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D4 SDT B

SOAL

1. $f(x) = x_1^2 + x_2^2$
2. $f(x) = x_1 - x_2 + 2x_1 + 2x_1 + x_2^2$
3. $f(x) = -x_1^2 - x_2^2 + 8x_1 + 4x_2$
4. $f(x) = x_1 x_2 x_3$

Jawaban :

1. $\nabla f(x) = 0$

$$\nabla f(x) = \begin{bmatrix} 2x_1 \\ 2x_2 \end{bmatrix} = 0$$

$$H = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$$

Determinan :

$|h_{11}| = |2| > 0$

$$\begin{vmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{vmatrix} = \begin{vmatrix} 2 & 0 \\ 0 & 2 \end{vmatrix} = (2.2) - (0.0) = 4 - 0 = 4 > 0$$

kedua nilai determinan > 0 maka positive definite ⇒ min point

2. $\nabla f(x) = 0$

$$\nabla f(x) = \begin{bmatrix} 1 + 4x_1 + 2x_2 \\ -1 + 2x_1 + 2x_2 \end{bmatrix} = 0$$

$$\begin{array}{r} 1 + 4x_1 + 2x_2 = 0 \\ -1 + 2x_1 + 2x_2 = 0 \\ \hline 2 + 2x_1 = 0 \end{array} \; -$$

$2x_1 = -2$

$x_1 = -1$

$1 + 4x_1 + 2x_2 = 0$

$1 + 4(-1) + 2x_2 = 0$

$1 - 4 + 2x_2 = 0$

$2x_2 = 3$

$x_2 = 3/2$

$$H = \begin{bmatrix} 4 & 2 \\ 2 & 2 \end{bmatrix}$$

Determinan :

$|h_{11}| = |4| > 0$

$$\begin{vmatrix} h_{11} & h_{12} \\ h_{31} & h_{32} \end{vmatrix} = \begin{vmatrix} 4 & 2 \\ 2 & 2 \end{vmatrix} = (4.2) - (3.2) = 8 - 4 = 4 > 0$$

kedua nilai determinan > 0 maka positive definite ⇒ min point

$\nabla f(x) = 0$

$$\nabla f(x) = \begin{bmatrix} -2x_1 + 8 \\ -2x_1 + 4 \end{bmatrix} = 0$$

$$-2x+8=0 \qquad -2x_1=-8 \qquad x_1=4$$

$$-2x_2+4=0 \qquad -2x_2=-4 \qquad x_2=2$$

$$H = \begin{bmatrix} -2 & 0 \\ 0 & -2 \end{bmatrix}$$

Determinan :

$|h_{11}| = |-2| < 0$

$$\begin{vmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{vmatrix} = \begin{vmatrix} -2 & 0 \\ 0 & -2 \end{vmatrix} = (-2.-2) - (0.0) = 4.0 = 4 > 0$$

Jadi karena nilai determinan $|h_{11}| < 0$ dan $\begin{vmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{vmatrix} > 0$ maka negative point $\Rightarrow$ max point

4. $\nabla f(x) = 0$

$$\nabla f(x) = \begin{bmatrix} x_2 & x_3 \\ x_1 & x_3 \\ x_1 & x_2 \end{bmatrix} = 0$$

Kemungkinan nilai x yaitu $x_1=0$, $x_2=0$, dan $x_3=0$

$$H = \begin{bmatrix} 0 & x_3 & x_2 \\ x_3 & 0 & x_1 \\ x_2 & x_1 & 0 \end{bmatrix}$$

Dalam matrix Hessian di atas masih terdapat X, maka nilai x yg diperoleh dimasukkan ke dalam matriks hesian sehingga akan menjadi matriks nol

$$H = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

Karena matriks nol tidak bisa menentukan jenis titik secara langsung, dimana tidak diketahui nilai determinan > atau < 0 maka merupakan tadale point //