國立暨南國際大學九十五學年度碩士班研究生入學考試試題　第2節

科目：訊號與系統　適用：電機所系統組

編號：432

考生注意：
1.依次序作答，只要標明題號，不必抄題。
2.答案必須寫在答案卷上，否則不予計分。
3.限用藍、黑色筆作答；試題須隨卷繳回。

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第 1 頁

1. The autocorrelation of a real signal $x(t)$ is defined as

$$r_{xx}(t) = \int_{-\infty}^{\infty} x(\tau)x(\tau - t)d\tau,$$

Evaluate the autocorrelation of the following signals:

(a) (5%) $x(t) = e^{-t}u(t)$

(b) (5%) $x(t) = \cos(\pi t)[u(t+1) - u(t-1)]$

(c) (5%) $x(t) = u(t) - 2u(t-1) + u(t-2)$

(d) (5%) $x(t) = u(t-a) - u(t-a-1)$

2. A linear system H has the input-output pairs depicted in Fig P2(a). Answer the following questions, and explain your answers.

(a) (5%) Could this system be causal?

(b) (5%) Could this system be time-invariant?

(c) (5%) Could this system be memoryless?

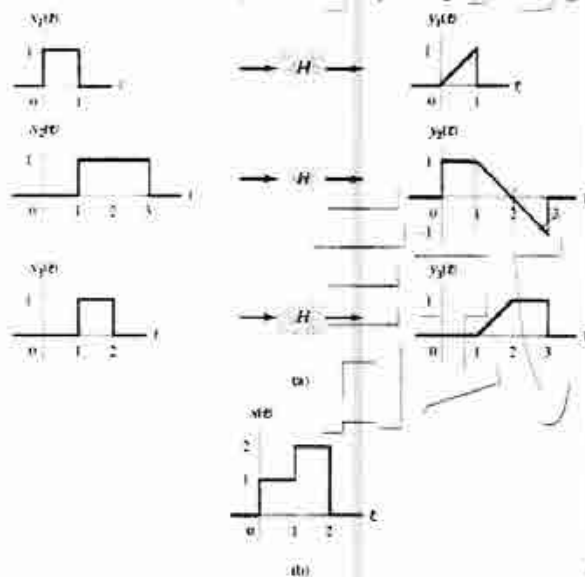(d) (5%) What is the output for the input depicted in Fig. P2(b)?

Figure P2

3. Determine the inverse continuous-time Fourier Transform for the following signals

(a) (5%) $X(j\omega) = \dfrac{j\omega - 2}{-\omega^2 + 5j\omega + 4}$

(b) (5%) $X(j\omega) = \dfrac{j\omega + 3}{(j\omega + 1)^2}$

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4. Determine the inverse discrete-time Fourier Transform for the following signals

   (a) (5%) $X\left(e^{j\Omega}\right) = \dfrac{2e^{-j\Omega}}{-\frac{1}{2}e^{-j2\Omega}+1}$

   (b) (5%) $X\left(e^{j\Omega}\right) = \dfrac{6 - \frac{2}{3}e^{-j\Omega} - \frac{1}{6}e^{-j2\Omega}}{1 + \frac{1}{6}e^{-j\Omega} - \frac{1}{6}e^{-j2\Omega}}$

5. For each of the following signals, sampled with sampling interval T_s, determine the bounds on T_s, which guarantee that there will be no aliasing:

   (a) (5%) $x(t) = \dfrac{\sin(3\pi t)}{t} + \cos(2\pi t)$

   (b) (5%) $x(t) = \cos(12\pi t)\dfrac{\sin(\pi t)}{2t}$

6. Given the z-transform pair $x[n] \xleftrightarrow{z} \dfrac{z^2}{z^2 - 16}$ with ROC $|z| < 4$, determine the z-transform of the following signals

   (a) (5%) $y[n] = nx[n]$

   (b) (5%) $y[n] = x[n] * x[n-3]$　　(* : linear convolution)

7. Determine the time-domain signal corresponding to the following z-transforms:

   (a) (5%) $X(z) = \cos\left(z^{-1}\right)$, $|z| > 0$

   (b) (5%) $X(z) = \ln\left(1 + z^{-1}\right)$, $|z| > 0$

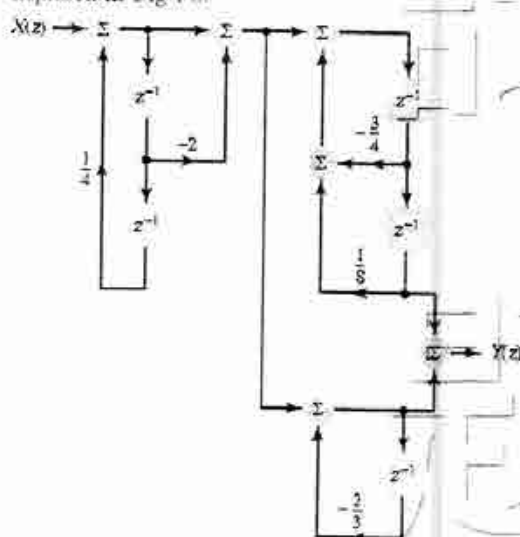8. (10%) Determine the transfer function $H(z) = Y(z)/X(z)$ of the system depicted in Fig P8.

Figure P8