

Assignment 3
Course Code (Name) : BM206(Quantitative Techniques)

Section 1: Problems

Course Covered : Matrix Algebra, Determinants & Vectors

Instructions : Attempt all questions on your own at the first instance. If you cannot do them on your own, you are free to take help of your batch mates or your course instructor. The assignments need not be submitted but the course instructor reserves the right to ask for the solutions any time.

1. Find the inverse of the following matrix using three different techniques:

$$\begin{pmatrix} 2 & -2 & 1 \\ -3 & 1 & 4 \\ 1 & 2 & 1 \end{pmatrix}$$

2. Use three different techniques for determining the consistency of the equations and then separately solve them using three different methods:

$$\begin{aligned} \text{(i)} \quad & 3x - y - z = 10 \\ & 2x + y + 3z = 12 \\ & 2x + y - 2z = 5 \end{aligned}$$

$$\begin{aligned} \text{[ii]} \quad & x + 3y + 4z = 0 \\ & 2x + 2z = 0 \\ & x + 2y + 3z = 0 \end{aligned}$$

3. A company earns before-tax profits of Rs. 100000. It is committed to making a donation to the Red Cross of 10% of its after-tax profits. The Central Government levies corporate taxes of 50% of profits after deducting charitable donations and any local taxes. The company must also pay local taxes of 10% of its profits less the donation to the Red Cross. Formulate a set of equations and compute how much the company pays in corporate taxes, local taxes and as a donation to the Red Cross.

4. An amount of Rs. 5000 is put into three different investments at the rates of interest of 6%, 7% and 8% per annum respectively. The total annual income is Rs. 358. If the combined income from the first two investments is Rs. 70 more than the income from the third, find the amount of each investment by using matrix algebra.

5. A firm produces two products P1 and P2, passing through two machines M1 and M2 before completion. M1 can produce either 10 units of P1 or 15 units of P2 per hour. M2 can produce 15 units of either product per hour. Find daily production of P1 and P2 if time available is 12 hours of machine M1 and 10 hours of machine M2 per day. Use matrix inversion.

6. Prove that

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

is a perfect square.

7. Find the rank of the matrix

$$\begin{pmatrix} 1 & 2 & 3 \\ 2 & 5 & 1 \\ 1 & 2 & 1 \end{pmatrix}$$

8. Show that the matrix

$$\mathbf{R} = \begin{pmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{pmatrix}$$

satisfies the equation $\mathbf{R}^2 - 4\mathbf{R} - 5\mathbf{I} = 0$ and hence find \mathbf{R}^{-1} .

9. Investigate whether the vectors $[3 \ 1 \ 2]$, $[4 \ 2 \ 1]$ and $[2 \ 4 \ 1]$ are linearly independent or dependent.

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- ✓ Take a bag with you whenever you go shopping to the market. That way, you avoid bringing polybags which ultimately finds its way to the waste basket. These are not bio-degradable and harm the environment.
 - ✓ Take the print out of this assignment in a paper which is already used on one side. This can help save paper and associated costs. In fact, make it a habit to always use papers to the optimum. Even envelopes just thrown away can be used to do rough work.
 - ✓ Check to see that all electrical appliances are switched off when they are not being used. Switch to CFLs. You can do a lot to save power.
 - ✓ Make it fashionable to be environmentally conscious and aware. You can make a real difference to the only place we have to live called EARTH.
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