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If A, B are square matrices of order n, and I_n is a corresponding unit matrix, then

(a) A(adj.A) = | A | I_n = (adj A) A

(b) | adj A | = | A $|^{n-1}$ (Thus A (adj A) is always a scalar matrix)

(c) adj (adj.A) = | A $|^{n-2}$ A

(e) **|adj\,(adj.A)|=|A{{|}^{{{(n-1)}^{2}}}}** $|adj(adj.A)|=|A|^{(n-1)^2}$

(f) adj (AB) = (adj B) (adj A)

(g) adj (A^m) = (adj A$)^m$,

(h) **adj (kA) = {{k}^{n-1}}(adj. A) ,k\in R** $adj(kA)=k^{n-1}(adj.A),k\in R$

(i) adj\left({{I}_{n}} \right)={{I}_{n}} $(I_n)=I_n$

(j) adj 0 = 0

(k) A is symmetric ⇒adj A is also symmetric

(l) A is diagonal ⇒adj A is also diagonal

(m) A is triangular ⇒adj A is also triangular

(n) A is singular ⇒| adj A | = 0

Types of Matrices

(i) Symmetric Matrix: A square matrix A =[{{a}_{ij}}]=$[a_{ij}]$ is called a symmetric matrix if {{a}_{ij}}={{a}_{ji}},$a_{ij}=a_{ji}$, for all i, j.

(ii) Skew-Symmetric Matrix: when {{a}_{ij}}=-{{a}_{ji}}$a_{ij}=-a_{ji}$

(iii) Hermitian and skew – Hermitian Matrix: **A={{A}^{\theta }}**$A=A^{\theta}$ (Hermitian matrix)

{{A}^{\theta }}=-A$A^{\theta}=-A$ (skew-Hermitian matrix)

(iv) Orthogonal matrix: if A{{A}^{T}}={{I}_{n}}={{A}^{T}}A$AA^T=I_n=A^TA$

(v) Idempotent matrix: if {{A}^{2}}=A$A^2=A$

(vi) Involuntary matrix: if {{A}^{2}}=I\,\,or\,\,{{A}^{-1}}=A$A^2=I or A^{-1}=A$

(vii) Nilpotent matrix: if \exists \,\,p\in N$\exists p\in N$ such that {{A}^{P}}=0$A^P=0$

Trace of matrix

(i) **tr\left(\lambda A \right)=\lambda tr\left(A \right)**$\mathbf{tr(\lambda A)=\lambda tr(A)}$

(ii) **tr(A+B)=tr(A)+tr(B)**$\mathbf{tr(A+B)=tr(A)+tr(B)}$

(iii) **tr(AB)=tr(BA)**$\mathbf{tr(AB)=tr(BA)}$

Matrix Transpose

(i) {{({{A}^{T}})}^{T}}=A \;\;\;\;\;\; (ii) {{(A\pm B)}^{T}}={{A}^{T}}\pm {{B}^{T}} \;\;\;\;\; (iii) {{(AB)}^{T}}={{B}^{T}}{{A}^{T}}$(i)(A^T)^T=A(ii)(A\pm B)^T=A^T\pm B^T(iii)(AB)^T=B^TA^T$

(iv) {{(kA)}^{T}}=k{{\left(A \right)}^{T}} \;\;\;\;\;\; (v) {{({{A}_{1}}{{A}_{2}}{{A}_{3}}…….{{A}_{n-1}}{{A}_{n}})}^{T}}=A_{n}^{T}A_{n-1}^{t}…….A_{3}^{T}A_{2}^{T}A_{1}^{T}$\mathbf{(iv)(kA)^T=k(A)^T(v)(A_1A_2A_3\ldots\ldots.A_{n-1}A_n)^T=A_n^TA_{n-1}^t\ldots\ldots.A_3^TA_2^TA_1^T}$

(vi) {{I}^{T}}=I \;\;\;\;\;\;\; (vii) tr(A)=t({{A}^{T}})$\mathbf{(vi)I^T=I(vii)tr(A)=t(A^T)}$