built-in functions. However, if you do not use them correctly, you will loose the corresponding grade.
9) **The .pdf report is the main document** to be evaluated, *i.e.* no credit is given for the source codes alone. However, source codes will be checked against plagiarism.

GRADING CRITERIA

Grading of the assessment will depend on:

- **50%:** Completeness and correctness of deliverables (as per the .pdf report)
- **30%:** Clarity of figures, and proper labeling (as per the .pdf report)
- **20%:** Report writing and organization.

SUBMISSION

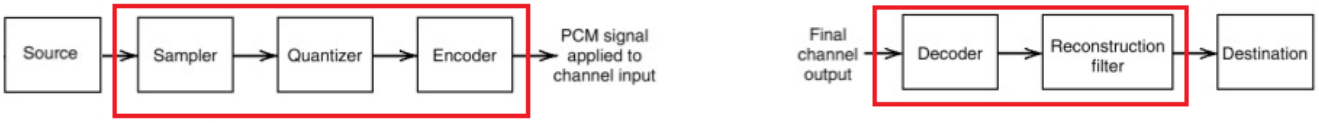
You are required to submit, by the due date, the following on Classroom:

1) A single .pdf file representing the whole assessment report, and including a cover page with names, emails and ID numbers.
2) A single .zip folder, including .m files and .fig figures for each of the system components as described in the deliverables.

Both the file and the folder should be named: ELCN306_Spring2020_XXXXXXXX, where XXXXXXXX is the student ID of the team member who submits the assessment.

ASSESSMENT DETAILS

Consider the following PCM system:



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

Tasks

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

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

	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

You are required to create and deliver the following:

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 $m(t)$, given as 2 vectors, t and m.
   - 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

Note that:
All source .m files and .fig figures should be included in the submitted .zip file.
All the figures, labeled, organized and commented on should be included in the submitted .pdf file.