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Data Science

CSE DATA SCIENCE

Symmetric Positive Definite Matrices

Question:-

$$A = \begin{bmatrix} 2 & -2 & 0 \\ -2 & 1 & -2 \\ 0 & -2 & 1 \end{bmatrix} \qquad B = \begin{bmatrix} 2 & 2 & -2 \\ 2 & 5 & -4 \\ -2 & -4 & 5 \end{bmatrix}$$

check if the symmetric matrices A, B are positive
definite: for matrix A

Answer:- $|2| = 2$

$$\begin{vmatrix} 2 & -2 \\ -2 & 1 \end{vmatrix} = 1 \times 2 - (-2)(-2) = 2 - 4 = -2 < 0$$

$\longrightarrow$ A is not positive definite

For matrix B

$|2| = 2$

$$\begin{vmatrix} 2 & 2 \\ 2 & 5 \end{vmatrix} = 2 \times 5 - 2 \times 2 = 10 - 4 = 6$$

After Row transformation

$$\begin{vmatrix} 2 & 2 & -2 \\ 2 & 5 & -4 \\ -2 & -4 & 5 \end{vmatrix} = \begin{vmatrix} 2 & 2 & -2 \\ 0 & 3 & 2 \\ 0 & -2 & 3 \end{vmatrix}$$

$$= 2 \cdot \begin{vmatrix} 3 & -2 \\ -2 & 3 \end{vmatrix}$$

$$= 10$$

$\longrightarrow$ all determinant of B is greater than 0
So B is Positive definite.