

數值方法作業八

1. Given the data as listed below

x	4.0	4.2	4.5	4.7	5.1	5.5	5.9	6.3
y	102.6	113.2	130.1	142.1	167.5	195.1	224.9	256.8

- Construct the least squares approximation of degree two and compute the error.
- Construct the least squares approximation of the form be^{ax} and compute the error.
- Construct the least squares approximation of the form bx^n and compute the error.

```
C:\Users\user\Desktop\Tkinter-Designer-master\venv\Scripts\python.exe
=== (a) Quadratic Polynomial Fit ===
y = 3.0864 + -1.8837x + 6.6912x^2
SSE: 0.0052

=== (b) Exponential Fit: y = b * e^(a*x) ===
b = 21.4445, a = 0.3985
y = 21.4445 * exp(0.3985 * x)
SSE: 94.9830

=== (c) Power Fit: y = b * x^n ===
b = 6.2390, n = 2.0196
y = 6.2390 * x^2.0196
SSE: 0.0117
```

2. Find the least squares polynomial approximation of degree two on the interval $[-1,1]$ for the function $f(x) = \frac{1}{2}\cos x + \frac{1}{4}\sin 2x$

```
C:\Users\user\Desktop\Tkinter-Designer-master\venv\Scripts\python.exe
Approximation polynomial: p(x) = 0.498212 + 0.323568x + -0.232296x^2
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3. Determine the discrete least squares trigonometric polynomial S_4

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using $m=16$ for $f(x) = x^2 \sin x$ on the interval $[0,1]$.

b. Compute $\int_0^1 S_4(x) dx$

c. Compare the integral in part (b) to $\int_0^1 x^2 \sin x dx$

d. Compute the error $E(S_4)$

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(a) Coefficients:
a0 = 0.197672
a1 = 0.072827, b1 = -0.237249
a2 = -0.022262, b2 = -0.123859
a3 = -0.038390, b3 = -0.077809
a4 = -0.043865, b4 = -0.052223

(b)  $\int S_4(x) dx \approx 0.197672$ 
(c)  $\int x^2 \sin(x) dx = 0.223244$ 
(d) Error  $E(S_4) = 0.077402$ 
```