Assignment #01

1) (a) BA

A	B	C	D	E
4×5	4×5	5×2	4×2	5×4

(a) BA

undefine

(b) AB^T

$B^T = 5 \times 4$

AB^T is define

$AB^T = 4 \times 4$

c) AC+D

AC is ~~undefine~~ define ~~(5×5)~~ (4×2)

AC+D is undefine

d) E(AC)

AC is define (4×2)

EAC is define (5×2)

e) $A - 3E^T$

$E^T = 4 \times 5$

$A - 3E^T$ not define

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f) E(5B+A)

(5B+A) is define (4x5)

E(5B+A) is define (4x4)

2) a) CD^t

D^t = 2x4

CD^t is define

order = (5x4)

b) DC

DC not define

c) BC - 3D

BC is define

order = (4x2)

BC - 3D is define

order = (4x2).

A) $D^t(BE)$

$D^t = 2 \times 4$

BE is define

Order = (4×4)

$D^t(BE)$ is define

order = (2×4).

$B^t D + ED$

$B^T = 5 \times 4$

$B^T D$ is define

(5×2)

ED is define

order = (5×2)

$B^t D + ED$ is define

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5) $BA^T + D$

$A^T = 5 \times 4$

BA^T is define

order $= 4 \times 4$

D. BA^T is not define

Q3

a) $D + E$

$$\begin{bmatrix} 7 & 6 & 5 \\ -2 & 1 & 3 \\ 7 & 3 & 7 \end{bmatrix}$$

b) $D - E$

$$\begin{bmatrix} -5 & 4 & -1 \\ 0 & -1 & -1 \\ -1 & 1 & 1 \end{bmatrix}$$

c) $5A$

$$5A = \begin{bmatrix} 15 & 0 \\ -5 & 10 \\ 5 & 5 \end{bmatrix}$$

d) $-7C$

$$-7C = \begin{bmatrix} -7 & -28 & -14 \\ -21 & -7 & -35 \end{bmatrix}$$

e) $2B - C$

$2B$

$$2B = \begin{bmatrix} 8 & -2 \\ 0 & 4 \end{bmatrix}$$

$2B - C$ is not possible

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d) $4E - 2D$

$$4E = \begin{bmatrix} 24 & 4 & 12 \\ -4 & 4 & 8 \\ 16 & 4 & 12 \end{bmatrix}$$

$$4 \cdot 2D = \begin{bmatrix} 2 & 10 & 4 \\ -2 & 0 & 2 \\ 6 & 4 & 8 \end{bmatrix}$$

$$4E - 2D = \begin{bmatrix} 22 & -6 & 8 \\ 6 & 4 & 6 \\ 10 & 0 & 4 \end{bmatrix}$$

e) $-3(D + 2E)$

$$2E = \begin{bmatrix} 1812 & 2 & 6 \\ -2 & 2 & 4 \\ 8 & 2 & 6 \end{bmatrix}$$

$$D + 2E = \begin{bmatrix} 13 & 7 & 8 \\ -3 & 2 & 5 \\ 11 & 4 & 10 \end{bmatrix}$$

$$-3(D+2E) = \begin{bmatrix} -39 & -21 & -24 \\ +9 & -6 & -15 \\ -33 & -12 & -30 \end{bmatrix}$$

A - A

$$A - A = \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$$

$tr(D)$

$-tr(D) = 5$

$-[tr(D-3E)]$

$$D-3E = \begin{bmatrix} -17 & 2 & -7 \\ 2 & -3 & -5 \\ -9 & -1 & -25 \end{bmatrix}$$

$tr(D-3E) = -25$

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$tr(7B)$

$$7B = \begin{bmatrix} 28 & -7 \\ 0 & 14 \end{bmatrix}$$

$tr(B) = 42$

$4 + 42 = \cancel{1764}\ 1768$

(k) $tr(A)$

undefine.

4)

a) $2A^T + C$

$$A^T = \begin{bmatrix} 3 & -1 & 1 \\ 0 & 2 & 1 \end{bmatrix}$$

$$2A^T = \begin{bmatrix} 6 & -2 & 2 \\ 0 & 4 & 2 \end{bmatrix}$$

$$2A^T + C = \begin{bmatrix} 7 & 2 & 4 \\ 3 & 5 & 7 \end{bmatrix}$$

OVER

$D^T - E^T$:

$$D^T = \begin{bmatrix} 1 & -1 & 3 \\ 5 & 0 & 2 \\ 2 & 1 & 4 \end{bmatrix}$$

$$E^T = \begin{bmatrix} 6 & -1 & 4 \\ 1 & 1 & 1 \\ 3 & 2 & 3 \end{bmatrix}$$

$$D^T \cdot E^T = \begin{bmatrix} -5 & 0 & -1 \\ 4 & -1 & 1 \\ -1 & -1 & 7 \end{bmatrix}$$

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c) $(D-E)^T$

Solve:

$$D-E = \begin{bmatrix} -5 & 4 & -1 \\ 0 & -1 & -1 \\ -1 & 1 & 1 \end{bmatrix}$$

$$(D-E)^T = \begin{bmatrix} -5 & 0 & -1 \\ 4 & -1 & 1 \\ -1 & -1 & 1 \end{bmatrix}$$

d) $B^T + 5C^T$

$$B^T = \begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix}$$

$$5C^T = \begin{bmatrix} 5 & 15 \\ 20 & 5 \\ 10 & 25 \end{bmatrix}$$

$B^T + 5C^T$ is not possible.

e) $\frac{1}{2}C^T - \frac{1}{4}A$

Sol:

$$C^T = \begin{bmatrix} 1 & 3 \\ 4 & 1 \\ 2 & 5 \end{bmatrix} \rightarrow \frac{1}{2}C^T = \begin{bmatrix} 1/2 & 3/2 \\ 2 & 1/2 \\ 1 & 5/2 \end{bmatrix}$$

$$\frac{1}{4}A = \begin{bmatrix} 3/4 & 0 \\ -1/4 & 1/2 \\ 1/4 & 1/4 \end{bmatrix}$$

$$\frac{1}{2}C^T - \frac{1}{4}A = \begin{bmatrix} 1/2 \cdot 3/4 \\ -1/4 \cdot 2 \\ 1/4 \cdot -1 \end{bmatrix}$$

$$\frac{1}{2}C^T - \frac{1}{4}A = \begin{bmatrix} 1/2 - 3/4 & 3/2 \\ 2 + 1/4 & 0 \\ 1 - 1/4 & 1/4 - 5/2 \end{bmatrix}$$

$$\frac{1}{2}C^T - \frac{1}{4}A = \begin{bmatrix} -1/4 & 3/2 \\ 9/4 & 0 \\ 3/4 & -9/4 \end{bmatrix}$$

Date:

i) $B - B^T$

$$B^T = \begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix}$$

$$B - B^T = \begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}$$

4 mks.

j) $2E^T - 3D^T$

$$E^T = \begin{bmatrix} 6 & -1 & 4 \\ 1 & 1 & 1 \\ 3 & 2 & 3 \end{bmatrix}$$

$$2E^T = \begin{bmatrix} 12 & -2 & 8 \\ 2 & 2 & 2 \\ 6 & 4 & 6 \end{bmatrix}$$

$$D^T = \begin{bmatrix} 1 & -1 & 3 \\ 5 & 0 & 2 \\ 2 & 1 & 4 \end{bmatrix}$$

$$3D^T = \begin{bmatrix} 3 & -3 & 9 \\ 15 & 0 & 6 \\ 6 & 3 & 12 \end{bmatrix}$$

$$2E^T - 3D^T = \begin{bmatrix} 9 & 1 & -1 \\ -13 & 2 & -4 \\ 0 & 1 & -6 \end{bmatrix}.$$

4) $(2E^T - 3D^T)^T$

$$2E^T - 3D^T = \begin{bmatrix} 9 & 1 & -1 \\ -13 & 2 & -4 \\ 0 & 1 & -6 \end{bmatrix}$$

$$(2E^T - 3D^T)^T = \begin{bmatrix} 9 & -13 & 0 \\ 1 & 2 & 1 \\ -1 & -4 & -6 \end{bmatrix}.$$

5) $(CD)E$

$$CD = \begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix} \begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix}$$

$$CD = \begin{bmatrix} 1-4+6 & 5+0+4 & 2+4+8 \\ 3-1+15 & 15+0 & 6+1+20 \end{bmatrix}$$

$$CD = \begin{bmatrix} 3 & 1 & 14 \\ 17 & 25 & 27 \end{bmatrix}$$

$$(CD)E = \begin{bmatrix} 3 & 1 & 14 \\ 17 & 25 & 27 \end{bmatrix} \begin{bmatrix} 6 & 1 & 3 \\ -1 & 1 & 2 \\ 4 & 1 & 3 \end{bmatrix}$$

$$(CD)E = \begin{bmatrix} 18-1+56 & 3+1+14 & 9+2+42 \\ 102-25+108 & 17+25+27 & 51+(0+81 \end{bmatrix}$$

$$(CD)E = \begin{bmatrix} 73 & 18 & 53 \\ 185 & 69 & 182 \end{bmatrix}$$ 4.5

Date:

j) (BA)

Sol:

BA is not possible

B = 2×3, A = 3×2

Row of A ≠ column of B.

k) tr(DE^T)

$$E^T = \begin{bmatrix} 6 & -1 & 4 \\ 1 & 1 & 1 \\ 3 & 2 & 3 \end{bmatrix}$$

$$DE^T = \begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix} \begin{bmatrix} 6 & -1 & 4 \\ 1 & 1 & 1 \\ 3 & 2 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 6+5+6 & -1+5+4 & 4+5+6 \\ -6+0+3 & 1+0+2 & -4+0+1 \\ 18+2+12 & -3+2+8 & 12+2+12 \end{bmatrix}$$

$$DE^T = \begin{bmatrix} 17 & 8 & 15 \\ -3 & 3 & -3 \\ 32 & 7 & 26 \end{bmatrix}$$

tr(DE^T) = 46

Ans

B + tr(BC)

Solⁿ:

$$BC = \begin{bmatrix} 4 & -1 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix}$$

$$= \begin{bmatrix} 4-3 & 16-1 & 8-5 \\ 0-6 & 0-2 & 0+10 \end{bmatrix}$$

$$tr\,BC = \begin{bmatrix} 1 & 15 & 3 \\ 6 & -2 & 10 \end{bmatrix}$$

tr(BC) = Not Possible.

Q#5

a) AB

$$AB = \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} 4 & -1 \\ 0 & 2 \end{bmatrix}$$

$$= \begin{bmatrix} 12-0 & -3 \\ -4 & -1+4 \\ 4 & -1+2 \end{bmatrix}$$

$$AB = \begin{bmatrix} 12 & -3 \\ -4 & 3 \\ 4 & 1 \end{bmatrix}$$

Ans

Date:

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b. BA

BA is not possible

c. (3E)D

$$(3E)D = \begin{bmatrix} 18 & 3 & 9 \\ -3 & 3 & 6 \\ 12 & 3 & 9 \end{bmatrix} \begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix}$$

$$(3E)D = \begin{bmatrix} 18-3+27 & 90+0+18 & 36+3+36 \\ -3+3+18 & -15+0+12 & -6+3+24 \\ 12-3+27 & 60+0+18 & 24+3+36 \end{bmatrix}$$

$$(3E)D = \begin{bmatrix} 42 & 108 & 75 \\ 18 & -3 & 21 \\ 36 & 78 & 63 \end{bmatrix}$$

Ans.

Date:

d. $(AB)C$

$$AB = \begin{bmatrix} 12 & -3 \\ -4 & 3 \\ 4 & 1 \end{bmatrix}$$

$$(AB)C = \begin{bmatrix} 12 & -3 \\ -4 & 3 \\ 4 & 1 \end{bmatrix} \begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix}$$

$$(AB)C = \begin{bmatrix} 12-9 & 48-3 & 24-15 \\ -4-9 & -16+3 & -8+15 \\ 4-3 & 16-1 & 8-5 \end{bmatrix}$$

$$(AB)C = \begin{bmatrix} 3 & 45 & 9 \\ 5 & -13 & 7 \\ 1 & 15 & 3 \end{bmatrix}$$

Ans

e. $A(BC)$

Date:

e $A(BC)$

$$A(BC) = \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} 1 & 15 & 3 \\ 6 & -2 & 10 \end{bmatrix}$$

$$A(BC) = \begin{bmatrix} 3+0 & 45+0 & 9 \\ -1+12 & -15-4 & -3+20 \\ 1+6 & 15-2 & 3+10 \end{bmatrix}$$

$$A(BC) = \begin{bmatrix} 13 & 45 & 9 \\ 11 & -19 & 17 \\ 7 & 13 & 13 \end{bmatrix}$$

Ans

f CC^T.

$$C^T = \begin{bmatrix} 1 & 3 \\ 4 & 1 \\ 2 & 5 \end{bmatrix}$$

$$CC^T = \begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix} \begin{bmatrix} 1 & 3 \\ 4 & 1 \\ 2 & 5 \end{bmatrix}$$

$$= \begin{bmatrix} 1+16+4 & 3+4+10 \\ 3+4+10 & 9+1+25 \end{bmatrix}$$

$$CC^T = \begin{bmatrix} 21 & 17 \\ 17 & 35 \end{bmatrix}$$

Ans

Date:

g. $(DA)^T$

$$DA = \begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix} \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 3-5+2 & 0+10+2 \\ -3-1 & 0+0+1 \\ 9-2+4 & 0+4+4 \end{bmatrix}$$

$$DA = \begin{bmatrix} 0 & 12 \\ -2 & 1 \\ 11 & 8 \end{bmatrix}$$

$$(DA)^T = \begin{bmatrix} 0 & -2 & 11 \\ 12 & 1 & 8 \end{bmatrix}$$

Ans

h. $(C^TB)A^T$

$$C^T = \begin{bmatrix} 1 & 3 \\ -4 & 1 \\ 2 & 5 \end{bmatrix}$$

$$(C^TB) = \begin{bmatrix} 1 & 3 \\ 4 & 1 \\ 2 & 5 \end{bmatrix} \begin{bmatrix} 4 & -1 \\ 0 & 2 \end{bmatrix}$$

$$= \begin{bmatrix} 4+0 & -1+6 \\ 16+0 & -4+2 \\ 8+0 & -2+10 \end{bmatrix}$$

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$$(C^TB)A^T = \begin{bmatrix} 4 & 5 \\ 16 & -2 \\ 8 & 8 \end{bmatrix} \begin{bmatrix} 3 & -1 & 1 \\ 0 & 2 & 1 \end{bmatrix}$$

$$(C^TB)A^T = \begin{bmatrix} 12+0 & -4+10 & 4+5 \\ 48 & -16-4 & 16-2 \\ 24 & -8+16 & 8+8 \end{bmatrix}$$

$$(C^TB)A^T = \begin{bmatrix} 12 & 6 & 9 \\ 48 & -20 & 14 \\ 24 & 8 & 16 \end{bmatrix}$$

i) $tr(DD^T)$

$$D^T = \begin{bmatrix} 1 & -1 & 3 \\ 5 & 0 & 2 \\ 2 & 1 & 4 \end{bmatrix}$$

$$DD^T = \begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix} \begin{bmatrix} 1 & -1 & 3 \\ 5 & 0 & 2 \\ 2 & 1 & 4 \end{bmatrix}$$

$$= \begin{bmatrix} 1+25+4 & -1+2 & 3+10+8 \\ -1+0+2 & 1+0+1 & -3+0+4 \\ 3+10+8 & -3+0+4 & 9+4+16 \end{bmatrix}$$

$$DD^T = \begin{bmatrix} 30 & 1 & 21 \\ 1 & 2 & 1 \\ 21 & 1 & 29 \end{bmatrix}$$

Date:

$$\boxed{\text{tr}(D^T) = 6.1}$$

Ans

Q.E

j) $\text{tr}(4E^T - D)$

$$E^T = \begin{bmatrix} 6 & -1 & 4 \\ 1 & 1 & 1 \\ 3 & 2 & 3 \end{bmatrix}$$

$$4E^T = \begin{bmatrix} 24 & -4 & 16 \\ 4 & 4 & 4 \\ 12 & 8 & 12 \end{bmatrix}$$

$$4E^T - D = \begin{bmatrix} 24 & -4 & 16 \\ 4 & 4 & 4 \\ 12 & 8 & 12 \end{bmatrix} - \begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix}$$

$$= \begin{bmatrix} 23 & -9 & 14 \\ 5 & 4 & 3 \\ 9 & 6 & 8 \end{bmatrix}$$

$$\text{tr}(4E^T - D) = 26 + 4 = \boxed{30}$$

Ans

Date:

k. $tr(C^TA^T + 2E^T)$

$$C^TA^T = \begin{bmatrix} 1 & 3 \\ 4 & 1 \\ 2 & 5 \end{bmatrix} \begin{bmatrix} 3 & -1 & 1 \\ 0 & 2 & 1 \end{bmatrix}$$

$$C^TA^T = \begin{bmatrix} 3+0 & -1+6 & 1+3 \\ 12+0 & -4+2 & 4+1 \\ 6 & -2+10 & 2+5 \end{bmatrix}$$

$$C^TA^T + 2E^T = \begin{bmatrix} 3 & 5 & 4 \\ 12 & -2 & 5 \\ 6 & 8 & 7 \end{bmatrix} + \begin{bmatrix} 12 & -2 & 8 \\ 2 & 2 & 2 \\ 6 & 4 & 6 \end{bmatrix}$$

$$= \begin{bmatrix} 15 & +3 & 12 \\ 14 & 0 & 7 \\ 12 & 12 & 13 \end{bmatrix}$$

$tr(C^TA^T + 2E^T) = 28$ Ans

Ans

Date:

(i) $tr((EC^T)^T A)$

$$\begin{bmatrix} 6 & 1 & 3 \\ 1 & 1 & 2 \\ 4 & 1 & 3 \end{bmatrix} \begin{bmatrix} 1 & 3 \\ 4 & 1 \\ 3 & 5 \end{bmatrix}$$

~~not possible~~

$$EC^T = \begin{bmatrix} 6+4+6 & 18+1+15 \\ -1+4+4 & -3+1+10 \\ 4+4+6 & 12+1+15 \end{bmatrix}$$

$$(EC^T)^T A = \begin{bmatrix} 16 & 7 & 14 \\ 34 & 8 & 31 \end{bmatrix} \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix}$$

$$(EC^T)^T A = \begin{bmatrix} 48-7+14 & 0+14+14 \\ 48-8+31 & 0+16+31 \end{bmatrix}$$

$$(EC^T)^T A = \begin{bmatrix} 55 & 28 \\ 71 & 47 \end{bmatrix}$$

$$tr((EC^T)^T A) = 102$$

Ans.

Date:

6)

a) $(2D^T - E)A$

$$2D^T - E = \begin{bmatrix} 2 & -2 & 6 \\ 10 & 0 & 4 \\ 4 & 2 & 8 \end{bmatrix} - \begin{bmatrix} 6 & 1 & 3 \\ -1 & 1 & 2 \\ 4 & 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} -4 & -3 & 3 \\ 11 & -1 & 2 \\ 0 & 1 & 5 \end{bmatrix}$$

$$(2D^T - E)A = \begin{bmatrix} -4 & -3 & 3 \\ 11 & -1 & 2 \\ 0 & 1 & 5 \end{bmatrix} \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} -12+3+3 & 0-6+3 \\ 33+1+2 & 0-2+2 \\ 0-1+5 & 0+2-5 \end{bmatrix}$$

$$(2D^T - E)A = \begin{bmatrix} -6 & -3 \\ 36 & 0 \\ 4 & -3 \end{bmatrix}$$

Ans

Date:

b) $(4B)C + 2B$

Sol:

$$4B = \begin{bmatrix} 16 & -4 \\ 0 & 8 \end{bmatrix}$$

$$(4B)C = \begin{bmatrix} 16 & -4 \\ 0 & 8 \end{bmatrix} \begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix}$$

$$= \begin{bmatrix} 16-12 & 64-4 & 32-20 \\ 0+24 & 0+8 & 0+40 \end{bmatrix}$$

$$(4B)C = \begin{bmatrix} 4 & 60 & 12 \\ 24 & 8 & 40 \end{bmatrix}$$

$$(4B)C + 2B = \begin{bmatrix} 4 & 60 & 12 \\ 24 & 8 & 40 \end{bmatrix} + \begin{bmatrix} 8 & -2 \\ 0 & 4 \end{bmatrix}$$

Not possible.

Date:

c) $(-AC)^T + 5D^T$

$$AC = \begin{bmatrix} 3-0 & 12-0 & 6-0 \\ -1-6 & -4-2 & -2-0 \\ 1-3 & 4-1 & 2-5 \end{bmatrix}$$

$$(-AC)^T = \begin{bmatrix} -3 & -5 & -4 \\ -12 & 2 & -5 \\ -6 & -8 & -7 \end{bmatrix}$$

$$(-AC)^T + 5D^T = \begin{bmatrix} -3 & -5 & -4 \\ -12 & 2 & -5 \\ -6 & -8 & -7 \end{bmatrix} + \begin{bmatrix} 5 & -5 & 15 \\ 25 & 0 & 10 \\ 10 & 5 & 20 \end{bmatrix}$$

$$(-AC)^T + 5D^T = \begin{bmatrix} 2 & -10 & 11 \\ 13 & 2 & 5 \\ 4 & -3 & 13 \end{bmatrix}$$

Ans.

d) $(BA^T - 2C)^T$

$$BA^T = \begin{bmatrix} 4 & -1 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} 3 & -1 & 1 \\ 0 & 2 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 12+0 & -4+0 & 4-1 \\ 0+0 & 0+4 & 0+2 \end{bmatrix}$$

$$(BA^T - 2C) = \begin{bmatrix} 12 & -4 & 3 \\ 0 & 4 & 2 \end{bmatrix} - \begin{bmatrix} 2 & 8 & 4 \\ 6 & 2 & 10 \end{bmatrix}$$

$$(BA^T - 2C) = \begin{bmatrix} 10 & -12 & -1 \\ -6 & 2 & -8 \end{bmatrix}$$

$$(BA^T - 2C)^T = \begin{bmatrix} 10 & -6 \\ -12 & 2 \\ -1 & -8 \end{bmatrix}$$

Ans

Date:

c) $B^T(CC^T - A^TA)$

Ans:

$$A^TA = \begin{bmatrix} 3 & -1 & 1 \\ 0 & 2 & 1 \end{bmatrix} \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix}$$

$$A^TA = \begin{bmatrix} 9+1+1 & 0-2+1 \\ 0-2+1 & 0+4-1 \end{bmatrix}$$

$$CC^T - A^TA = \begin{bmatrix} 21 & 17 \\ 17 & 35 \end{bmatrix} - \begin{bmatrix} 11 & -1 \\ -1 & 5 \end{bmatrix}$$

$$CC^T - A^TA = \begin{bmatrix} 10 & 18 \\ 18 & 30 \end{bmatrix}$$

$$B^T(CC^T - A^TA) = \begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix} \begin{bmatrix} 10 & 18 \\ 18 & 30 \end{bmatrix}$$

$$= \begin{bmatrix} 40+0 & 72-0 \\ -10+16 & -18+60 \end{bmatrix}$$

$$B^T(CC^T - A^TA) = \begin{bmatrix} 40 & 72 \\ 6 & 42 \end{bmatrix}$$

Ans.

Date

-f) $D^TE^T - (ED)^T$

$$ED = \begin{bmatrix} 6 & 1 & 3 \\ -1 & 1 & 2 \\ 4 & 1 & 3 \end{bmatrix} \begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix}$$

$$= \begin{bmatrix} 6-1+9 & 30+0+6 & 12+1+12 \\ -1-1+6 & -5+0+4 & -2+1+8 \\ 4-1+9 & 20+0+6 & 8+1+12 \end{bmatrix}$$

$$ED = \begin{bmatrix} 14 & 36 & 25 \\ 4 & -1 & 7 \\ 12 & 26 & 21 \end{bmatrix}$$

$$D^TE^T = \begin{bmatrix} 1 & -1 & 3 \\ 5 & 0 & 2 \\ 2 & 1 & 4 \end{bmatrix} \begin{bmatrix} 6 & -1 & 4 \\ 1 & 1 & 1 \\ 3 & 2 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 6-1+9 & -1-1+6 & 4-1+9 \\ 30+0+6 & -5+0+4 & 20+0+6 \\ 12+1+12 & -2+1+8 & 8+1+12 \end{bmatrix}$$

$\Rightarrow$

$$D^TE^T - (ED)^T = \begin{bmatrix} 14 & 4 & 12 \\ 36 & -1 & 26 \\ 25 & 7 & 21 \end{bmatrix} - \begin{bmatrix} 14 & 4 & 12 \\ 36 & -1 & 26 \\ 25 & 7 & 21 \end{bmatrix}$$

$$D^TE^T - (ED)^T = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$ Ans.

Date:

Q#7

a) the first row of AB

$$\begin{bmatrix} 3 & -2 & 7 \end{bmatrix} \begin{bmatrix} 6 & -2 & 4 \\ 0 & 1 & 3 \\ 7 & 7 & 5 \end{bmatrix}$$

$$\Rightarrow [18+0+49 \quad -6-2+49 \quad 12-14+35]$$

$$\Rightarrow [67 \quad 41 \quad 41]$$

Ans.

b) the third row of AB

$$\begin{bmatrix} 0 & 4 & 9 \end{bmatrix} \begin{bmatrix} 6 & -2 & 4 \\ 0 & 1 & 3 \\ 7 & 7 & 5 \end{bmatrix}$$

$$\Rightarrow [0+0+63 \quad 0+4+63 \quad 0+12+45]$$

$$\Rightarrow [63 \quad 67 \quad 57]$$

Ans

c)

Date:

c) the second column of AB

$$\begin{bmatrix} -2 \\ 5 \\ 4 \end{bmatrix} \begin{bmatrix} 6 & -2 & 4 \\ 0 & 1 & 3 \\ -1 & -1 & 5 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 3 & -2 & 7 \\ 6 & 5 & 4 \\ 0 & 4 & 9 \end{bmatrix} \begin{bmatrix} -2 \\ 1 \\ 7 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} -6-2+49 \\ -12+5+28 \\ 0-4+63 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 41 \\ 18 \\ 67 \end{bmatrix}$$

d) the first column of BA

$$\begin{bmatrix} 6 & -2 & 4 \\ 0 & 1 & 3 \\ 7 & 7 & 5 \end{bmatrix} \begin{bmatrix} -2 \\ 5 \\ 4 \end{bmatrix}$$

$$= \begin{bmatrix} -12-10+16 \\ 0+5+12 \\ -14+35+20 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} -6 \\ 17 \\ 41 \end{bmatrix} \text{ Ans}$$

Date:

e) the third row of AA

$$\begin{bmatrix} 0 & 4 & 9 \end{bmatrix} \begin{bmatrix} 3 & -2 & 7 \\ 6 & 5 & 4 \\ 0 & 4 & 9 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 0+24+0 & 0+20+36 & 0+16+81 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 24 & 56 & 97 \end{bmatrix}$$

Ans.

f) the third column of AA

$$\begin{bmatrix} 3 & -2 & 7 \\ 6 & 5 & 4 \\ 0 & 4 & 9 \end{bmatrix} \begin{bmatrix} 7 \\ 4 \\ 9 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 21-8+63 \\ 42+20+36 \\ 0+16+81 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 76 \\ 98 \\ 97 \end{bmatrix}$$

Ans.

Date:

Q#8

a) the first column of AB

$$\begin{bmatrix} 3 & -2 & 7 \\ 6 & 5 & 4 \\ 0 & 4 & 9 \end{bmatrix} \begin{bmatrix} 6 \\ 0 \\ 7 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 18+0+49 \\ 36+0+28 \\ 0+0+63 \end{bmatrix} \Rightarrow \begin{bmatrix} 67 \\ 64 \\ 63 \end{bmatrix}$$

Ans

b) the third column of BB

$$\begin{bmatrix} 6 & -2 & 4 \\ 0 & 1 & 3 \\ 7 & 7 & 5 \end{bmatrix} \begin{bmatrix} 7 \\ 4 \\ 9 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 42-8+36 \\ 0+4+27 \\ 49+28+45 \end{bmatrix} \Rightarrow \begin{bmatrix} 70 \\ 31 \\ 122 \end{bmatrix}$$

Ans

Date:

c) the second row of BB

$$\begin{bmatrix} 6 & 5 & 4 \end{bmatrix} \begin{bmatrix} 6 \\ 0 \\ 7 \end{bmatrix}$$

$$\begin{bmatrix} 0 & 1 & 3 \end{bmatrix} \begin{bmatrix} 6 & -2 & 4 \\ 0 & 1 & 3 \\ 7 & 7 & 5 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 0+0+21 & 0+1+21 & 0+3+15 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 21 & 22 & 18 \end{bmatrix}$$

Ans.

d) the first column of AA

$$\begin{bmatrix} 3 & -2 & 7 \\ 6 & 5 & 4 \\ 0 & 4 & 9 \end{bmatrix} \begin{bmatrix} 3 \\ 6 \\ 0 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 9-12+0 \\ 18+30+0 \\ 0+24+0 \end{bmatrix} \Rightarrow \begin{bmatrix} -3 \\ 48 \\ 24 \end{bmatrix}$$

Ans

Date:

e) the third column of AB

$$\begin{bmatrix} 6 & -2 & 4 \\ 0 & 1 & 3 \\ 7 & 7 & 5 \end{bmatrix} \begin{bmatrix} 7 \\ 4 \\ 9 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 42-8+36 \\ 0+4+27 \\ 49+28+45 \end{bmatrix} \Rightarrow \begin{bmatrix} 70 \\ 31 \\ 122 \end{bmatrix}$$

Ans.

f) the first row of BA

$$\begin{bmatrix} 6 & -2 & 4 \end{bmatrix} \begin{bmatrix} 3 & -2 & 7 \\ 6 & 5 & 4 \\ 0 & 4 & 9 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 18-12+0 & -12-10+16 & 42-8+36 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 6 & -6 & 70 \end{bmatrix}$$

Date:

Q-19 -

a) Express each column vector of AA as a linear combination of column vectors of A

Sol^n:

1st Column vector:

$$\begin{bmatrix} 3 & -2 & 7 \\ 6 & 5 & 4 \\ 0 & 4 & 9 \end{bmatrix} \begin{bmatrix} 3 \\ 6 \\ 0 \end{bmatrix}$$

2nd Column vector

$$\begin{bmatrix} 3 & -2 & 7 \\ 6 & 5 & 4 \\ 0 & 4 & 9 \end{bmatrix} \begin{bmatrix} -2 \\ 5 \\ 4 \end{bmatrix}$$

3rd Column vector

$$\begin{bmatrix} 3 & -2 & 7 \\ 6 & 5 & 4 \\ 0 & 4 & 9 \end{bmatrix} \begin{bmatrix} 7 \\ 4 \\ 9 \end{bmatrix}$$

Ans.

b) Express each column vector of B as a linear combination of the column vectors of B.

Soln.

1st column vector:

$$\begin{bmatrix} 6 & -2 & 4 \\ 0 & 1 & 3 \\ 7 & 2 & 5 \end{bmatrix} \begin{bmatrix} 6 \\ 0 \\ 7 \end{bmatrix}$$

2nd column vector:

$$\begin{bmatrix} 6 & -2 & 4 \\ 0 & 1 & 3 \\ 7 & 2 & 5 \end{bmatrix} \begin{bmatrix} -2 \\ 1 \\ 2 \end{bmatrix}$$

3rd column vector:

$$\begin{bmatrix} 6 & -2 & 4 \\ 0 & 1 & 3 \\ 7 & 2 & 5 \end{bmatrix} \begin{bmatrix} 4 \\ 3 \\ 5 \end{bmatrix}$$

Date:

(2 pts)

a) Express each column vector of AB as a linear combination of the column vectors of A

Sol'n:

1st column of AB

$$\begin{bmatrix} 6 & -2 & 4 \\ 0 & 1 & 3 \\ -1 & -1 & 5 \end{bmatrix} \begin{bmatrix} 3 \\ 6 \\ 0 \end{bmatrix}$$

2nd column of AB

$$\begin{bmatrix} 6 & -2 & 4 \\ 0 & 1 & 3 \\ -1 & -1 & 5 \end{bmatrix} \begin{bmatrix} -2 \\ 5 \\ 4 \end{bmatrix}$$

3rd column of AB

$$\begin{bmatrix} 6 & -2 & 4 \\ 0 & 1 & 3 \\ -1 & -1 & 5 \end{bmatrix} \begin{bmatrix} 7 \\ 4 \\ 9 \end{bmatrix}$$

Date:

b) Express each column vector of BA as a linear combination of the column vectors of B.

Sol^n

1st column of BA

$$\begin{bmatrix} 3 & -2 & 7 \\ 6 & 5 & 4 \\ 0 & 4 & 9 \end{bmatrix} \begin{bmatrix} 6 \\ 0 \\ -1 \end{bmatrix}$$

2nd column of BA

$$\begin{bmatrix} 3 & -2 & 7 \\ 6 & 5 & 4 \\ 0 & 4 & 9 \end{bmatrix} \begin{bmatrix} -2 \\ 1 \\ 7 \end{bmatrix}$$

3rd column of BA

$$\begin{bmatrix} 3 & -2 & 7 \\ 6 & 5 & 4 \\ 0 & 4 & 9 \end{bmatrix} \begin{bmatrix} 4 \\ 3 \\ 5 \end{bmatrix}$$

Ans.

Date

Q#11

a) $2x_1 - 3x_2 + 5x_3 = 7$
$9x_1 - x_2 + x_3 = -1$
$x_1 + 5x_2 + 4x_3 = 0$

Sol:

$$\begin{bmatrix} 2 & -3 & 5 \\ 9 & -1 & 1 \\ 1 & 5 & 4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 7 \\ -1 \\ 0 \end{bmatrix}$$

$$A \qquad X = B$$

b) $4x_1 - 3x_3 + x_4 = 1$
$5x_1 + x_2 - 8x_4 = 3$
$2x_1 - 5x_2 + 9x_3 - x_4 = 0$
$3x_2 - x_3 + 7x_4 = 2$

Sol:

$$\begin{bmatrix} 4 & 0 & -3 & 1 \\ 5 & 1 & 0 & -8 \\ 2 & -5 & 9 & -1 \\ 0 & 3 & -1 & 7 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 1 \\ 3 \\ 0 \\ 2 \end{bmatrix}$$

$$A \qquad X = B.$$

Date:

13.

a) $x_1 - 2x_2 + 3x_3 = -3$

$2x_1 + x_2 = 0$

$-3x_2 + 4x_3 = 1$

$x_1 + x_3 = 5$

Solve:

$$\left[\begin{array}{ccc|c} 1 & 2 & 3 & \\ 2 & 1 & 0 & \\ 0 & -3 & 4 & \\ 1 & 0 & 1 & \end{array}\right]$$

$$\begin{bmatrix} 1 & -2 & 3 & 0 \\ 2 & 1 & 0 & 0 \\ 0 & -3 & 4 & 0 \\ 1 & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 3 \\ 0 \\ 1 \\ 5 \end{bmatrix}$$

$$A \qquad X = B.$$

b) $3x_1 + 3x_2 + 3x_3 = -3$

$-x_1 + -5x_2 - 2x_3 = 3$

$-4x_2 + x_3 = 0$

Solve:

$$\begin{bmatrix} 3 & 3 & 3 \\ -1 & -5 & -2 \\ 0 & -4 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} -3 \\ 3 \\ 0 \end{bmatrix}$$

Date:

Q#13

a) $\begin{bmatrix} 5 & 6 & -7 \\ -1 & -2 & 3 \\ 0 & 4 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 2 \\ 0 \\ 3 \end{bmatrix}$

$5x_1 + 6x_2 - 7x_3 = 2$
$-x_1 - 2x_2 + 3x_3 = 0$
$4x_2 - x_3 = 3$

b) $\begin{bmatrix} 1 & 1 & 1 \\ 2 & 3 & 0 \\ 5 & -3 & -6 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2 \\ 2 \\ -9 \end{bmatrix}$

$x + y + z = 2$
$2x + 3y = 2$
$5x - 3y - 6z = -9$

Q#14

a) $\begin{bmatrix} 3 & -1 & 2 \\ 4 & 3 & 7 \\ -2 & 1 & 5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 2 \\ -1 \\ 4 \end{bmatrix}$

$3x_1 - x_2 + 2x_3 = 2$
$4x_1 + 3x_2 + 7x_3 = -1$
$-2x_1 + x_2 + 5x_3 = 4$

Date

b) $\begin{bmatrix} 3 & -2 & 0 & 1 \\ 5 & 0 & 2 & -3 \\ 3 & 1 & 4 & 7 \\ -2 & 5 & 1 & 6 \end{bmatrix} \begin{bmatrix} w \\ x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$

Sol:-

$3w - 2x + z = 0$

$5w + 2y - 3z = 0$

$3w + x + 4y + 7z = 0$

$-2w + 5x + y + 6z = 0$

8) Ans

Find all values of k

$$\begin{bmatrix} k & 1 & 1 \end{bmatrix} \begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 2 \\ 0 & 2 & -3 \end{bmatrix} \begin{bmatrix} k \\ 1 \\ 1 \end{bmatrix} = 0$$

Sol:-

$$\Rightarrow \begin{bmatrix} k+1 & k+2 & 2-3 \end{bmatrix} \begin{bmatrix} k \\ 1 \\ 1 \end{bmatrix} = 0$$

$$\Rightarrow \begin{bmatrix} k+1 & k+2 & -1 \end{bmatrix} \begin{bmatrix} k \\ 1 \\ 1 \end{bmatrix} = 0$$

Date:

$\Rightarrow [k(k+1)+k+2-1] = 0$

On comparing:

$k^2+k+k+1 = 0$

$k^2+2k+1 = 0$

$(k+1)^2 = 0$

$k+1 = 0$

$\boxed{k = -1}$

16) $\begin{bmatrix} 2 & 2 & k \end{bmatrix} \begin{bmatrix} 1 & 2 & 0 \\ 2 & 0 & 3 \\ 0 & 3 & 1 \end{bmatrix} \begin{bmatrix} 2 \\ 2 \\ k \end{bmatrix} = 0$

Sol:

$\Rightarrow \begin{bmatrix} 2+4 & 4+3k & 6+k \end{bmatrix} \begin{bmatrix} 2 \\ 2 \\ k \end{bmatrix} = 0$

$\Rightarrow \begin{bmatrix} 6 & 4+3k & 6+k \end{bmatrix} \begin{bmatrix} 2 \\ 2 \\ k \end{bmatrix} = 0$

$\Rightarrow [12+8+6k+6k+k^2] = 0$

Upon comparing

$\Rightarrow k^2+12k+20 = 0$

$k^2+10k+2k+20 = 0$

$k(k+10)+2(k+10) = 0$

$\boxed{k = -2}$ $\boxed{k = -10}$

17)

$$A = \begin{bmatrix} 4 & -3 \\ 2 & -1 \end{bmatrix}, \quad B = \begin{bmatrix} 0 & 1 & 2 \\ -2 & 3 & 1 \end{bmatrix}$$

Sol:

$AB = C_1R_1 + C_2R_2$

$$= \begin{bmatrix} 4 \\ 2 \end{bmatrix}\begin{bmatrix} 0 & 1 & 2 \end{bmatrix} + \begin{bmatrix} -3 \\ -1 \end{bmatrix}\begin{bmatrix} -2 & 3 & 1 \end{bmatrix}$$

$$AB = \begin{bmatrix} 0 & 4 & 8 \\ 0 & 2 & 4 \end{bmatrix} + \begin{bmatrix} 6 & -9 & -3 \\ 2 & -3 & -1 \end{bmatrix}$$

$$AB = \begin{bmatrix} 6 & -5 & 5 \\ 2 & -1 & 3 \end{bmatrix}$$

Ans.

18) $$A = \begin{bmatrix} 0 & -2 \\ 4 & -3 \end{bmatrix}, \quad B = \begin{bmatrix} 1 & 4 & 1 \\ -3 & 0 & 2 \end{bmatrix}$$

Sol:

$AB = C_1R_1 + C_2R_2$

$$\Rightarrow AB = \begin{bmatrix} 0 \\ 4 \end{bmatrix}\begin{bmatrix} 1 & 4 & 1 \end{bmatrix} + \begin{bmatrix} -2 \\ -3 \end{bmatrix}\begin{bmatrix} -3 & 0 & 2 \end{bmatrix}$$

Date:

$$\Rightarrow \begin{bmatrix} 0 & 0 & 0 \\ 4 & 16 & 4 \end{bmatrix} + \begin{bmatrix} 6 & 0 & -4 \\ 9 & 0 & -6 \end{bmatrix}$$

$$\Rightarrow AB = \begin{bmatrix} 6 & 0 & -4 \\ 13 & 16 & -2 \end{bmatrix}$$

19) $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix}$

Sol^n:

$AB = (1^{st}) + (2^{nd})$

$$= \begin{bmatrix} 1 \\ 4 \end{bmatrix} \begin{bmatrix} 1 & 2 \end{bmatrix} + \begin{bmatrix} 2 \\ 5 \end{bmatrix} \begin{bmatrix} 3 & 4 \end{bmatrix} + \begin{bmatrix} 3 \\ 6 \end{bmatrix} \begin{bmatrix} 5 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 2 \\ 4 & 8 \end{bmatrix} + \begin{bmatrix} 6 & 8 \\ 15 & 20 \end{bmatrix} + \begin{bmatrix} 15 & 18 \\ 30 & 36 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 22 & 28 \\ 49 & 64 \end{bmatrix} = AB$$

Ans.

Date:

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

Sol:-

$$AB = \begin{bmatrix} 0 \\ 1 \end{bmatrix}\begin{bmatrix} 2 & -1 \end{bmatrix} + \begin{bmatrix} 4 \\ -2 \end{bmatrix}\begin{bmatrix} 4 & 0 \end{bmatrix} + \begin{bmatrix} 2 \\ 5 \end{bmatrix}\begin{bmatrix} 1 & 1 \end{bmatrix}$$

$$\Rightarrow AB = \begin{bmatrix} 0 & 0 \\ 2 & -1 \end{bmatrix} + \begin{bmatrix} 16 & 0 \\ -8 & 0 \end{bmatrix} + \begin{bmatrix} 2 & 2 \\ 5 & 5 \end{bmatrix}$$

$$\Rightarrow AB = \begin{bmatrix} 18 & 2 \\ -1 & 4 \end{bmatrix}$$

Ans.