

國立臺灣科技大學

八十九學年度碩士班招生考試試題

系所組別：電子工程系乙二組

科目：線性系統

(總分共 100 分)

1. The impulse response of a causal continuous-time system is a right-sided function shown in Fig. P1. (a) Please find the system function (transfer function) of this system and the corresponding region of convergence. (15 分) (b) Please determine the poles of the system function. (5 分)

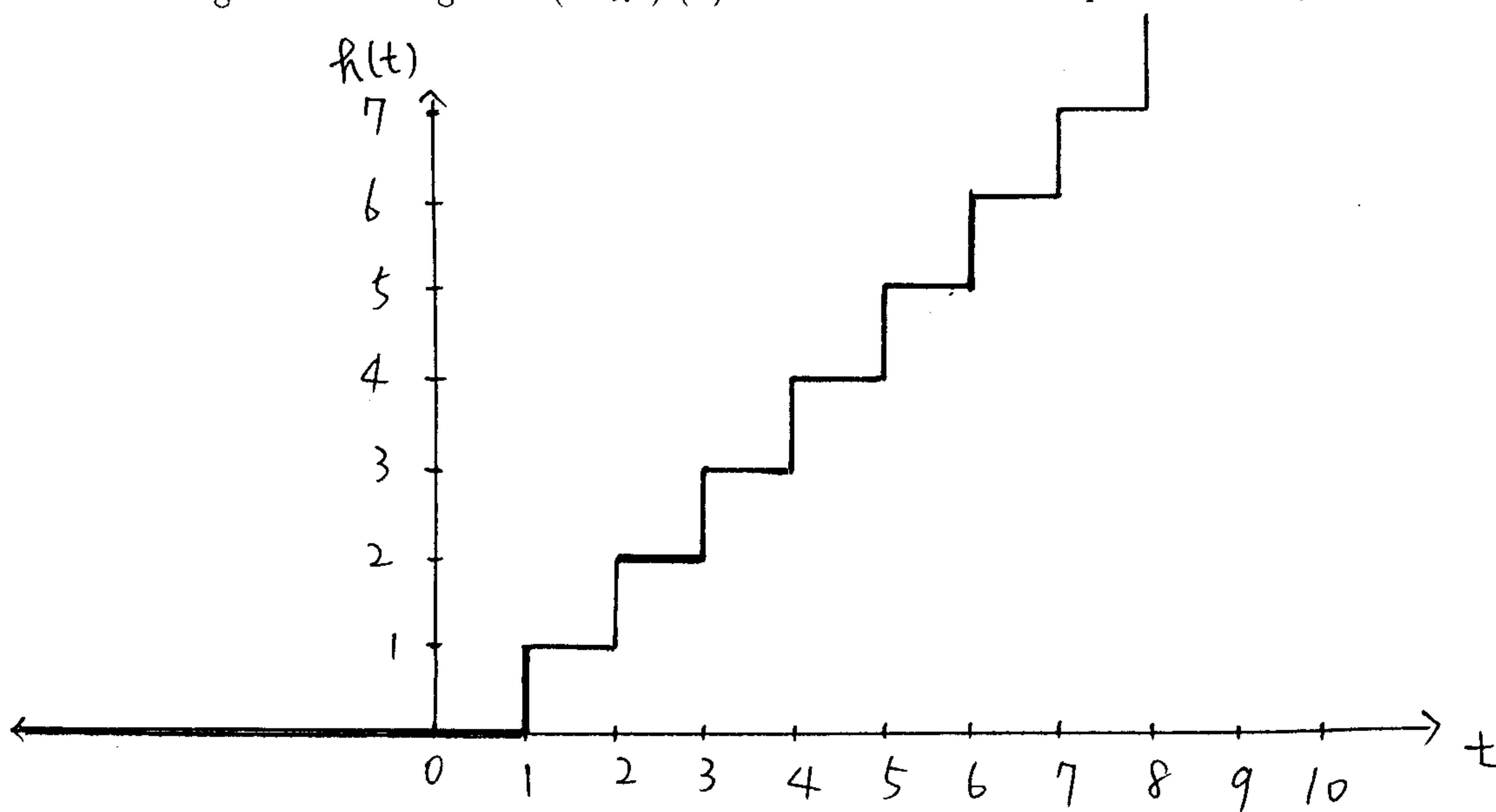


Fig. P1

2. The state vector of a state-space model is governed by the equation $\dot{X}(t) = AX(t) + Bv(t)$, where $A = \begin{bmatrix} -1 & 1 \\ 0 & -2 \end{bmatrix}$, $B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$. It is assumed that the state-space model is driven from an initial state $X(t_0)$ by a known scalar input $v(t)$. Please determine an explicit time-domain formula to compute the state vector $X(t)$ for all $t \geq t_0$. (20 分)
3. Let T be a positive real number and let $x(t) = |\sin(\frac{4\pi t}{T})|$. (a) Please determine the fundamental period of $x(t)$. (5 分) (b) Please determine the Fourier series coefficients a_k of the signal $x(t)$ for the fundamental period determined in part (a). (10 分) (c) Please determine the Fourier transform of the signal $x(t)$. (5 分)
4. Let $u(t)$ denote the unit step function. Suppose $x(t) = e^{\alpha t}u(t)$ and $y(t) = e^{\beta t}u(-t)$, where α and β are two complex-valued numbers. (a) Please determine the conditions on α and β such that the convolution between $x(t)$ and $y(t)$ is well defined. (5 分) (b) Please compute the convolution between $x(t)$ and $y(t)$ when the convolution is well defined. (15 分)
5. The input-output relationship of a discrete-time LTI system is governed by the difference equation $y[n] + y[n-1] + \frac{1}{4}y[n-2] = x[n] - x[n-1]$, where $x[n]$ is the input and $y[n]$ is the output. (a) Please determine the impulse response of the system. (10 分) (b) Please determine the step response of the system. (10 分)

