1. For a polynomial $A(s) = s^5 + 3s^4 + 2s^3 + 6s^2 + 6s + 9$, determine whether the polynomial is stable or not.

2. If the sampling time is 0.1 second, and the CT transfer function of a plant is $5/(s^2 + s)$, calculate its DT transfer function. (CT: continuous time; DT: discrete time)

3. What are transfer functions of $\text{Out}_1(s)/\text{In}_1(s)$ and $\text{Out}_1(s)/\text{In}_2(s)$?

4. Given the system as follows:

$$
\dot{X} = \begin{bmatrix} 0 & 2 \\ -3 & -5 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} e^{-t}
$$

$$
Y = \begin{bmatrix} 1 & 3 \end{bmatrix} X
$$

$$
X(0) = \begin{bmatrix} 2 \\ 1 \end{bmatrix}
$$

Do the following:
(a) Solve for $y(t)$.
(b) Find the eigenvalues and the system poles.

5. Find the range of gain $K$ for stability for the unity feedback system shown below

\[
\begin{align*}
R(s) & \quad + \quad E(s) \\
& \quad \quad \downarrow \quad G(s) \\
C(s) & \quad \quad \quad \downarrow
\end{align*}
\]

Where $G(s) = \frac{K(s-2)(s+4)(s+5)}{(s^5 + 3)}$
每題 20 分，各小題分數相同 請注意 控制 與 計算機 二者只能擇一題作答，不可混合選答

1. Explain the following terms:
   (a) Embedded System
   (b) Hash Function
   (c) Greedy Algorithm

2. Design a circuit that generates the 9's complement of a BCD digit. Note that the 9's complement of $d$ is $9 - d$.

3. Find a simplified sum-of-products form for $F(A, B, C, D) = \Sigma m(0, 4, 6, 8, 9, 15) + D(3, 7, 11, 13)$

4. An imaginary computer has four data registers (R0 to R3), 1024 words in memory, and 16 different instructions (add, subtract, etc.). What is the minimum size of an instruction in bits if a typical instruction uses the following format: add 565 R2. (20%)  

5. Please do the following calculations:
   (a) Change $-2^5 \times 1.01101000$ into 32-bit IEEE format using excess_127 system. (5%)
   (b) Change $12 - \frac{5}{128}$ into binary fraction. (5%)
   (c) Change 7.1825 into 32-bit IEEE format using excess_127 system. (5%)
   (d) Change 10110100 into a 8-bit sign-and-magnitude number to decimal. (5%)