Department of Computer Systems Engineering
University of Engineering & Technology
Peshawar, PAKISTAN

Subject: Digital Signal Processing (5th Semester)

Exam: Mid Term (Fall 2019)

Max Marks: 20

Time allowed : 2 hours

Attempt All Questions **(CLO_1)**

Question 1:

1) Answer the following:

i. What is quantization error $e_q(t)$? Can quantization be made lossless? **(1 Mark)**

ii. How is quantization error $e_q(t)$ related to the quantization step size 'Δ' in case of (a) rounding (b) truncation? **(1 Mark)**

iii. How quantization step size 'Δ' is related to number of quantization levels 'L' and bit size 'b'? **(1 Marks)**

iv. A discrete-time signal $x[n] = 1.5sine\left(\frac{\pi}{5}\right)n$ is quantized with resolution (a) Δ= 0.05 and (b) Δ= 0.01. How many bits are required in A/D converter in each case? **(1 Marks)**

2) For the x(n) shown in Figure 1, find and sketch **(2 Marks)**

a. $-2x(\frac{1}{2}n + 2)$

b. $2x(-2n + 1)$

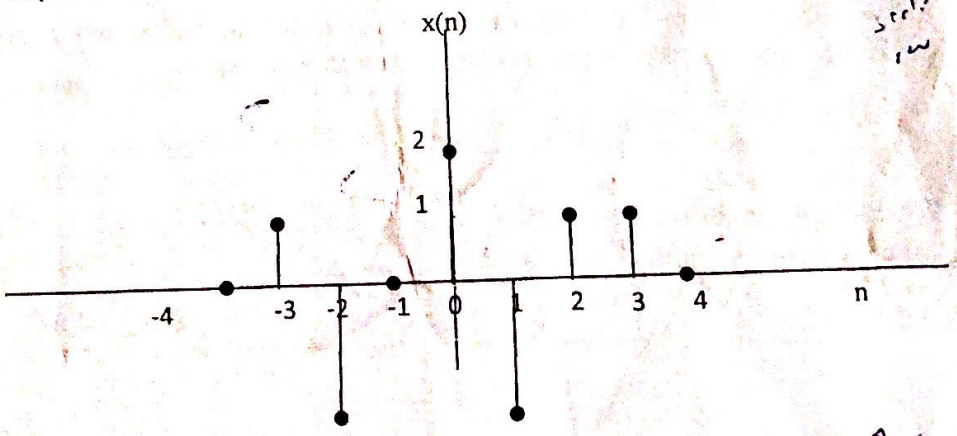

Figure 1

P.T.O

(CLO_2)

Question 2:

1) Determine the response y[n], of a system with impulse response h[n] to the input x[n], where, **(4+2 Marks)**

$$x[n] = \begin{cases} 1, & -2 \le n \le 4 \\ 0, & otherwise \end{cases}$$

and

$$h[n] = \begin{cases} 2, & -1 \le n \le 2 \\ 0, & otherwise \end{cases}$$

Is the system given by h[n] a stable or non-stable system, and why?

Is h[n] a causal or non-causal system, and why?

2) Write down the expression for finding overall impulse response h[n] and output y[n] of the system made of the interconnection of LTI systems shown in Figure 2. **(2 Mark)**

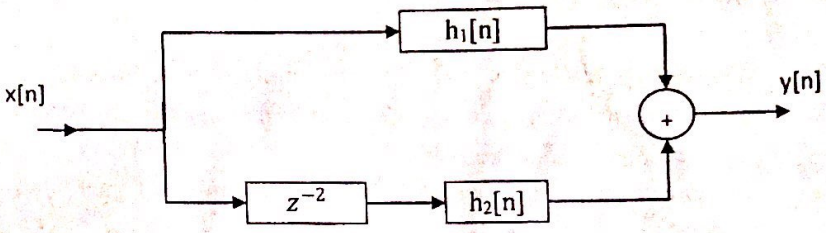

Figure 2

3) Find the homogeneous solution of the system given by the following difference equation with given initial condition. **(2 Mark)**

$$y[n] - 3y[n-1] - 4y[n-2] = x[n] + 2x[n-1]$$

$$y[0] = 1, \quad y[1] = 5$$

Question 3: **(CLO_3)**

1) Draw the direct form I and direct form I structure for the LTI system described by the difference equation. Which implementation is better and why? **(2 Marks)**

$$2y[n] - 3y[n-1] - 4y[n-3] = x[n] + 2x[n-2]$$

2) Write down the difference equation for the discrete-time system shown in Figure 3. Is this a recursive or non-recursive system? **(2 Marks)**

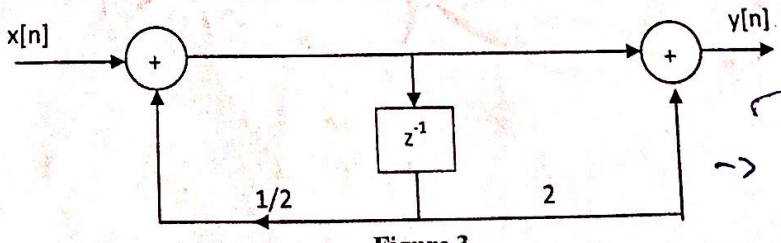

Figure 3

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Department of Computer Systems Engineering
University of Engineering & Technology
Peshawar, Pakistan
Communication Systems (Mid Term Exam, Fall 2019)

Time Allowed: 02 Hours, Total Marks: 40, Weightage: 20%

Instructions:

- Attempt ALL questions in sequence; Paper consists of four questions.
- Write your name on all resources before starting the paper.
- Read the complete paper in the first 15 minutes and get your queries (if any) clarified within this time; No question will be entertained after this time. Moreover, if you feel any data missing, you can assume any reasonable values for it.

Question # 1 (Marks 10, CLO-2, Cognitive-2)

a) Draw the functional block diagram of basic communication system and explain functionality of each stage of communication.

b) What are the reasons of modulating the output of transducer?

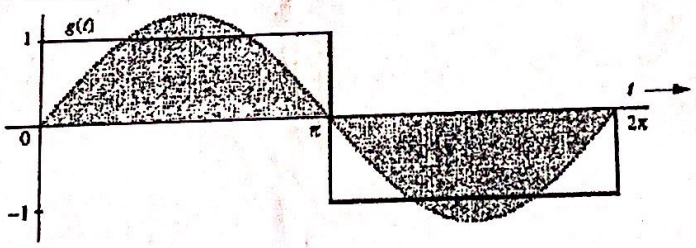
Question # 2 (Marks 10, CLO-1, Cognitive-1)

a) Briefly describe Unit Gate Function, Unit Triangle function and interpolation function. Also discuss the bandwidth of ***rect*** $\left(\frac{t}{\tau}\right)$.

b) For the square signal ***g(t)*** shown in figure below, find the components ***g(t)*** of the form of ***sin(t)***. In other words, approximate ***g(t)*** in term of ***sin(t)***.

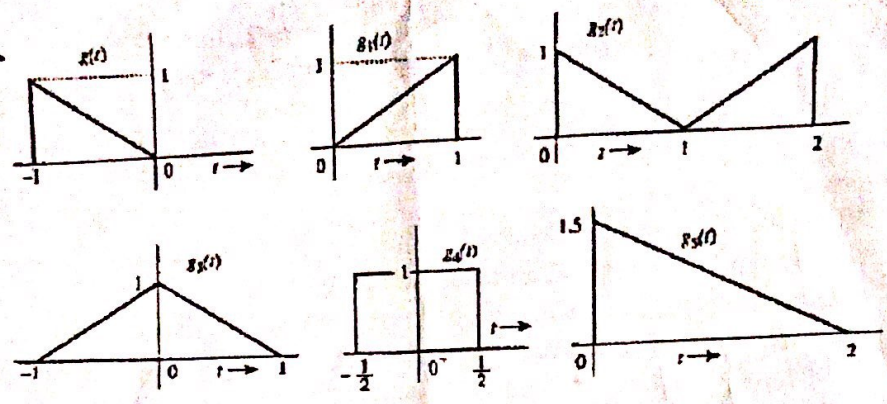
$$g(t) = c\sin(t); \qquad 0 \le t \le 2\pi;$$

So that the energy of the error signal is minimum.



Question # 3 (Marks 10)

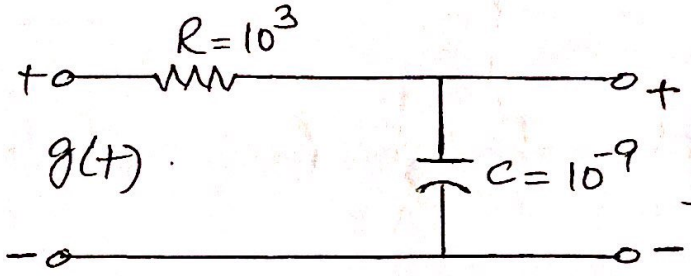
In figure below, the signal $g_1(t) = g(-t)$. Express signals $g_2(t)$, $g_3(t)$, $g_4(t)$, and $g_5(t)$ in term of the signal $g(t)$, $g_1(t)$, and their time-shifted, time scaled, or time inverted versions. For *instant* the signal $g(t)$, $g_1(t)$, and their time-shifted, time scaled, or time inverted versions. For instant $g_2(t) = g(t-T) + g_1(t-T)$ for some suitable value of T. Similarly, both $g_3(t)$ and $g_4(t)$ can be expressed as $g(t-T) + g(t+T)$ for some suitable value of T. In addition, $g_5(t)$ can be expressed as $g(t)$ time shifted, time scaled, and then multiplied by a constant. (These operations may be performed in any order).



Question # 4 (Marks 10)

a) Describe distortion less transmission with necessary equations and arguments; also describe the intuitive explanation of the distortion less transmission conditions.

b) If ***g(t)*** and ***y(t)*** are the input and the output, respectively, of a simple RC low pass filter (figure below), Determine the transfer function ***H(ω)*** and sketch ***|H(ω)|***, ***$\vartheta_h(\omega)$***, and ***$t_d(\omega)$***. For distortion less transmission through this filter, what is the requirement on the bandwidth of ***g(t)*** if amplitude response variation within ***2%*** and the time delay variation within ***5%*** are tolerable? What is transmission delay? Find the output ***y(t)***.



$$C = \frac{\int_0^{2\pi} g(t)\,x(t)}{\int_0^{2\pi} x^2(t)\,dt} \Rightarrow$$

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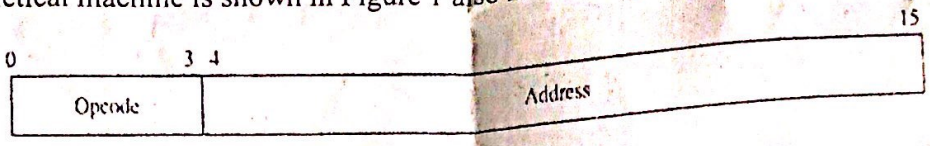
Midterm Exam (Fall 2019) **Paper:** CSE-304 Computer Organization and Architecture
Time: 2 Hours **Marks:** 20

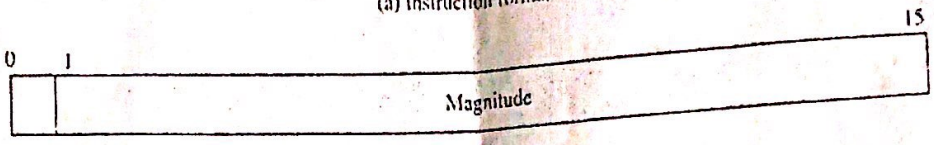
Note: Attempt all questions on answer sheet.

Question No. 1 (Marks=5) (CLO-1)

The hypothetical machine is shown in Figure 1 also has two I/O instructions:



(a) Instruction format



(b) Integer format

Program counter (PC) = Address of instruction
Instruction register (IR) = Instruction being executed
Accumulator (AC) = Temporary storage

(c) Internal CPU registers

0001 = Load AC from memory
0010 = Store AC to memory
0101 = Add to AC from memory

(d) Partial list of opcodes

Figure 1: Characteristics of hypothetical Machine

1. 0011 Load AC from I/O
2. 0111 Store AC to I/O

In these cases, the 12-bit address identifies a particular I/O device. Show the program execution (using the format of Figure 2) for the following program:

1. Load AC from device 5.
2. Add contents of memory location 940.
3. Store AC to memory location 941.
4. Store AC to device 6.

Assume that the next value retrieved from device 5 is 3 and that location 940 contains a value of 2.

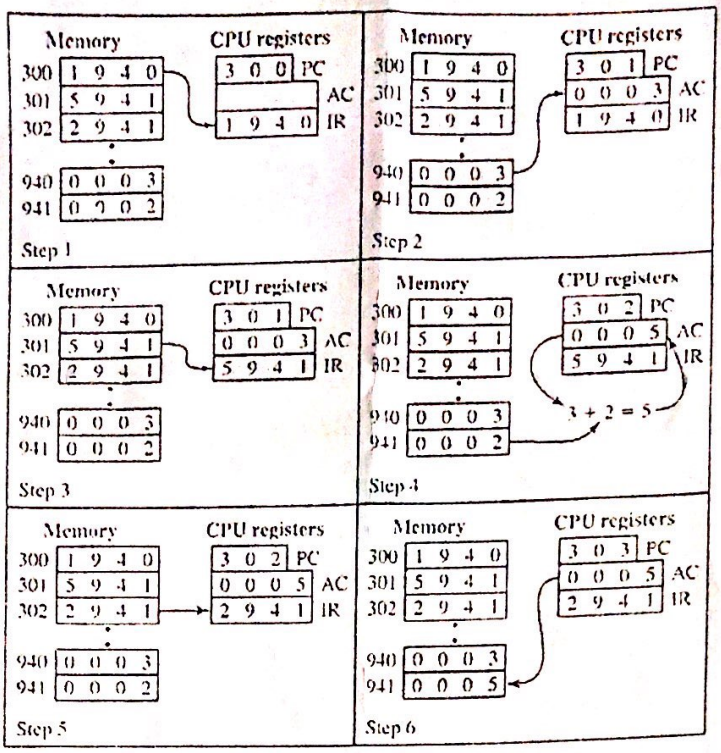


Figure 2: Example of program execution

Question No. 2 (Marks=5) (CLO-3)

Divide -5 by 3 (i.e. -5 is dividend and 3 is divisor) using signed division rules?

Question No. 3 (Marks=5)

Consider a hypothetical microprocessor generating a 16-bit address and having a 16-bit data bus.

1. What is the maximum memory address space that the processor can access directly if it is connected to a "16-bit memory"?
2. What is the maximum memory address space that the processor can access directly if it is connected to an "8-bit memory"?

Question No. 4 (Marks=5)

i. What are synchronous and asynchronous systems? Explain it with the help of timing diagram.

ii. How can we extend the 16-bit signed number to 32-bit signed number? Give examples. What is the range of signed numbers, if number of bits of a word is 32 bit.