**Pandit Deendayal Petroleum University**

School of Technology

ICT Department

Artificial Intelligence, BTech ICT Sem VI

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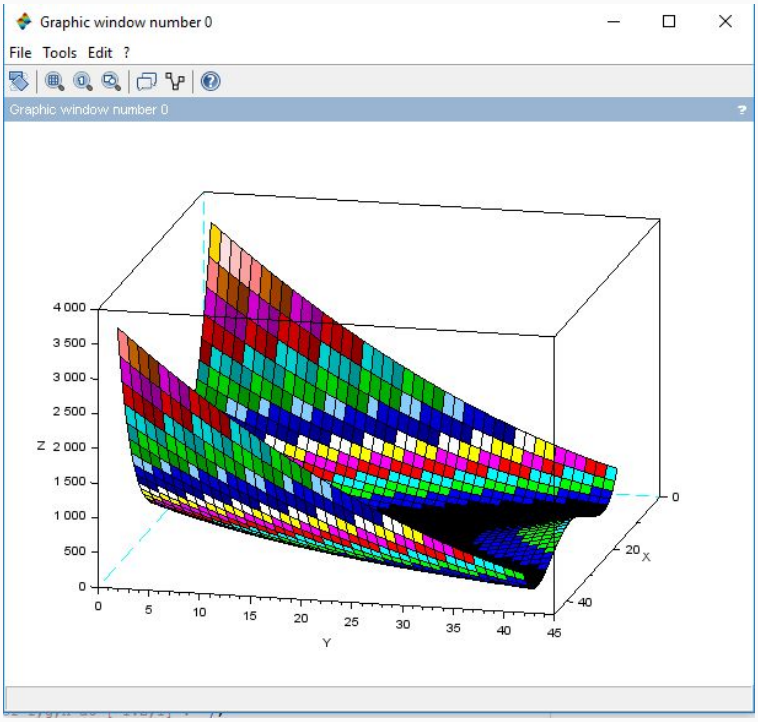
Plot Of The Graph




Ans 1 and 2)

$$f(x) = 100(x_2 - x_1^2)^2 + (1 - x_1)^2$$

$$g(x) = \left(\frac{\partial f}{\partial x_1}, \frac{\partial f}{\partial x_2}\right)^T$$

$$\therefore \frac{\partial f}{\partial x_1} = 100 * 2 * (x_2 - x_1^2) * 2x_1 * (-1) + 2 * (1 - x_1) * (-1)$$

$$= -400x_1(x_2 - x_1^2) + 2x_1(-2)(1 - x_1)$$

$$= +400x_1^3 - 400x_1x_2 + 2x_1 - 2$$

$$\frac{\partial f}{\partial x_2} = 2 * 100(x_2 - x_1^2) + 0$$

$$= 200(x_2 - x_1^2)$$

$$= -200x_1^2 + 200x_2$$

$$\therefore g(x) = \begin{pmatrix} 400x_1^3 - 400x_1x_2 + 2x_1 - 2 \\ -200x_1^2 + 200x_2 \end{pmatrix}$$

$$H(x) = \frac{\partial g_1(x)}{\partial x_1} \frac{\partial g_1}{\partial x_2} + \cdots$$

$$H(x) = \begin{pmatrix} \frac{\partial^2 f}{\partial x_1 \partial x_1} & \frac{\partial^2 f}{\partial x_1 \partial x_2} \\ \frac{\partial^2 f}{\partial x_2 \partial x_1} & \frac{\partial^2 f}{\partial x_2 \partial x_2} \end{pmatrix}$$

$$= \begin{pmatrix} 3 \times 400 x_1^2 - 400 x_2 + 2 & -400 x_1 \\ 2 \times (-200) \times x_1 & 200 \end{pmatrix}$$

$$H(x) = \begin{pmatrix} 1200 x_1^2 - 400 x_2 + 2 & -400 x_1 \\ -400 x_1 & 200 \end{pmatrix}$$

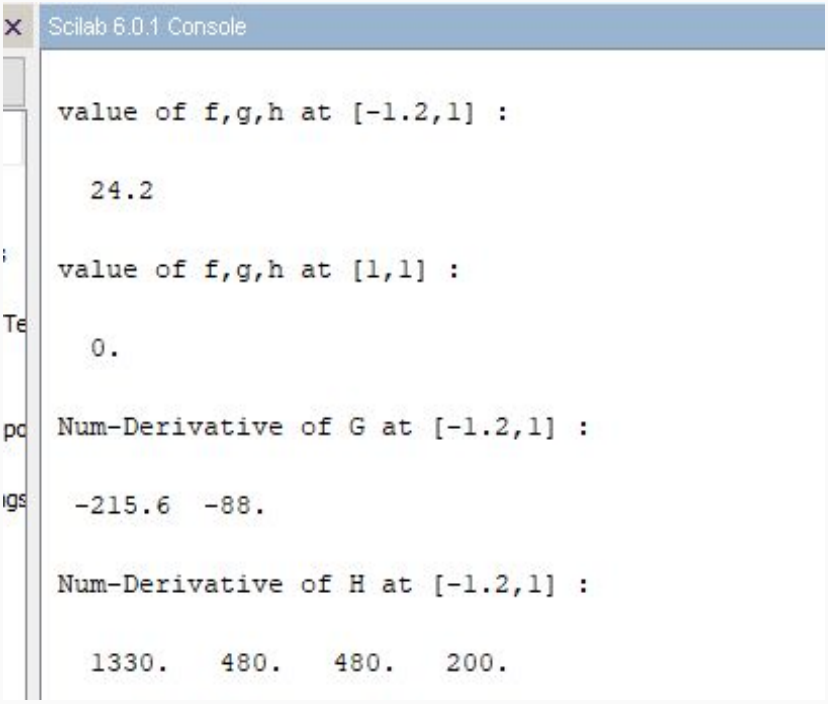
derivative at $[-1.2, 1]^T$

$$g(x) = \begin{pmatrix} -215.6 \\ -88 \end{pmatrix}$$

Hessian at $[-1.2, 1]^T$

$$H(x) = \begin{pmatrix} 1330 & 480 \\ 480 & 200 \end{pmatrix}$$

Ans 3)




Ans 4)

The numderivative function returns the same value as of computed on paper as well as by the Rosenbrock.