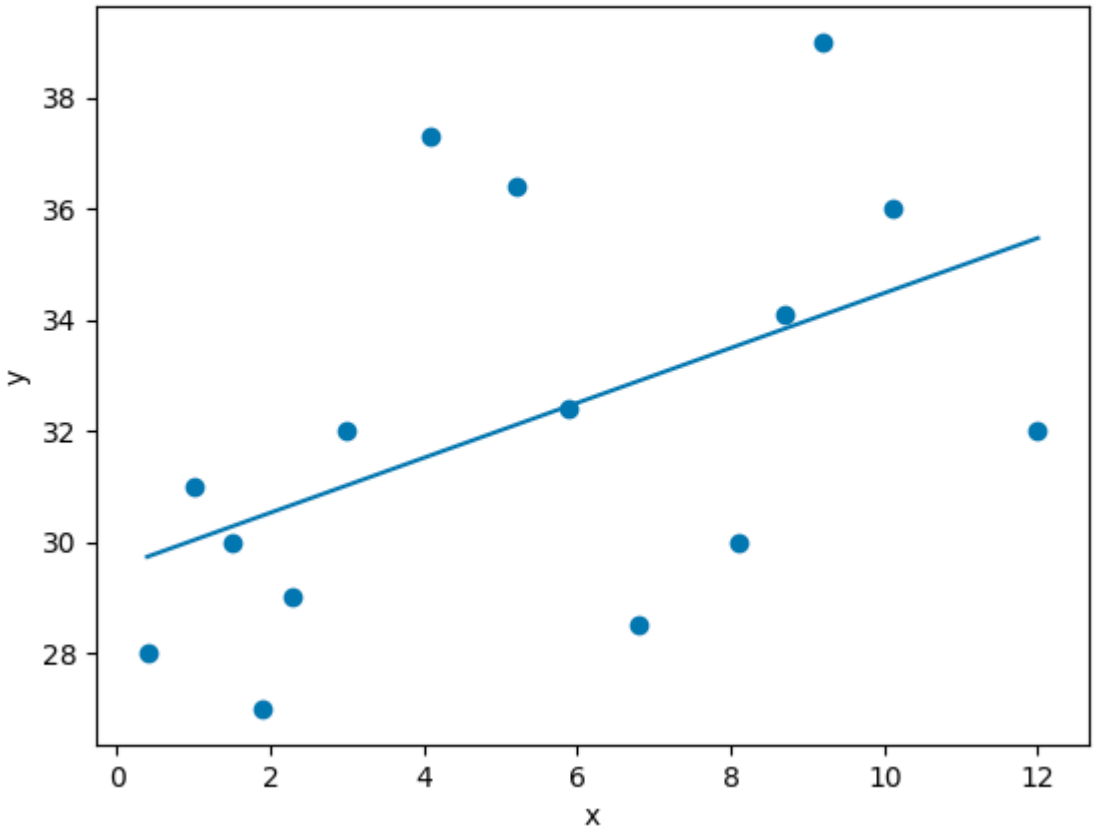
最佳化 HW3

tags: 課程

Q1

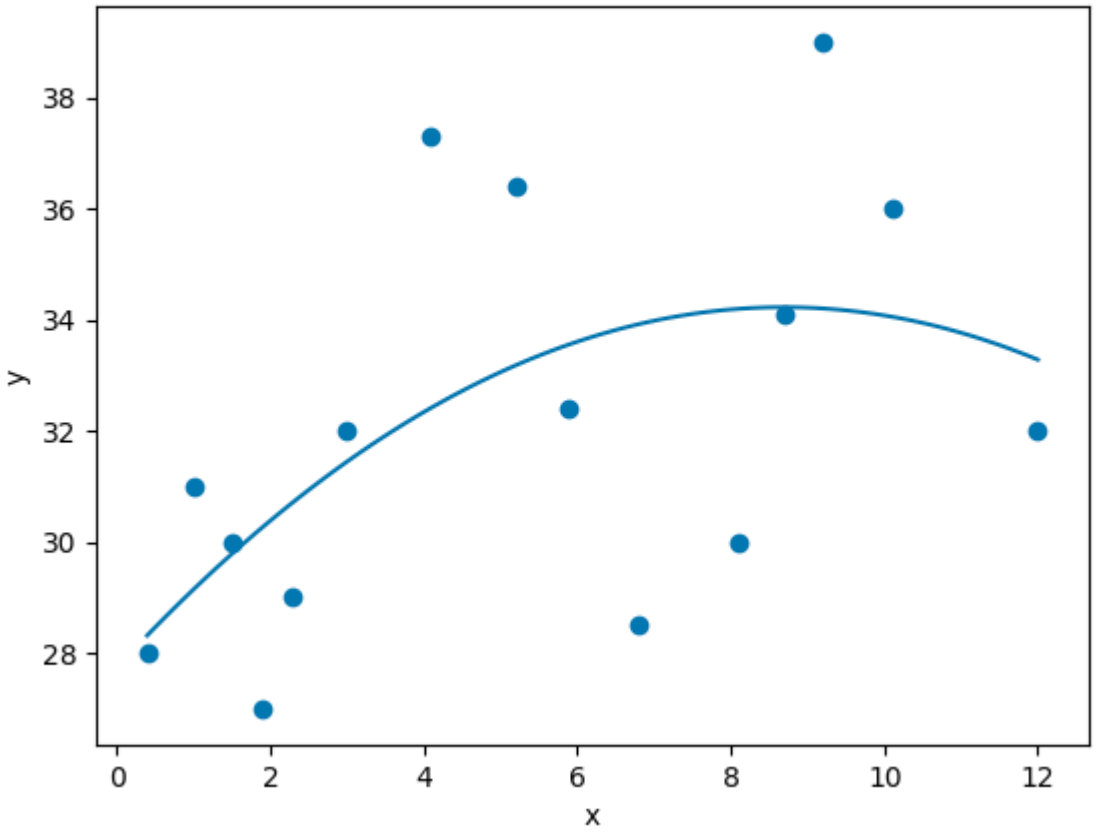
1.1 Linear equation



$$y = mx + b$$

$$\begin{cases} m = 29.5370108 \\ b = 0.49432466 \end{cases}$$

1.2 Quadratic equaton



Using coef = $([X]^T[X])^{-1}[X]^T\underline{y}$

$$y = a_0 + a_1x + a_2x^2$$

$$\begin{cases} a_0 = 27.73437299 \\ a_1 = 1.49454072 \\ a_2 = -0.08602588 \end{cases}$$

Q2

2.1 Fletcher-Reeves

2.1.1 Linear equation $y = mx + b$.

To find m and b, we can minimize $f(m, b) = \sum_{i=1}^{n}(mx_i + b - y_i)^2$.

tol = 5e-1
stop iter: 255
start $(m, b) = (0, 0)$.
Final $(m, b) = (0.500331265506910, 29.4925275561142)$.

2.1.2 Quadratc

To find a, b and c, we can minimize $f(a, b, c) = \sum_{i=1}^{n} ax^2 + bx + c$

tol = 5e-1
stop iter: 2000
start $(a, b, c) = (1, 1, 1)$.
Final $(a, b, c) = (-0.6093577083989218.7634920547787 67.78329124612855)$.

因為使用 scipy 幫助微分，在 Armijo algorithm 時每次都要微分計算時間過長因此沒有跑到收斂為止。

2.2 Quasi Newton (DFPS)

2.2.1 Linear equation $y = mx + b$.

To find m and b, we can minimize $f(m, b) = \sum_{i=1}^{n} (mx_i + b - y_i)^2$.

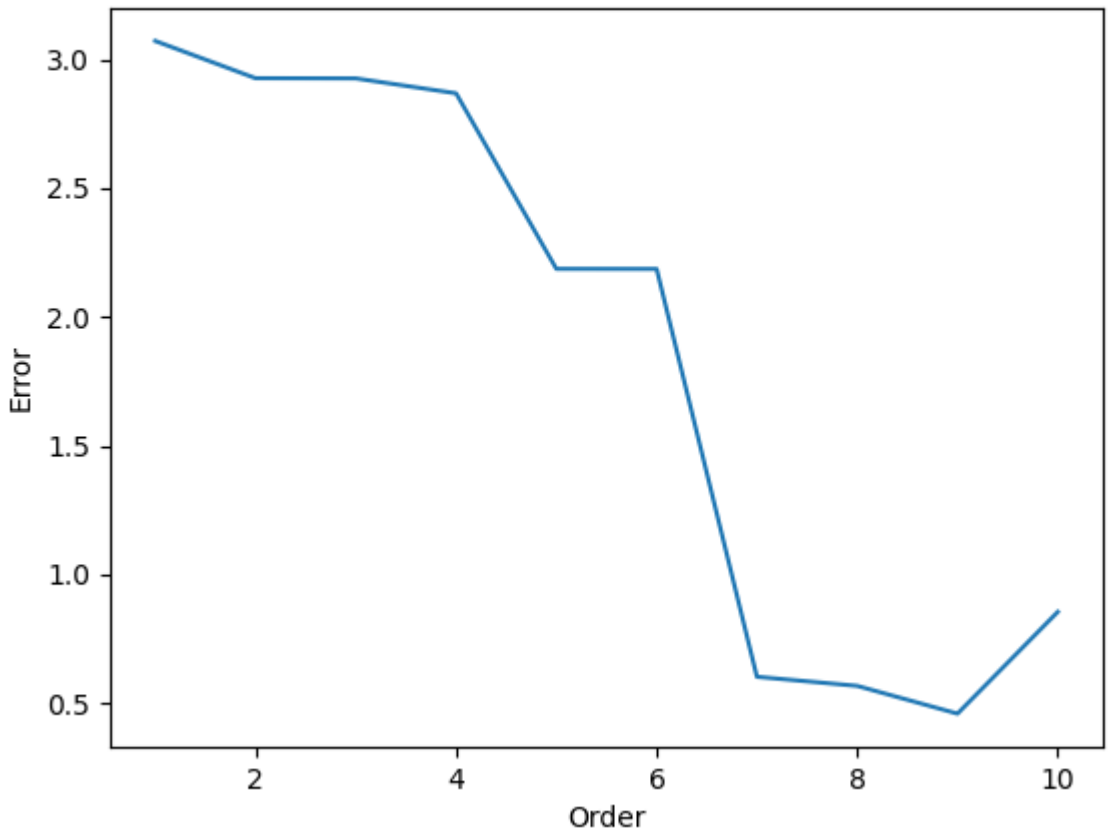
tol = 5e-1
stop iter: 3
start $(m, b) = (1, 1)$.
Final $(m, b) = (0.494010205260325, 29.5368238704832)$.

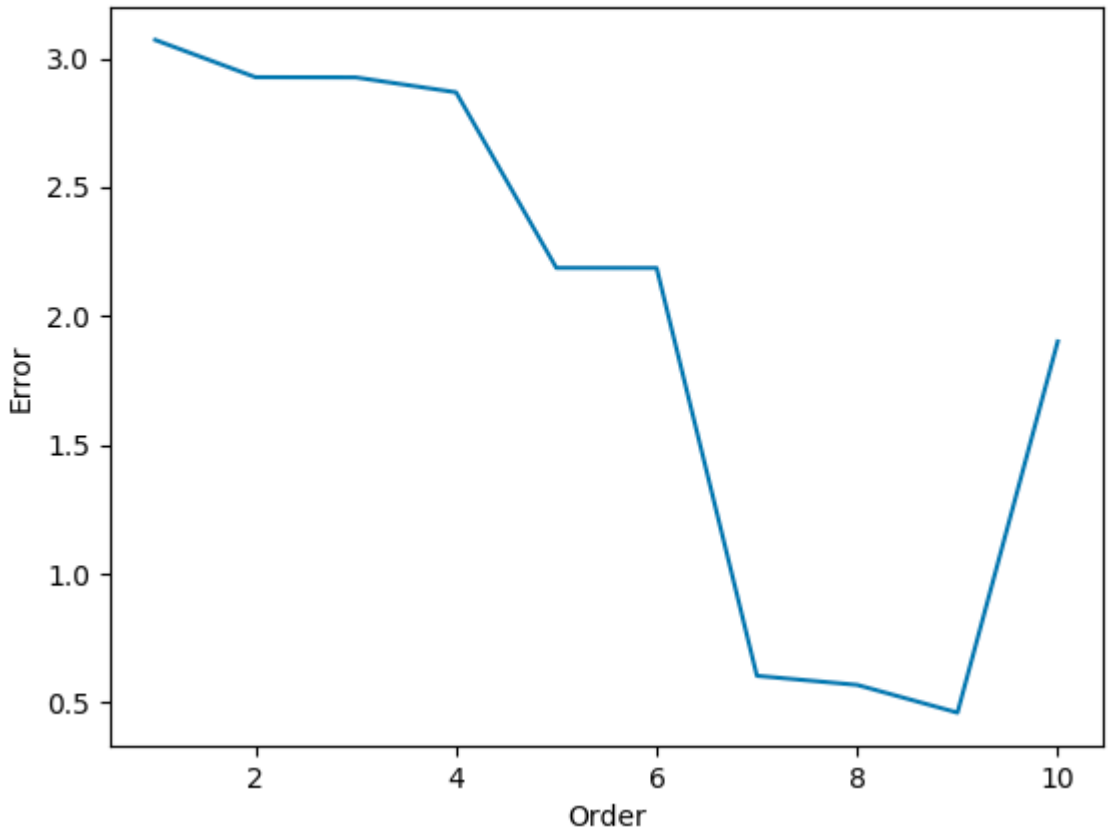
2.2.2 Quadratc

To find a, b and c, we can minimize $f(a, b, c) = \sum_{i=1}^{n} ax^2 + bx + c$

tol = 5e-1
stop iter: 5
start $(a, b, c) = (1, 1, 1)$.
Final $(a, b, c) = (-0.0866186855594477, 1.50233242086847, 27.7210757293663)$.

Q3


3.0
2.5
2.0
1.5
1.0
0.5
Error
2
4
6
8
10
Order


3.0
2.5
2.0
1.5
1.0
0.5
Error
2
4
6
8
10
Order

order	1	2	3	4	5	6	7	8	9
error	3.072	2.927	2.926	2.868	2.187	2.187	0.604	0.568	0.461

The proper order = 9.
The error = 0.4607, when order = 9.

Q4

My equation: $y = a_0 + a_1 x + a_2 \sin(x)$
Using coef = $([X]^T[X])^{-1}[X]^T\underline{y}$

$$X = \begin{pmatrix} 1 & x_1 & \sin(x_1) \\ 1 & x_2 & \sin(x_2) \\ \dots & & \\ \dots & & \\ 1 & x_n & \sin(x_n) \end{pmatrix}$$

$$\begin{cases} a_0 = 31.38151299 \\ a_1 = 0.26735614 \\ a_2 = -2.98182099 \end{cases}$$