FIRST MID-TERM TEST - 2022	Reg. No.							

XI - BUSINESS MATHEMATICS & STATISTICS

Time Allowed : 1:30 Hrs. *Maximum Marks: 50*

PART - I

Note *i)* ***Answer all the questions***

ii) ***Choose the most appropriat answer from the given four alternatives and write the option code and the corresponding answer.*** ***(10×1=10)***

1. The value of x if $\begin{vmatrix} 0 & 1 & 0 \\ x & 2 & x \\ 1 & 3 & x \end{vmatrix} = 0$ is ________

a) 0, -1 b) 0, 1 c) -1, 1 d) - 1, -1

2. The number of Hawkins - Simon conditions for the viability of an input-output analysis is ________

a) 1 b) 3 c) 4 d) 2

3. adj (AB) is equal to ________

a) adjA adjB b) $adjA^T\ adjB^T$ c) adjB adjA d) $adjB^T\ adjA^T$

4. If A is 3 x 3 matrix and $|A| = 4$ then $|A^{-1}|$ is equal to ________

a) 1/4 b) 1/16 c) 2 d) 4

5. If any three rows or columns of a determinant are identical then the value of the determinant is ________

a) 0 b) 2 c) 1 d) 3

6. If $nC_3 = nC_2$ then the value of nC_4 is ________

a) 2 b)3 c) 4 d) 5

7. The number of ways selecting 4 players out of 5 is ________

a) 4! b) 20 c) 25 d) 5

8. If n is a positive integer, then the number of terms in the expansion of $(x + a)^n$ is ________

a) n b) n+1 c) n-1 d) 2n

9. The number of ways to arrange the letters of the word "CHEESE" ________

a) 120 b) 240 c) 720 d) 6

10. Sum of the binomial coefficients is ________

a) 2^n b) n^2 c) 2n d) n+17

PART - II

Answer any five questions. Question Number 17 is compulsory. ***(5x2=10)***

11. Evaluate : $\begin{vmatrix} 2 & 4 \\ -1 & 4 \end{vmatrix}$

12. If, $A = \begin{bmatrix} -2 & 6 \\ 3 & -9 \end{bmatrix}$ then, find A^{-1}

13. Find the adjoint of the matrix $A = \begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}$

14. Show that $\begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix}$ is a singular matrix

15. Rewrite 7! interms of 5!

16. Evaluate i) $8P_3$ ii) $5P_4$

17. If $15C_{3r} = 15C_{r+3}$, find r.

PART - III

Answer any five questions. Question no. 24 is compulsory. ***(5x3=15)***

18. Evaluate : $\begin{vmatrix} 3 & -2 & 4 \\ 2 & 0 & 1 \\ 1 & 2 & 3 \end{vmatrix}$

19. Solve : $\begin{vmatrix} x-1 & x & x-2 \\ 0 & x-2 & x-3 \\ 0 & 0 & x-3 \end{vmatrix} = 0$

20. The technology matrix of an economic system of two industries is $\begin{bmatrix} 0.50 & 0.30 \\ 0.41 & 0.33 \end{bmatrix}$. Test whether the system is viable as per Hawkins-Simon conditions.

21. Find the values of A and B if $\frac{1}{x^2-1} = \frac{A}{x-1} + \frac{B}{x+1}$

22. Evaluate the following : i) $\frac{7!}{6!}$ ii) $\frac{9!}{6!3!}$

23. Find the number of arrangements that can be made out of the letters of the word "ASSASSINATION".

24. Using binomial theorem, expand $\left(x^2 + \frac{1}{x^2}\right)^4$

PART - IV

Answer all the questions. ***(3x5=15)***

25. a. Prove that $\begin{vmatrix} -a^2 & ab & ac \\ ab & -b^2 & bc \\ ac & bc & -c^2 \end{vmatrix} = 4a^2b^2c^2$ **(OR)**

b. If $A = \begin{bmatrix} 3 & 7 \\ 2 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 6 & 8 \\ 7 & 9 \end{bmatrix}$ then, verify that $(AB)^{-1} = B^{-1}A^{-1}$

26. a. Solve by using matrix inversion method: $2x + 5y = 1$, $3x + 2y = 7$

(OR)

b. Suppose the inter-industry flow of the product of two sectors X and Y are given as under.

Production Sector	Consumption Sector		Domestic demand	Gross Output
	X	Y		
X	15	10	10	35
Y	20	30	15	65

Find the gross output when the dometic demand changes to 12 for X and 18 for Y.

27. a. Find n, if $\frac{1}{9!} + \frac{1}{10!} = \frac{n}{11!}$ **(OR)**

b. Using mathematical induction method prove that

$$1 + 2 + 3 + \ldots\ldots + n = \frac{n(n+1)}{2}, \ n \in N$$

First Mid Term - 2022 - Trichy Dt.

Std: 11 Business maths - Key

Part - I

1. (b) 0, 1
2. (d) 2
3. (c) (adj B)(adj A)
4. (a) $\frac{1}{4}$
5. (a) 0
6. (d) 5
7. (d) 5
8. (b) $n+1$
9. (a) 120
10. (a) 2^n

Part - II

(11) $\begin{vmatrix} 2 & 4 \\ -1 & 4 \end{vmatrix} = 8+4 = 12$

(12) $|A| = \begin{vmatrix} -2 & 6 \\ 3 & -9 \end{vmatrix} = 18-18 = 0$

$\therefore A^{-1}$ does not exist.

(13) $\text{adj}\,A = \begin{pmatrix} 4 & -3 \\ -1 & 2 \end{pmatrix}$

(14) $|A| = \begin{vmatrix} 1 & 2 \\ 2 & 4 \end{vmatrix} = 4-4=0$

$\therefore A$ is singular

(15) $7! = 7\times6\times5! = 42\times5!$

(16) (i) $8P_3 = \frac{8!}{(8-3)!} = \frac{8!}{5!}$

$= \frac{8\times7\times6\times5!}{5!}$

$8P_3 = 336$

(ii) $5P_4 = \frac{5!}{(5-4)!} = \frac{5!}{1!} = 120$

(17) $15C_{3r} = 15C_{r+3}$

$\Rightarrow 3r + r+3 = 15$

$4r+3 = 15$

$4r = 12$

$r = 3$

Part - III

(18) $\Delta = \begin{vmatrix} 3 & -2 & 4 \\ 2 & 0 & 1 \\ 1 & 2 & 3 \end{vmatrix}$

$= 3(0-2) + 2(6-1) + 4(4-0)$

$= -6+10+16$

$\Delta = 20$

(19) $(x-1)(x-2)(x-3)=0$

$\Rightarrow x = 1, 2, 3$

(20) $B = \begin{pmatrix} 0.50 & 0.30 \\ 0.41 & 0.33 \end{pmatrix}$

$I - B = \begin{pmatrix} 0.50 & -0.30 \\ -0.41 & 0.67 \end{pmatrix}$

$\therefore |I-B| = \begin{vmatrix} 0.50 & -0.30 \\ -0.41 & 0.67 \end{vmatrix}$

$= 0.335 - 0.123$

$|I-B| = 0.212$, +ve

$\therefore$ The system is viable.

(21) $A(x+1) + B(x-1) = 1$

Put $x=1$, $2A = 1 \Rightarrow A = \frac{1}{2}$

Put $x=-1$, $-2B = 1 \Rightarrow B = \frac{-1}{2}$

(22) (i) $\frac{7!}{6!} = \frac{7\times 6!}{6!} = 7$

(ii) $\frac{9!}{6!3!} = \frac{\cancel{9}^{3} \times \cancel{8}^{4} \times 7 \times \cancel{6!}}{\cancel{6!} \times \cancel{3} \times \cancel{2} \times 1}$

$= 84$

(23) Total No. of arrangements $= \frac{13!}{3!4!2!2!}$

(24) $(x+a)^n = nC_0 x^n + nC_1 x^{n-1} a^1 + \dots + nC_n a^n$

$\left(x^2+\frac{1}{x^2}\right)^4 = 4C_0 (x^2)^4 + 4C_1 (x^2)^3 \left(\frac{1}{x^2}\right)$

$+ 4C_2 (x^2)^2 \left(\frac{1}{x^2}\right)^2 + 4C_3 (x^2) \left(\frac{1}{x^2}\right)^3$

$+ 4C_4 \left(\frac{1}{x^2}\right)^4$

$\Rightarrow \left(x^2+\frac{1}{x^2}\right)^4 = x^8 + 4x^4 + 6$

$+ \frac{4}{x^2} + \frac{4}{x^4} + \frac{1}{x^8}$

Part - IV

(25) (a)

LHS $= \begin{vmatrix} -a^2 & ab & ac \\ ab & -b^2 & bc \\ ac & bc & -c^2 \end{vmatrix}$

Take a, b, c in R_1, R_2, R_3 respectively.

$= abc \begin{vmatrix} -a & b & c \\ a & -b & c \\ a & b & -c \end{vmatrix}$

Take a, b, c in C_1, C_2, C_3 respectively

$= a^2b^2c^2 \begin{vmatrix} -1 & 1 & 1 \\ 1 & -1 & 1 \\ 1 & 1 & -1 \end{vmatrix}$

$= a^2b^2c^2 (4)$

$= 4a^2b^2c^2 =$ RHS.

(25) (b)

$AB = \begin{pmatrix} 67 & 87 \\ 47 & 61 \end{pmatrix}$

$|AB| = -2 \neq 0$

$\text{adj}(AB) = \begin{pmatrix} 61 & -87 \\ -47 & 67 \end{pmatrix}$

$(AB)^{-1} = \frac{1}{2} \begin{pmatrix} -61 & 87 \\ 47 & -67 \end{pmatrix} \rightarrow (1)$

$$|B| = -2 \neq 0$$

$$\text{adj}\,B = \begin{pmatrix} 9 & -8 \\ -7 & 6 \end{pmatrix}$$

$$B^{-1} = \frac{1}{-2}\begin{pmatrix} 9 & -8 \\ -7 & 6 \end{pmatrix}$$

$$|A| = 1 \quad \text{adj}A = \begin{pmatrix} 5 & -7 \\ -2 & 3 \end{pmatrix}$$

$$A^{-1} = \frac{1}{1}\begin{pmatrix} 5 & -7 \\ -2 & 3 \end{pmatrix}$$

$$\therefore B^{-1}A^{-1} = \frac{1}{2}\begin{pmatrix} -61 & 87 \\ 47 & -67 \end{pmatrix}$$

28 (a) $Ax = B$

$$\begin{pmatrix} 2 & 5 \\ 3 & 2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1 \\ 7 \end{pmatrix}$$

$$A = \begin{pmatrix} 2 & 5 \\ 3 & 2 \end{pmatrix} \therefore |A| = -11 \neq 0$$

$$\text{adj}\,A = \begin{pmatrix} 2 & -5 \\ -3 & 2 \end{pmatrix}$$

$$A^{-1} = \frac{1}{-11}\begin{pmatrix} 2 & -5 \\ -3 & 2 \end{pmatrix}$$

$$\therefore X = A^{-1} \cdot B$$

$$= \frac{1}{-11}\begin{pmatrix} 2 & -5 \\ -3 & 2 \end{pmatrix}\begin{pmatrix} 1 \\ 7 \end{pmatrix}$$

$$= \frac{-1}{11}\begin{pmatrix} -33 \\ 11 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$$

26 (b) $B = \begin{pmatrix} \frac{3}{7} & \frac{2}{13} \\ \frac{4}{7} & \frac{6}{13} \end{pmatrix}$

$$I - B = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} - \begin{pmatrix} \frac{3}{7} & \frac{2}{13} \\ \frac{4}{7} & \frac{6}{13} \end{pmatrix}$$

$$I - B = \begin{pmatrix} \frac{4}{7} & -\frac{2}{13} \\ -\frac{4}{7} & \frac{7}{13} \end{pmatrix} \therefore |I-B| = \frac{20}{91}$$

$$\text{adj}(I-B) = \begin{pmatrix} \frac{7}{13} & \frac{2}{13} \\ \frac{4}{7} & \frac{4}{7} \end{pmatrix}$$

$$(I-B)^{-1} = \frac{1}{\left(\frac{20}{91}\right)}\begin{pmatrix} \frac{7}{13} & \frac{2}{13} \\ \frac{4}{7} & \frac{4}{7} \end{pmatrix}$$

$$X = (I-B)^{-1} \cdot D = \frac{91}{20}\begin{pmatrix} \frac{7}{13} & \frac{2}{13} \\ \frac{4}{7} & \frac{4}{7} \end{pmatrix}\begin{pmatrix} 12 \\ 18 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 42 \\ 78 \end{pmatrix}$$

27 (a) $\frac{1}{9!} + \frac{1}{10 \times 9!} = \frac{n}{11 \times 10 \times 9!}$

$$\cancel{\frac{1}{9!}}\left[1 + \frac{1}{10}\right] = \frac{n}{110 \times \cancel{9!}}$$

$$\frac{11}{10} = \frac{n}{110}$$

$$110 \times \frac{11}{10} = n$$

$$\Rightarrow n = 121$$

27 (b)

$p(n): 1 + 2 + \cdots + n = \frac{n(n+1)}{2}$

put $n=1$, LHS $p(1) = 1$

RHS $\frac{1(1+1)}{2} = 1$

$\therefore$ LHS = RHS

$\therefore p(1)$ is true.

Let us assume $P(K)$ is true

$$\therefore 1+2+3+\cdots+K = \frac{K(K+1)}{2}$$

To prove : $P(K+1)$ is true

$$P(K+1) = 1+2+\cdots+K+(K+1)$$

$$= \frac{K(K+1)}{2} + (K+1)$$

$$= \frac{(K+1)(K+2)}{2}$$

$\therefore P(K+1)$ is true.

$\therefore P(n)$ is true $\forall\, n \in N$.

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