DATE / /

$e^{x^{-2}} = e^{\frac{1}{x^2}}$ $\int_0 e^{-\frac{x^2}{2}}$

※ data.
※ penalty ft. $P_\lambda(\beta)$
※ $\min_\beta \| y - x\beta \| + \boxed{n P_\lambda(\beta)}$

$n \lambda_n \sum_{j=1} P(\beta_j)$

LASSO.
$n \sum_{j=1}^{d} \lambda |\beta_j|$

SCAD.
$n \sum_{j=1}^{d} P_\lambda(\beta_j)$

$$f(x) = \begin{cases} 1 & x \ge 10 \\ 0 & x < 10. \end{cases}$$

$$\frac{4 - 7.4 \times 2 + 1}{5.4}$$

統算 3/8.

$\int_0^1 e^{-\frac{x^2}{2}} dx = ?$ $\Rightarrow$ $f(x) = e^{-\frac{x^2}{2}}$

$\xrightarrow[\text{expen}]{\text{Taylors}}$ $f(x) = \sum_{n=0}^{\infty} \frac{f^{(n)}(x_0)}{n!} (x - x_0)^n$

Quadrature integration

- $[a, b] \xrightarrow[\text{成}]{\text{分割}} \bigcup_{i=1}^{n} I_i$ , $I_i = (a_{i-1}, a_i)$

i.e. $P = \bigcup_{i=1}^{n} I_i$ be a partition of $[a, b]$

s.t. $a = a_0 < a_1 < \cdots < a_n = b$

- For each interval, evaluate some function value.
- Add up the evaluated information for each interval.

$\Longrightarrow$ To approximate Area.

- 根據分割 $[a,b]$ 的方式及 $f$ 的取值，可能有：

① Rectangle Rule

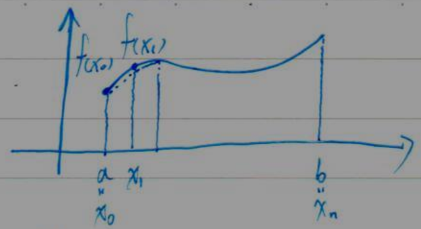
$\hat{I}_R = \sum_{i=1}^{n} f(x_{i-1}) \Delta x_i$ (Upper Riemann Sum)

$\hat{I}^* = \sum_{i=1}^{n} f(x_i) \Delta x_i$ (Lower Riemann Sum)

$$f(x)-f(x_0)=\sum_{n=1}^{\infty}\frac{f^{(n)}(x_0)}{n!}(x-x_0)$$



② Trapezoidal Rule




$$\hat{I}_T=\sum_{i=1}^{n}\left(\frac{f(x_{i-1})+f(x_i)}{2}\right)\Delta x_i$$

若等分割 i.e. $\Delta x_i=\Delta x,\ \forall i$

$$=\frac{\Delta x}{2}\left[f(x_0)+f(x_n)+2\sum_{j=1}^{n-1}f(x_j)\right]$$

③. Simpson's Rule

Approximated by a polynomial with order of 2.
( $ax^2+bx+c$ .)

assume that any three points $u<v<w$ on $(u,w)$.

Approx. $f(x)$ by $p(x)=ax^2+bx+c$

$$\Rightarrow p(x)=f(u)\frac{(x-v)(x-w)}{(u-v)(u-w)}+f(v)\frac{(x-u)(x-w)}{(v-u)(v-w)}+f(w)\frac{(x-u)(x-v)}{(w-u)(w-v)}$$

assume $x_i-x_{i-1}=\Delta x=\frac{b-a}{n}$ . $\forall i$

Calculate : $\int_u^w p(x)\,dx=\ ?\ \overset{\text{check}}{=}\ \frac{\Delta x}{3}\left(f(u)+4f(v)+f(w)\right)$

$$\Rightarrow \hat{I}_S=\frac{\Delta x}{3}\left[f(x_0)+4f(x_1)+2f(x_2)+4f(x_3)+2f(x_4)+\dots+f(x_n)\right]$$

n even $=\frac{\Delta x}{3}\left[f(x_0)+f(x_n)+\sum_{i=1}^{\frac{n}{2}}4f(x_{2i-1})+\sum_{i=1}^{\frac{n-2}{2}}2f(x_{2i})\right]$

n odd. $=\frac{\Delta x}{3}\left[f(x_0)+f(x_n)+\sum_{i=1}^{\frac{n-1}{2}}4f(x_{2i-1})+\sum_{i=1}^{\frac{n-1}{2}}2f(x_{2i})\right]$

$n=100$ $h_1$ $h_2$ — $4h_{100}$. $h_{101}$

$n=101$ $h_1$ $h_2$ — $h_{101}$ $h_{102}$
$2x_{100}$ $x_{101}$

$h_1$ $h_2$ — 4 $2h_{11}$ $h_{12}$
$x_{11}$