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Optimization - 3

CB.EN.U4CSE19453

1) $n = 7$

$f(x) = x^5 - 5x^3 - 20x + 5$, $(0, 5)$

$a = 0$
$b = 5$ $\quad L = b - a = 5$
$k = 2$

$$L_k^* = \frac{F_{n-1}}{F_{n+1}} \times L$$

$$L_2 = \frac{F_6}{F_8} \times L \Rightarrow \frac{13}{34} \times 5 = 1.911$$

$x_1 = a + L_2 \Rightarrow 0 + 1.911 = 1.911$
$x_2 = a - L_2 \Rightarrow 5 - 1.911 = 3.089$

$f(x_1) = (1.911)^5 - (1.911)^3 5 - 20(1.911) + 5 = -42.62$
$f(x_2) = (3.089)^5 - 5(3.089)^3 - 20(3.089) + 5 = 77$

$f(x_2) > f(x_1)$

So, new interval is $(0, 3.089)$

2) $n = 6$

$$f(x) = 0.65 - \frac{0.75}{1+x^2} - 0.65 x \tan^{-1}\left(\frac{1}{x}\right) \; ; \; x \in (0,3)$$

$a = 0, \; b = 3, \; L = 3 \; ; \; n = 6 \; ; \; k = 2$

$$L_2^* = \frac{F_{n-1}}{F_{n+1}} = \frac{F_5}{F_7} \times L$$

$$= \frac{8}{21} \times 3 = 1.142$$

$$x_1 = 0 + 1.142 = 1.142$$

$$x_2 = 3 - 1.142 = 1.858$$

0.324 $\quad -0.63 \quad$ 0.86

$f(x_1) = (-0.314)$

$f(x_2) = -0.433$

$f(x_2) > f(x_1)$

0.04 $\quad -0.433$

delete x_2>

New interval $\Rightarrow (0, 1.846)$

3) $F_0 = 1$

$F_1 = 1$

$F_2 = 2$

$F_3 = 3$

$F_4 = 5$

$F_5 = 8$

$F_6 = 13$

$F_7 = 21$

$F_8 = 34$

$F_9 = 55$

$F_{10} = 89$

$F_{11} = 144$

4) $f(x,y) = 2x - y + 2x^2 + 2xy + y^2$

$x^0 = (1,2)$

$H^{-1} = \begin{bmatrix} \frac{1}{2} & \frac{-1}{2} \\ \frac{-1}{2} & 1 \end{bmatrix}$ $\therefore \nabla f(x,y) = \begin{bmatrix} 2+4x+2y \\ -1+2x+2y \end{bmatrix}$

$= \begin{bmatrix} 2+4+4 \\ -1+2+4 \end{bmatrix}$

$= \begin{bmatrix} 10 \\ 5 \end{bmatrix}$

$H^{-1} \times f(x,y) = \begin{bmatrix} \frac{10}{2} & \frac{-5}{2} \\ \frac{-10}{2} & 5 \end{bmatrix}$

$= \begin{bmatrix} \frac{1}{2} \\ 2 \end{bmatrix} - \begin{bmatrix} 5/2 \\ 0 \end{bmatrix} = \begin{bmatrix} -1.5 \\ 2 \end{bmatrix}$