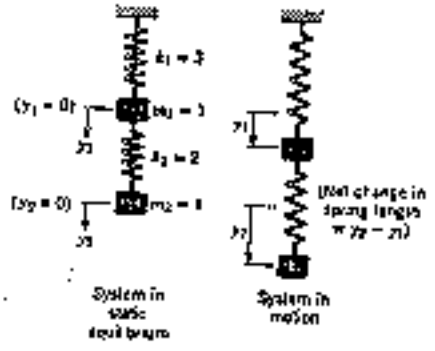
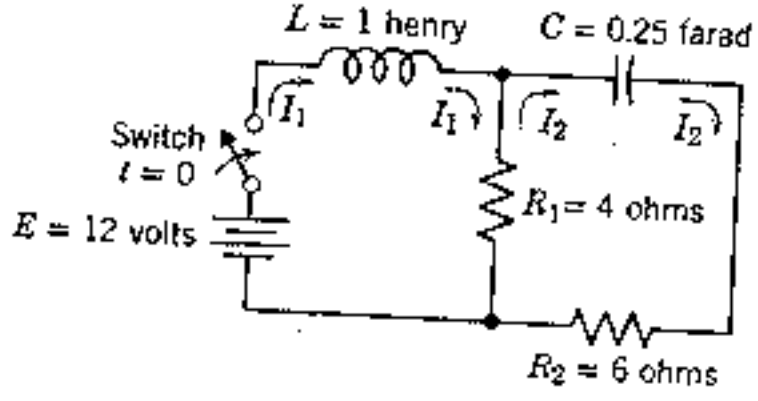
1. (20%) System of Differential Equations. 請任選一題作答：

(i) A mechanical system of two masses on two springs in the following figures, find the solution of $y_1(t)$ and $y_2(t)$ with initial conditions of zero.



(ii) Find the currents $I_1(t)$ and $I_2(t)$ in the network shown in the following figure, assuming that all charges and current are zero when the switch is closed at t=0.



2. (20%) Fourier analysis:

Find the convolution of a rectangular pulse f(t) and triangular pulse h(t), where

$$\begin{cases} f(t)=1, & |t|\le 1 \\ =0, & |t|>1 \end{cases} \quad \begin{cases} h(t)=t, & 0\le t\le 3 \\ =0, & \text{otherwise} \end{cases}$$

3. (10%) Statistics:

Explain The Central Limit Theorem and application.

(背面仍有題目,請繼續作答)

4. (30%)在空間中有四點：A：(1, 1, 0), B：(3, 5, 7), C：(2, 3, 5) 及 D：(1, 0, 1).
   a. 試求這四點所構成之四面體的體積 (7 points)
   b. 試求這四面體之表面積. (8 points)
   c. 令 $F(x,y,z) = x\vec{i} + y\vec{j} + z\vec{k}$

      試求 $\sum_{i=1}^{4}\iint_{A_i} F \bullet n_i dA_i$ (15 points)

      其中 A_i 為以上四面體之四個面，n_i 為這四個面之單位法向量。
      (Hint: Divergence theorem of Gauss)

5. (10%)我們知道矩陣是一種線性轉換(Linear transformation), 一個向量經矩陣轉換成另一個向量，如果有一矩陣 A 且其映射關係如下：

   向量 (1, 2, 3) 映射至向量 (4, 5, 6)

   向量 (4, 5, 6) 映射至向量 (7, 8, 9)

   請問向量(7, 8, 9)應該映射至何點？ (10 points)

6. (10%)解下面微分方程式

   $y'' + 3y' + 2y = r(t)$ $y'(0) = 0, y(0) = 0$ (10 points)