MATHS.
(Sub. & Gen)
Part - I

Topic: Linear Programming.
(Convex Set)

Def^n.

1. **Euclidean Space or an - n dimensional vector Space R^n:** The Set in which every element or point is represented by means of n-coordinates i.e the Set of all ordered n-tuples of real numbers $(x_1, x_2, x_3 - - - x_n)$ is Called the n-dimensional Space R^n of real numbers. This is a vector Space under the two compositions of addition and Scalar multiplication.

2. **Addition and multiplication:**

if $x = (x_1, x_2, x_3 - - - x_n)$

$y = (y_1, y_2, y_3 - - - y_n)$

Then $x + y = (x_1+y_1, x_2+y_2, x_3+y_3 - - - , x_n+y_n)$

and $\lambda x = (\lambda x_1, \lambda x_2, \lambda x_3 - - \lambda x_n)$
where λ is a Scalar.

3. Inner product of vectors:

For every pair of vectors u and v in R^n defined by
$u = (u_1, u_2, u_3 - - - u_n)$
and $v = (v_1, v_2, v_3 - - - v_n)$
the number $u \cdot v = u_1 v_1 + u_2 v_2 + u_3 v_3 + - - - + u_n v_n = \sum u_i v_i$
is called the inner product of u and v.

4 Line Segment: We know the the equation of a line passing through two points $P(x_1, y_1)$ and $Q(x_2, y_2)$ is

$$\frac{y - y_1}{y_1 - y_2} = \frac{x - x_1}{x_1 - x_2} = \lambda \text{ (say)}$$

then, $\frac{x - x_1}{x_1 - x_2} = \lambda$

Or, $x - x_1 = \lambda (x_1 - x_2)$

Or, $x = \lambda x_1 + (1 - \lambda) x_2$

Similarly, from $\frac{y - y_1}{y_1 - y_2} = \lambda$

we get,

$y = \lambda y_1 + (1-\lambda) y_2$

Thus, we get

$x = \lambda x_1 + (1-\lambda) x_2$

and $y = \lambda y_1 + (1-\lambda) y_2$

Thus if $x \in R^n$, $y \in R^n$ and $x \neq y$, then the set of points of R^n defined as

$Z = \{ z : z = \lambda x + (1-\lambda) y,\ 0 \leq 1 \}$ is called the line segment joining the points x, y in R^n.

<u>Hyper Plane</u>: if the set of points $x = (x_1, x_2, x_3 \ldots x_n) \in R^n$ satisfy the relation

$c_1 x_1 + c_2 x_2 + c_3 x_3 + \ldots + c_n x_n = a$

where $c = (c_1, c_2, c_3, \ldots, c_n) \neq 0$ and $a \in R$ are preassigned. In particular, if $x = (x_1, x_2, x_3) \in R^3$ then the set of point R^3 which satisfy the relation $c_1 x_1 + c_2 x_2 + c_3 x_3 = a$, is called a hyperplane in three dimension where c_1, c_2, c_3 are all non-zero at the same time and a is a real constant.

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