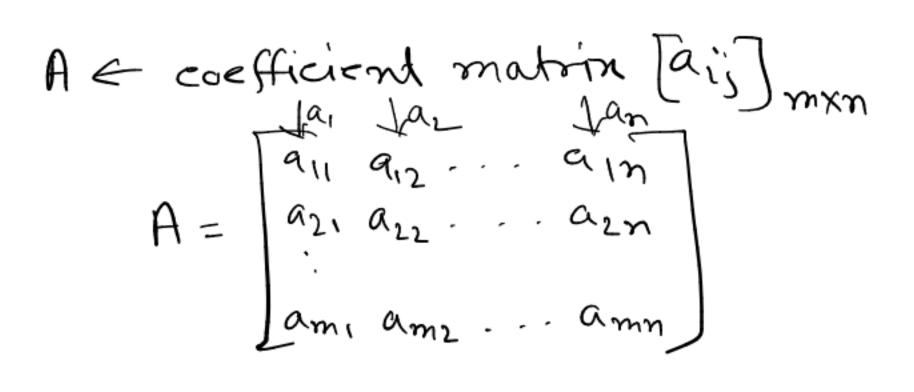
Matrix formulation of an LPP The linear programming problem can be written on. optimise z = \$\frac{1}{2} \circ \chi \chi \frac{1}{2} $5 \cdot \frac{\pi_1}{j=1} a_{ij} \chi_j (\leq = \frac{\pi_2}{j}) b_i$ $\forall i=1,2,.m$ スラグログリニリスノック This can be written on, optimise Z = CXz = cx z = cx zoptimise Z = CX where, Ce cost vectors, is an neomponent X = variable rector, is an neomponent column vector [x1, x2, ... , 2m] b = constant/requirement vector is an m component column rector



Let a denote the i-th column receter of A then we can write $A \times (==>)$ b an,

 $(2)x_1+a_2x_2+\cdots+a_nx_n (== 7)b$

Bassic solution: consider a set of m linear simultaneon equations of n variables (n) m) AX=b) Assume that rank (A) = rank (Ab)=m (Ab < Augmented matrin of Ax=6) If any [mxm] non-singular square matrix be chosen from A and if all the (n-m) variables that are not associated with the chosen matrix be set equal to zero, then the solution to the resulting system of equations is called a

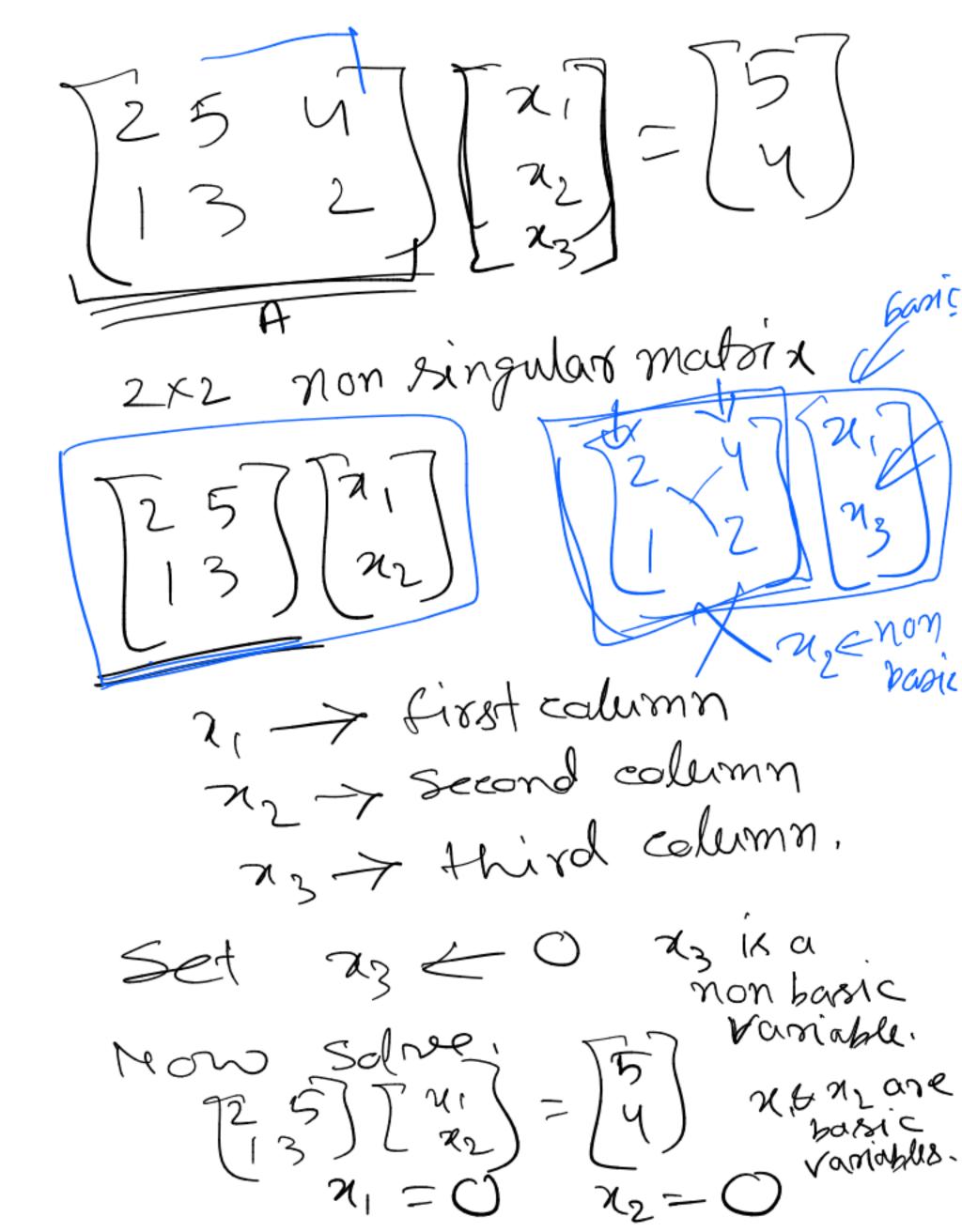
basic solution.

- · The basic solution has not more than m non-servo variable.
 - · These non-zero variables are called basic variables.
 - The variables that are not basic are called non-basic variables.

How to find basic variables

- Find a mxm non-singular matrix
 - i.e., select on linearly independent vectors out of n linearly independent vectors that from A.
 - set variables to zero that are associated with the remaining (n-m) columns.
 - find the solution to the resulting system of equations.

more precisely
$A \times = b$ $A \times = b$ $A \times A \times$
Partition A and X on follows
$A = [B, R] \times = [x_B, x_R]$
where Bisan mxm non singular matrix. Risan mx(n-m) matrix.
Risan mx(n-m) matorix.
Then Ax=6 com be written on.
AX = BXB+RXR = b
setting xR = 0
$B \times B = b$
$\Rightarrow \times_{\mathbf{B}} = \mathbf{B}^{-1}\mathbf{b}$



 Degenerate basic solution. If the number of basic variables is less than m. 14, any one of the bassic variables Then the solution is called degenerate basic solution. Non-degenerate bassic solution If there are exactly m n n-sero variables.

The total number of basic solutions is at most.

Mem

Example Find the basic solutions of the following set of equations. $2x_1+3x_2-x_3+4x_4=8$ $x_1-2x_2+6x_3-7x_4=-3$ $x_1,x_2,x_3,x_4>0$ write it in matrix form $\begin{bmatrix} 2 & 3 & -1 & 4 \\ 1 & -2 & 6 & -7 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 8 \\ -3 \\ b \end{bmatrix}$ $x_1 a_1 + x_2 a_2 + x_3 a_3 + x_4 a_4 = b$ $a_1 = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$ $b_2 = \begin{bmatrix} 3 \\ -2 \end{bmatrix}$ $a_3 = \begin{bmatrix} 1 \\ 6 \end{bmatrix}$ $a_4 = \begin{bmatrix} 4 \\ -4 \end{bmatrix}$

 $b = \begin{bmatrix} 8 \\ -3 \end{bmatrix}$

the manimum number of basic solutions is. (n=4, m=2) $M_{em} = 4e_2 = 6$ $\begin{pmatrix} B_1 \end{pmatrix} = \begin{bmatrix} a_1 & a_2 \end{bmatrix} = \begin{bmatrix} 2 & 3 \\ 1 & -2 \end{bmatrix} \quad det(B_1) = -7$ det (02) = 13 $\left(B_{2}\right)=\left[a_{1}a_{5}\right]=\left[a_{1}a_{5}\right]$ (B3)= [a, an] det (B3)=-18 det(Bu)=16 (By) = [a2 a3] det (B5)=-13 (B5) = [az ay] (BC)=[a3ay]=[-14] def(BC)=7-24 =-17

Observation: Hone of the determinant is zero. Hence creeky set of the column vectors of A are linearly independent.

we set. 73=0,74=0 $x_{B1} = B_1 b$ $= \begin{bmatrix} 2 & 3 \\ 1 & -2 \end{bmatrix} b$ $= -\frac{1}{7} \begin{bmatrix} -2 & -3 \\ -1 & 2 \end{bmatrix} \begin{bmatrix} 8 \\ -3 \end{bmatrix}$ = - 7 [-7 = -16+ 9 solution to the LPP 113 $x_1 = 1$, $(x_2 = 2)$, $x_3 = 0$, $x_4 = 0$ both basic Variables non-zero hence it is non-degenerate basic solution.

tor B2 we set $x_2 = 0$ and $x_4 = 0$ $X_{B_2} = B_2^{-1}b$ $=\begin{bmatrix}2 & -17 & 18 \\ 1 & 6\end{bmatrix} \begin{bmatrix} -3 \end{bmatrix}$ $=\frac{1}{13}\begin{bmatrix} 6 & 1 \\ -1 & 2 \end{bmatrix} \begin{pmatrix} 8 \\ -3 \end{pmatrix}$ $=\frac{1}{13}\left|\frac{45}{-14}\right|$ - \45 -143 2nd basic solution is $\chi_1 = \frac{45}{13}, \chi_2 = 0, \chi_3 = -\frac{14}{13}, \chi_4$ is also a non-degenerate bask

Bassic feasible solution

consider the LPP obtimise $Z = (X \\ S.f. A \times (\leq = >)b \\ \times > 0$

Basic feasible salution:

A solution that is basic and satisfies all the constraints and non-negativity restrictions is called a basic Reasible solution.

- · A féasible solution contains attleast (n-m) zerso variables.
 - · A basic feasible solution generates a basic.

Degenerate basic feasible solution at least one basic variable is zero.

Non-degenerate basic feasible solution Each basic variable is non-sesse