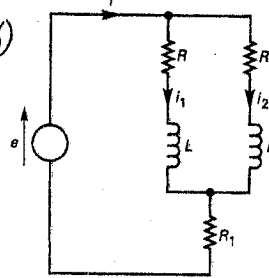1.　Consider the following circuit

(1) Determine whether the system is controllable (10%)

(2) write down the state equation of the system. (10%)

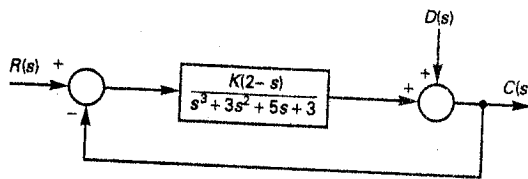(3) Find the transfer function $I(s)/E(s)$ for this circuit (5%)

2　The Routh array has the form

$$
\begin{array}{c|ccc}
\vdots & \vdots & & \\
s^4 & x & x & \circledx \\
s^3 & x & x & \\
s^2 & x & \circledx & \\
s^1 & x & & \\
s^0 & \circledx & &
\end{array}
$$

Show that the values of the elements circled are always equal (10%)
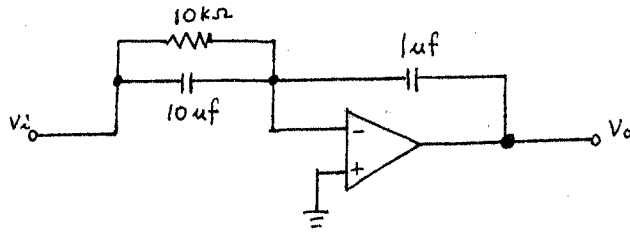
3.　Consider the following system
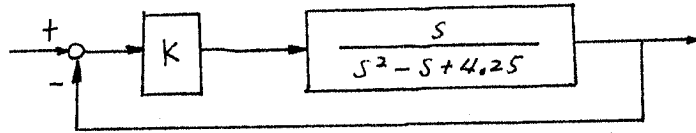

Determine the range of K for stability. (15%)

注意：背面有試題

4. What is the function of the following circuit?

10%

5. Plot the root locus in detail of the system: ($0.5 \leq k < \infty$)

20%

6. Is the following system stable? (Explain your answer.)

20%

$$\dot{x}(t) = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ -2 & -3 & -1 & -3 \end{bmatrix} x(t) + \begin{bmatrix} 1 \\ 2 \\ 3 \\ 2 \end{bmatrix} u(t)$$

$$y(t) = \begin{bmatrix} 2 & 3 & 1 & 0 \end{bmatrix} x(t)$$