專題生基本能力培養練習一

“經過幾星期 meeting 心得，希望各位從實際操作中學習，才會踏實”

陳正宗 特聘教授

請大家完成如下工作：

The Fourier series is employed to approximate the boundary densities in the boundary integral equation

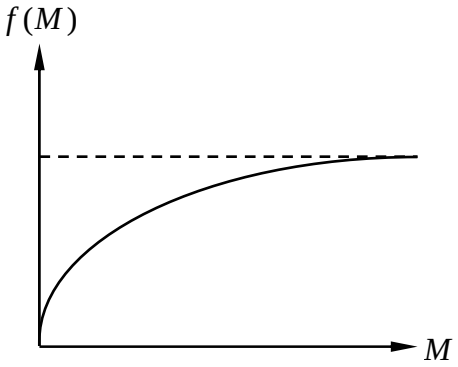
$$f(\theta) = a_0 + \sum_{n=1}^{M} (a_n \cos n\theta + b_n \sin n\theta),$$

and the Parserval's theorem are defined as below

$$\int_0^{2\pi} f(\theta)^2 d\theta \doteq 2\pi a_0^{\,2} + \pi \sum_{n=1}^{M} (a_n^{\,2} + b_n^{\,2}),$$

where a_0, a_n and b_n $(n = 1, 2, \cdots)$ denote the Fourier coefficients.

Please calculate the values of $f(M) = 2\pi a_0^{\,2} + \pi \sum_{n=1}^{M} (a_n^{\,2} + b_n^{\,2})$ by adopting the given data with different terms of Fourier series using numerical software *e.g.* FORTRAN, EXCEL, VISUAL BASIC and plot a graph of the results versus M.



分配工作如下

Data1.xls (沈-t1)	Data2.xls (沈-t2)	Data3.xls (陳-t1)	Data4.xls (陳-t2)
謝正昌	高聖凱	陳品妤	黃厚達
Data5.xls (蕭-m1)	Data6.xls (蕭-v1)	Data7.xls (蕭-m2)	Data8.xls (蕭-v2)
江明益	彭世豪	廖奐禎	廖奐禎

The meaning in each column of the data listed in the Microsoft Excel are shown below

$$M = 1 \quad M = 2 \quad M = 3 \quad \cdots \quad M = 20$$

$$\begin{Bmatrix} a_0 \\ a_1 \\ b_1 \end{Bmatrix} \quad \begin{Bmatrix} a_0 \\ a_1 \\ b_2 \\ a_1 \\ b_2 \end{Bmatrix} \quad \begin{Bmatrix} a_0 \\ a_1 \\ b_1 \\ a_2 \\ b_2 \\ a_3 \\ b_3 \end{Bmatrix} \quad \cdots \quad \begin{Bmatrix} a_0 \\ a_1 \\ b_1 \\ a_2 \\ b_2 \\ \vdots \\ a_{20} \\ b_{20} \end{Bmatrix}$$