

# Signal Processing Mock-Up Exam (not graded)

Istanbul University - Cerrahpaşa  
Computer Engineering Department - FALL 2020

Due November 23<sup>rd</sup>, 2020 23:59

## PLEASE READ

This is a mock-up exam. It will not be graded.

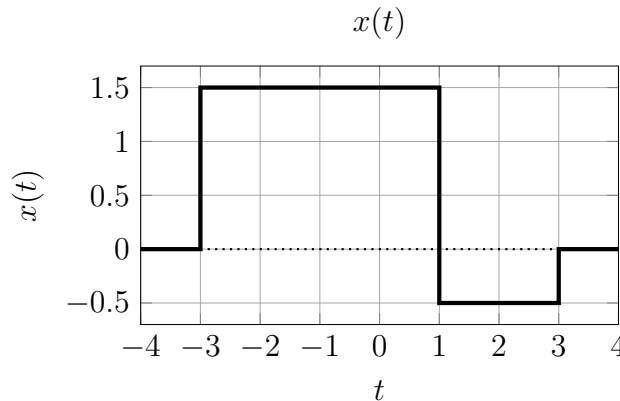
**Submission:** After finishing the exam, you must put your name, number and signature on every page on your answer sheet and use a mobile tool like Microsoft Office Lens or a similar Document scanner to take the pictures of your solutions (or scan using a desktop scanner) and create a single PDF file. Name your file in the following fashion, where you will replace 1306XXXX with your actual school number:

signal-2020-deneme-1306XXXX.pdf

**You must upload the file to MERGEN by the deadline.**

Good Luck. (Mustafa Dağtekin)

**Q1:** Consider the following CONTINUOUS TIME signal. Answer the following questions.



(a) (10 pts) Write  $x(t)$  as weighted superposition of step functions.

- (b) (10 pts) Carefully sketch  $2x(0.5t - 0.5) + 3x(2t + 1)$ .
- (c) (10 pts) Calculate its average power and total energy of  $x(t)$ . Is  $x(t)$  an energy signal, power signal or neither?

**Q2:** For the DT LTI system  $\mathcal{H}_1$ , the impulse response is given as:

$$h[n] = \begin{cases} 0 & , \quad n < 0 \\ \left(\frac{1}{2}\right)^n & , \quad 0 \leq n \end{cases}$$

Find the output of this system when the input is the following:

$$x[n] = 2^{-2n} u[n + 5]$$

**Q3:** Consider the following CT system. Answer the following questions.

$$y(t) = \mathcal{H}_2\{x(t)\} = e^{-|x(t+1)|} x(t - 1)$$

- (a) (10 pts) Is  $\mathcal{H}_2$  stable? Show your work.
- (b) (10 pts) Is  $\mathcal{H}_2$  linear? Show your work.
- (c) (10 pts) Is  $\mathcal{H}_2$  time invariant? Show your work.

**Q4:** For a system  $\mathcal{H}_3$ , the impulse response is given below. Answer the following questions.

$$h(t) = e^{-2t} u(t - 5)$$

- (a) (4 pts) Is  $\mathcal{H}_3$  stable? Show your work.
- (b) (3 pts) Is  $\mathcal{H}_3$  memoryless? Explain.
- (c) (3 pts) Is  $\mathcal{H}_3$  causal? Explain.
- (d) (10 pts) If the input of this system is given by  $x(t) = e^{-t/2} u(t - 1)$ , what is the output?