VIETNAM NATIONAL UNIVERSITY, HANOI
University of Engineering and Technology

Date: May 29, 2013

FINAL EXAMINATION - ANSWERS
Course: **Signals and Systems**
Duration: 90 minutes

Part 1 (Multiple-choice questions)*: For problems in this part, you only have to give the letter of the correct answer (A/B/C/D). Explanations are not required.*

Problem 1. What is the appropriate Fourier representation of the following signal:

$$x(t)=|\sin(2\pi t)|$$

A. The continuous-time Fourier transform (FT).

B. The discrete-time Fourier transform (DTFT).

C. The continuous-time Fourier series (FS).

D. The discrete-time Fourier series (DTFS).

Answer: C

Problem 2. Which one of the following signals is NOT periodic:

A. $x(n)=\cos(2n)$

B. $x(n)=\cos(2\pi n)$

C. $x(n)=\sum_{k=-\infty}^{+\infty}\{(-1)^k[\delta(n-2k)+\delta(n+3k)]\}$

D. $x(n)=2\sin(4\pi n/19)+\cos(10\pi n/19)+1$

Answer: A

Problem 3. Which one of the following systems is a causal linear time-invariant system?

A. $y(t)=(t-1)x(t)$

B. $y(t)=x(t)-2x(t/2)$

C. $y(n)=x(n)+y(n-1)$

D. $y(n)=|x(n)-x(n-1)|$

Answer: C

Problem 4. What is the final value of the signal $x(t)$, given its Laplace transform as follows:

$$X(s)=\frac{2s^2+3}{s^2+5s+1}$$

A. 0

B. 2

C. 3

D. Infinity

Answer: A

Problem 5. Which one of the systems described by the following transfer functions can be both causal and stable?

A. $H(z)=\frac{2z+3}{z^2+z-5/16}$

B. $H(z)=\frac{z^{-1}}{[1-(1/2)z^{-1}](1+3z^{-1})}$

C. $H(z)=\frac{z^2-1/4}{6z^2+7z+1}$

D. $H(z)=\frac{z^{-2}}{1-(1/2)z^{-1}+(1/4)z^{-2}}$

Answer: D

***Part 2 (Exercises)**:For problems in this part, detailed explanations/derivations that lead to the answer must be provided.*

Problem 6. Determine the frequency response and the impulse response of the system described by the following differential equation:

$$\frac{d^2y(t)}{dt^2}+3\frac{dy(t)}{dt}+2y(t)=-\frac{dx(t)}{dt}$$

Answer: $H(\omega)=\dfrac{j\omega}{\omega^2-3j\omega-2}$ if the system is causal, $h(t)=L^{-1}\left[\dfrac{-s}{s^2+3s+2}\right]$ (depending on the causality of the system)

Problem 7. Determine the output of the system described by the following difference equation:

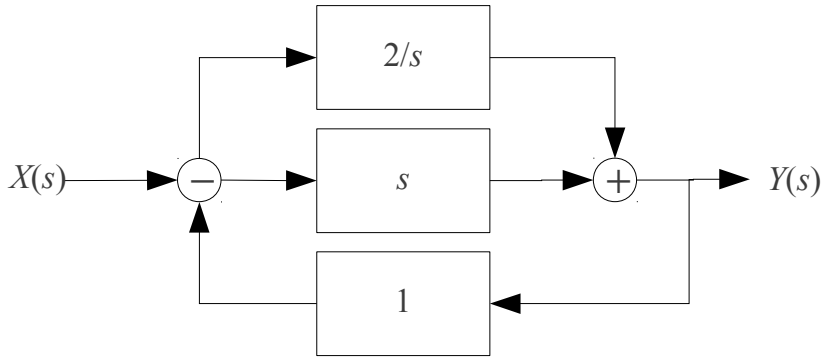
$$y(n)+(1/4)y(n-1)-(1/8)y(n-2)=x(n)+x(n-1)$$

given the input: $x(n)=(-1)^n u(n)$

and the initial conditions: $y(-1)=4$ and $y(-2)=-2$.

Answer: Use the forward and inverse unilateral Z transforms and their properties.

Problem 8. A causal LTI system is described by the following block diagram:



a) Determine the transfer function of the given system.

b) Find the differential equation describing the given system.

c) Is this system stable?

Answer:

a) $H(s)=\dfrac{s^2+2}{s^2+s+2}$

b) $\dfrac{d^2y(t)}{dt^2}+\dfrac{dy(t)}{dt}+2y(t)=\dfrac{d^2x(t)}{dt^2}+2x(t)$

c) Yes

***** END *****