ECE 2026 Exam 1
Summer 2025

Name _____

General Instructions instructions:

- Exam is closed book / closed notes other than the one-page of handwritten notes.
- Choose the best possible answer available in all cases.
- Blank scratch paper is allowed

The first part (Objective Questions) of the exam is to be completed and submitted first. When you have submitted the first part of the exam, you will be handed the second part (Open Response Question) part of the exam.

_____/72_ Part I: Objective Questions

_____/28_ Part II: Open Response Question

____/100_ Final Score

ECE 2026 Exam 3 (Final Exam) Part I Answer Sheet
Summer 2025

Name _____

General Instructions:

- Exam is closed book / closed notes other than the allowed handwritten notes.
- Choose the best possible answer available in all cases.
- The only graded answers are those placed on the lines below, and would be the identified element (e.g. a, b, c, d, e, f).
- Blank scratch paper is allowed

The first part (Objective Questions) of the exam is to be completed and submitted first. When you have submitted the first part of the exam, you will be handed the second part (Open Response Question) part of the exam. Each question has equal weight (4 points each).

_____ Question 1

_____ Question 2

_____ Question 3

_____ Question 4

_____ Question 5

_____ Question 6

_____ Question 7

_____ Question 8

_____ Question 9

_____ Question 10

_____ Question 11

_____ Question 12

_____ Question 13

_____ Question 14

_____ Question 15

_____ Question 16

_____ Question 17

_____ Question 18

Part I: Objective Questions

These questions have straight-forward answers. Make sure to put your answer in the line required as that is the part that will be graded for the answer given. Only the final answers, as indicated by the question, will be considered correct for each question. Each question is worth 4 points (total of 72 points)

Matching:

_____ 1. T_0

_____ 2. $f(nT_s)$

_____ 3. $\delta[n]$

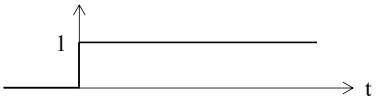
_____ 4. $H(\hat{\omega}) = \sum_{k=0}^{M} h_k e^{-j\hat{\omega}k}$

a. Convolution

b. FIR Frequency Response

c. Sampling Period

d. Waveform Period

e. 

f. Sampled function

g. Discrete Impulse Function

h. Discrete Step Function

Match the sampled signals to the real signal, $x(t) = 3\cos(2\pi ft) + \cos(6\pi ft)$. Assume an ideal Continuous to Discrete (C-to-D) transformation.

_____ 5. f_s = 18kHz

_____ 6. f_s = 6kHz

_____ 7. f_s = 3kHz

a. $3\cos(\frac{2\pi}{3}n) + \cos(\pi n)$

b. $3\cos(\frac{2\pi}{3}n) + 1$

c. $3\cos(\frac{\pi}{9}n) + \cos(\frac{\pi}{3}n)$

d. $3\cos(\frac{\pi}{3}n) + \cos(\frac{\pi}{2}n)$

e. $3\cos(\frac{\pi}{9}n) + \cos(-\frac{\pi}{2}n)$

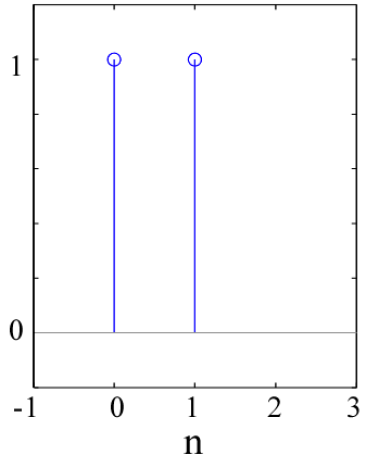
f. $3\cos(\frac{\pi}{3}n) + \cos(\pi n)$

g. $3\cos(\frac{\pi}{9}n) + \cos(\frac{\pi}{2}n)$

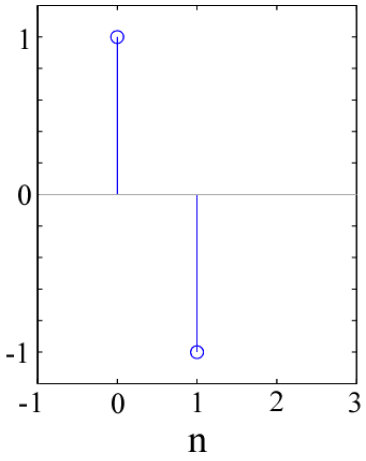
h. $3\cos(\frac{\pi}{3}n) - \cos(\pi n)$

What is the frequency response (magnitude) of the following impulse response functions:

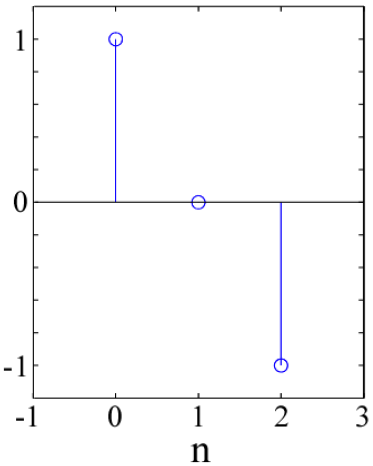
h[n]



_____ 8.

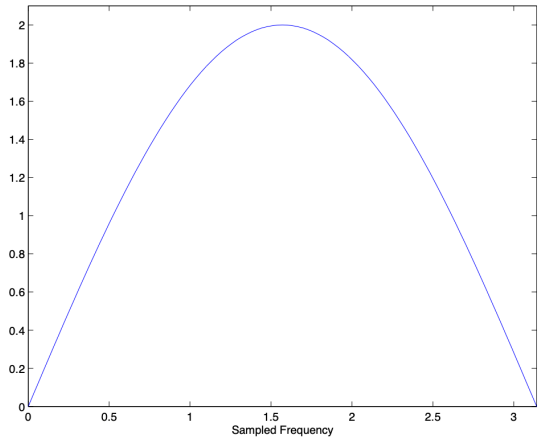


_____ 9.

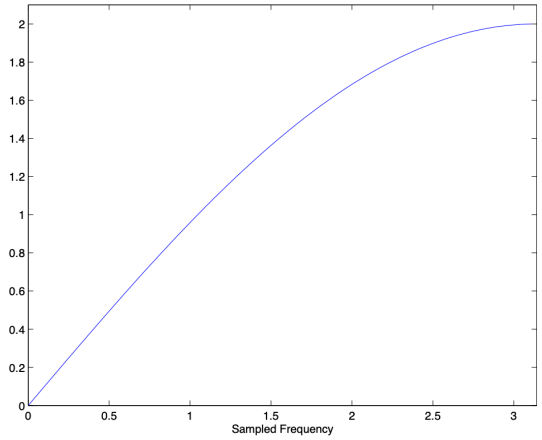


_____ 10.

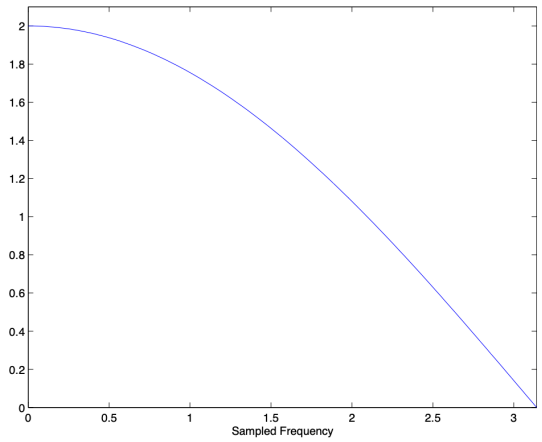
|H(Sampled Frequency)|



a.



b.



c.

What is the frequency response corresponding the h[n]?

h[n]

_____ 11. $h[n] = \delta[n] - \delta[n-2]$

_____ 12. $h[n] = \delta[n] + \delta[n-1]$

h[n]

a. $2j\sin(\hat{\omega}/2)e^{-j\hat{\omega}/2}$

b. $2j\sin(\hat{\omega})e^{-j\hat{\omega}}$

c. $2\cos(\hat{\omega}/2)e^{-j\hat{\omega}/2}$

_____ 13. (True / False) A linearly increasing set of notes with time on a keyboard would be a linearly increasing chirp signal with time.

_____ 14. (True / False) Sampling in frequency or time leads to periodicity in time or frequency, respectively.

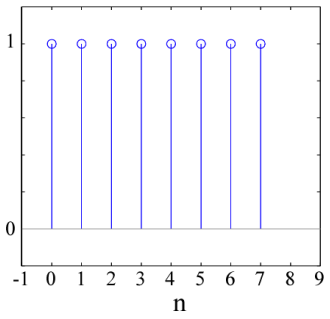
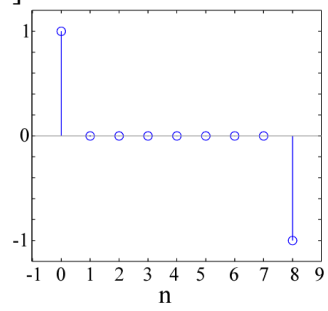
What h[n] creates the following transformation from input (x[n]) to output (y[n]):

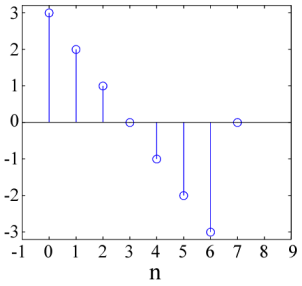
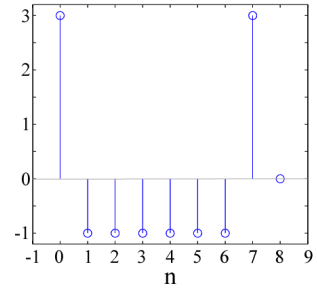
a. $h[n] = \delta[n] + \delta[n-1]$

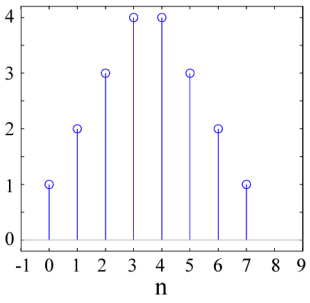
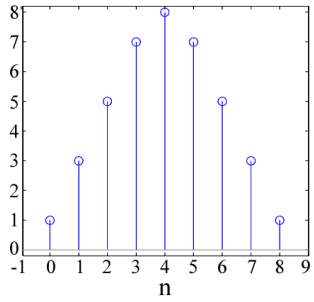
b. $h[n] = \delta[n] - \delta[n-1]$

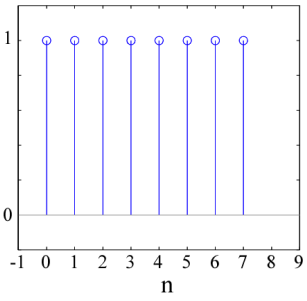
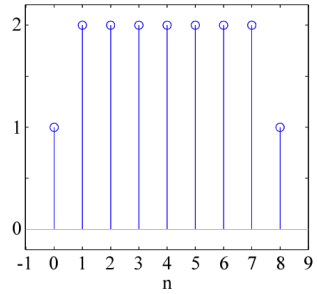
c. $h[n] = \delta[n] - \delta[n-2]$

x[n] y[n]

_____ 15.  → 

_____ 16.  → 

_____ 17.  → 

_____ 18.  → 

ECE 2026 Exam 3 (Final Exam) Part II Open Response Question
Summer 2025

Name _____

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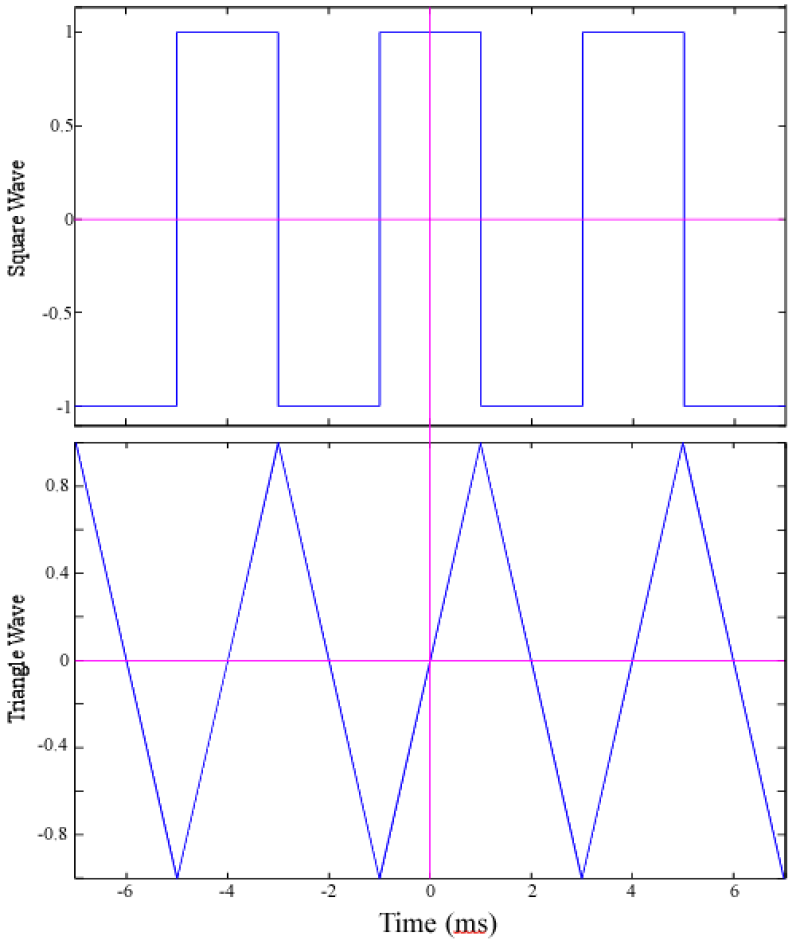
_____/28_ Part II: Open Response Question

A. Compute the Fourier Series of the following two waveforms:



B. What are the first four non-zero coefficients for the two cases? You may keep the coefficients with factor of π, as well as a fraction where helpful. What is the frequency for each of these coefficients?

Square wave:

Triangle wave:

C. What are these coefficients for the square wave and triangle wave case when we sample this waveform at 3kHz? Which of the two cases, the square wave or the triangle wave, has fewer issues when sampled? Why?

D. What is the relationship between the two waveforms (square wave and triangle wave)?