1- Tick right (√) or false (x) as appropriate (*6 marks*)

a) The $\mathcal{Z}|r(k-1)+u(k-1)| = R(z);\ r(k)\ unit\ ramp, u(k)\ unit\ step$ ( ) (*3 marks*)

b) $\mathcal{Z}^{-1}\left|\frac{z^{-1}}{(a+z^{-1})}+\frac{a}{(a+z^{-1})}\right| = 2(-\frac{1}{a})^{k}$ ( ) (*3 marks*)

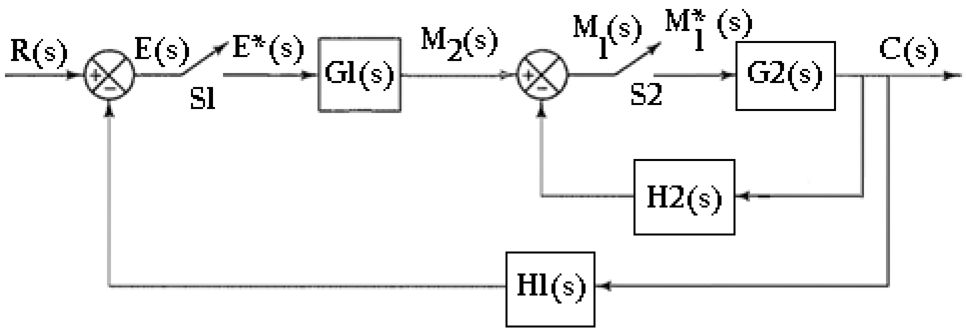
2- Find the initial and final values of X(z) where (*7 marks*)

$$X(z) = \frac{4z^4 - z}{(z^2+1-z^{-2})(z^3-2z+z^{-1})}$$

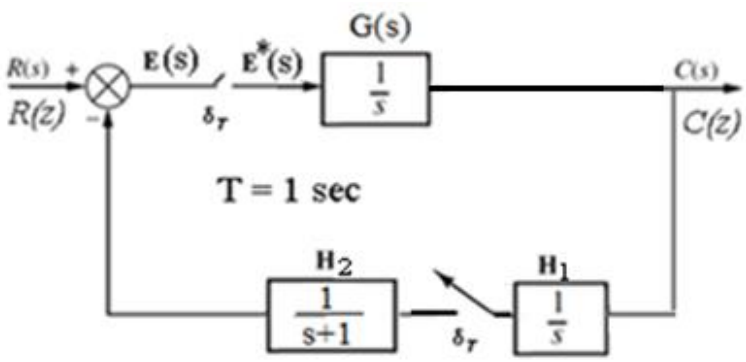
3- Use the Convolution Integral Method to find the z transform of (*7 marks*)

$; Confirm\ your\ results\ using\ another\ method. X(s) = \frac{as+1}{(1-s^2)(a+s)}$

4- Obtain the pulse transfer function of the system below: (**8** *marks*)



5- For the discrete data system shown below: (*12 marks*)



- Find the discrete time transfer function (*6marks)*
- Use the Jury test to determine the stability of the system when it is subjected to a Kronecker input; i.e. r(t) = δ(k) = Kronecker Delta. (*6 marks)*

See underneath for some given useful information

مع تمنياتي للجميع بالتوفيق والنجاح
أستاذ المادة : د. سميح العماري أبوسعد

Table of Laplace and Z-transforms

	$X(s)$	$x(t)$	$x(kT)$ or $x(k)$	$X(z)$
1.	–	–	Kronecker delta $\delta_0(k)$ 1 $k=0$ 0 $k\neq 0$	1
2.	–	–	$\delta_0(n-k)$ 1 $n=k$ 0 $n\neq k$	z^{-k}
3.	$\frac{1}{s}$	$1(t)$	$1(k)$	$\frac{1}{1-z^{-1}}$
4.	$\frac{1}{s+a}$	e^{-at}	e^{-akT}	$\frac{1}{1-e^{-aT}z^{-1}}$
5.	$\frac{1}{s^2}$	t	kT	$\frac{Tz^{-1}}{(1-z^{-1})^2}$
6	$\frac{1}{(s+a)^2}$	te^{-at}	kTe^{-akT}	$\frac{Te^{-aT}z^{-1}}{(1-e^{-aT}z^{-1})^2}$
7	$\frac{s}{(s+a)^2}$	$(1-at)e^{-at}$	$(1-akT)e^{-akT}$	$\frac{1-(1+aT)e^{-aT}z^{-1}}{(1-e^{-aT}z^{-1})^2}$
8	–	–	a^k	$\frac{1}{1-az^{-1}}$
9	–	–	a^{k-1} $k=1, 2, 3, \ldots$	$\frac{z^{-1}}{1-az^{-1}}$

The z transform is given as:

$$X(z)=\sum_{k=0}^{\infty}x(kT)z^{-k}$$

Initial value: $x(0)=\lim_{z\to\infty}X(z)$

Final value theorem: $x(\infty)=\lim_{z\to 1}[(1-z^{-1})X(z)]$

The convolution integral - simple poles

$$K_j=\lim_{s\to sj}\left[(s-sj)\frac{X(s)z}{z-e^{Ts}}\right]$$

The convolution integral - repeated poles

$$K_i=\frac{1}{(n_i-1)!}\lim_{s\to si}\frac{d^{n_i-1}}{ds^{n_i-1}}\left[(s-si)\frac{X(s)\,z}{z-e^{Ts}}\right]$$