

Signal Processing (Örgün Öğretim)

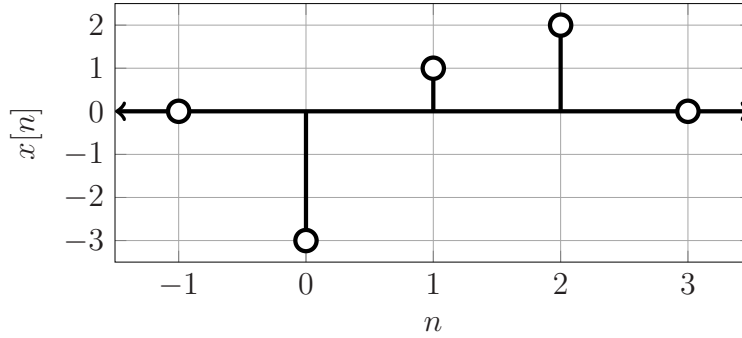
Final Exam

Istanbul University - Computer Engineering Department - FALL 2017

December 28th, 2017

PLEASE READ: The duration for this exam is **75** minutes. Please answer the questions in ENGLISH briefly and clearly. **Bad handwriting, unclear statements, ambiguous answers will result in credit loss.** You may bring one calculator, an A4 sized formula sheet and a copy of Appendix A from the book to the exam. The formula-sheet MUST NOT contain any problems and solutions. Every other material is forbidden. Sharing of materials is not allowed and will be considered cheating if done so. Please read the questions before solving them. Please RETURN your exam papers but KEEP your A4 formula-sheets at the end of the examination. This test has total of **100+10** points worth of questions. Anyone attempting to cheat, help someone else to cheat or make an effort to do these will receive 0 points for the exam and will be reported to the Dean's office. Good Luck. (Mustafa Dağtekin)

Q1: (15 pts) Consider the following DISCRETE TIME signal. Please carefully sketch $x[4n+4]$. Show your steps to receive credit.



Q2: Consider the following discrete time system, \mathcal{H}_1 . Answer the following questions.

$$y[n] = \mathcal{H}_1\{x[n]\} = x[n] - x[n-4]$$

- (a) (10 pts) Find and SKETCH the impulse response of \mathcal{H}_1 .
- (b) (15 pts) Find and SKETCH the step response of \mathcal{H}_1 .

Q3: For a discrete time system, \mathcal{H}_2 , the impulse response is given below as $h[n]$.

$$h[n] = e^{-2n} u[n - 3]$$

- (a) (10 pts) Please state whether or not \mathcal{H}_2 is memoryless and/or causal. (No explanation necessary)
- (b) (15 pts) Find the output of \mathcal{H}_2 when the input is given as the following:

$$x[n] = u[1 - n]$$

Q4: (10 pts) The step response of a continuous time system, \mathcal{H}_3 , is given as the following. Determine the impulse response of \mathcal{H}_3 .

$$s(t) = (1 - e^{-2t}) u(t)$$

Q5: (15 pts) For a continuous time system, \mathcal{H}_4 , the impulse response is given below as $h(t)$. Find the output when the input signal is $x(t)$.

$$h(t) = u(t + 1) - u(t - 1)$$

$$x(t) = e^{-t} u(t - 1)$$

Q6: (10 pts) Consider the following discrete time system, \mathcal{H}_5 . Determine whether it is linear.

$$y[n] = \mathcal{H}_5\{x[n]\} = 2x[n] + 3$$

Q7: (10 pts) (BONUS QUESTION) Is the signal $x(t)$ given in Q5 an energy signal, power signal, or neither? Calculate its average power and energy.