**EEM301 HOMEWORK**

**HW-1:**

**1**. Consider the following systems with x as input and y as output;

S1: 

S2: 

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **i** | **a** | **b** | **c** | **d** | **i** | **e** | **f** | **g** | **h** |
| **1** | 3 | 2 | 1 | 1 | **26** | ny | 1 | 2 | 1 |
| **2** | 1 | t | 1 | 1 | **27** | 3 | 2 | 1 | 1 |
| **3** | 1 | 1 | 1 | t | **28** | 1 | n | 1 | 1 |
| **4** | y | 1 | 0 | 1 | **29** | 1 | 1 | 1 | n |
| **5** | 1 | 1 | 1 | x | **30** | y | 1 | 0 | 1 |
| **6** | y | 1 | 0 | t | **31** | 1 | 1 | 1 | x |
| **7** | 2 | 1 | 0 | 2 | **32** | y | 1 | 0 | n |
| **8** | 2 | 1 | 2t | 3 | **33** | 2 | 1 | 0 | 2 |
| **9** | 2 | 2y | 0 | 1 | **34** | 2 | 1 | 2n | 3 |
| **10** | 3y | 1 | 1 | 1 | **35** | 2 | 2y | 0 | 1 |
| **11** | 0 | t | 2 | 1 | **36** | 3y | 1 | 1 | 1 |
| **12** | 0 | ty | 0 | 1 | **37** | 0 | n | 2 | 1 |
| **13** | 3 | 2 | x | 1 | **38** | 0 | ny | 0 | 1 |
| **14** | 3 | 2 | t | 0 | **39** | 3 | 2 | x | 1 |
| **15** | 0 | 0 | 0 | tx | **40** | 3 | 2 | n | 0 |
| **16** | y | 0 | 1 | t | **41** | 2 | 2 | 0 | x |
| **17** | 2 | 0 | 0 | 2 | **42** | 0 | y | 1 | n |
| **18** | 0 | 1 | 2t | 3 | **43** | 1 | n | 0 | 2 |
| **19** | 2 | 2y | 1 | 1 | **44** | 2 | 2 | 2n | 4 |
| **20** | 3y | t | 1 | 1 | **45** | 2 | ny | 0 | 1 |
| **21** | 0 | t | 2 | 0 | **46** | 3y | 1 | 1 | 0 |
| **22** | 0 | ty | 0 | 1 | **47** | 1 | n | 2 | 1 |
| **23** | 1 | 1 | y | 1 | **48** | 2 | ny | 2 | 1 |
| **24** | t | 2 | 1 | 0 | **49** | 3 | 3 | x | 2 |
| **25** | 1 | 0 | 0 | tx | **50** | 3 | n | 2 | 0 |

Mathematically determine whether S1 or S2 is a linear/nonlinear and time-invariant/time-varying system for the given coefficients. Note that the index i corresponds to the student’s place in the register.

**2.** Consider the S1 and S2 with the following coefficients:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **i** | **a** | **b** | **c** | **d** | **i** | **e** | **f** | **g** | **h** |
| **1** | 3 | 2 | 1 | 1 | **26** | -0.4 | 0.04 | 1 | 1 |
| **2** | 2 | 1 | 2 | 1 | **27** | -0.5 | 0.06 | 2 | 1 |
| **3** | 2 | 2 | 1 | 2 | **28** | -1 | 0.25 | 1 | 2 |
| **4** | 5 | 6 | 3 | 2 | **29** | -0.7 | 0.12 | 1 | 0 |
| **5** | 4 | 4 | 1 | 3 | **30** | -0.9 | 0.2 | 2 | 1 |
| **6** | 4 | 13 | 1 | 1 | **31** | -1.2 | 0.36 | 2 | 3 |
| **7** | 7 | 12 | 2 | 1 | **32** | -1.1 | 0.3 | 1 | 2 |
| **8** | 6 | 9 | 1 | 2 | **33** | -1.3 | 0.42 | 3 | 2 |
| **9** | 2 | 5 | 2 | 3 | **34** | -1.4 | 0.49 | 1 | 1 |
| **10** | 9 | 20 | 1 | 2 | **35** | -1.5 | 0.56 | 2 | 1 |
| **11** | 8 | 16 | 3 | 2 | **36** | -1.7 | 0.72 | 1 | 2 |
| **12** | 6 | 25 | 1 | 1 | **37** | -1.5 | 1.0 | 1 | 0 |
| **13** | 11 | 30 | 3 | 2 | **38** | -1.6 | 1.0 | 1 | 1 |
| **14** | 10 | 25 | 1 | 2 | **39** | -1.7 | 1.0 | 2 | 1 |
| **15** | 8 | 41 | 1 | 1 | **40** | -1.8 | 1.0 | 1 | 2 |
| **16** | 4 | 3 | 0 | 3 | **41** | -0,2 | 0,01 | 2 | 1 |
| **17** | 12 | 36 | 2 | 1 | **42** | -0,6 | 0,08 | 2 | 3 |
| **18** | 4 | 8 | 1 | 1 | **43** | -0,7 | 0,1 | 1 | 2 |
| **19** | 5 | 4 | 0 | 2 | **44** | -0,6 | 0,09 | 3 | 2 |
| **20** | 14 | 49 | 2 | 2 | **45** | -0,8 | 0,12 | 1 | 1 |
| **21** | 6 | 13 | 2 | 3 | **46** | -0,9 | 0,14 | 2 | 1 |
| **22** | 6 | 5 | 3 | 2 | **47** | -0,8 | 0,16 | 1 | 2 |
| **23** | 8 | 25 | 0 | 4 | **48** | -1 | 0,16 | 1 | 0 |
| **24** | 16 | 64 | 2 | 1 | **49** | -1,1 | 0,18 | 1 | 1 |
| **25** | 7 | 6 | 4 | 2 | **50** | -0,8 | 0,15 | 2 | 1 |

1. Find the impulse response h(t) or h(n) of the causal LTI system S1 or S2 with the corresponding coefficients given above.
2. Obtain the output y(t) or y(n) for the following casual input utilizing either the convolution integral or convolution sum,

 or 

1. Verify your findings in (b) by utilizing either p-operator or q-operator wherever it is applicable.

***Note that HW-1: Problems 1 and 2 are due on Friday of the 8th week.***

**HW-2:**

**3.** Consider S1 with {c=0 and d=1} or S2 with {g=1 and h=0} LTI system and the corresponding {a, b} or {e, f}coefficients given in Pr. 2 above. Find the Fourier series (FS) representation of the output y(t) or y(n) for the following input:

 or 

***Note that for the Problem 3, student’s new index is taken as***

***26 ≤ (i+25) ≤ 50 or 1 ≤ (i - 25) ≤ 25***

**4.** Consider S1 with {c=0 and d=1} or S2 with {g=1 and h=0} LTI system and the corresponding {a, b} or {e, f}coefficients given in Pr. 2 above.

(a) Determine the frequency response H(jω) of S1 or H(ejω) of S2 utilizing the Fourier (or DTFT) Transform.

(b) Obtain the output response y(t) or y(n) for the following input using FT or DTFT:

 or 

**5.** Consider S1 with {c=0 and d=1} or S2 with {g=1 and h=0} LTI system and the corresponding {a, b} or {e, f}coefficients given in Pr. 2 above.

Obtain the output response y(t) or y(n) for the following input using FT or DTFT:

 or 

***Note that for the Problem 5, student’s new index is taken as***

***26 ≤ (i+25) ≤ 50 or 1 ≤ (i - 25) ≤ 25***

***Note that HW-2: Problems 3, 4 and 5 are due on Friday of the 14th week.*** *Uraz*