FREE NOTES · NCERT + JEE LEVEL

Linear Programming

Linear programming problem kya hai, objective function aur constraints, graphical method, feasible region, corner point method, bounded aur unbounded regions, aur word problems ko kaise likhein.

01 Key terms
02 LPP likhna
03 Feasible region
04 Corner point method
05 Unbounded feasible regions
06 LPP ke types
07 Exam me kaise likhein (poore marks)
08 JEE Extra + Tricks
09 Solved examples
10 Common mistakes
11 Practice questions
12 Quick revision: exam se 5 minute pehle

01 Key terms

- **Objective function** Z = ax + by (profit maximise ya cost minimise).
- **Decision variables** x, y (har cheez kitni).
- **Constraints**: resources ki seemaon se bani linear inequalities.
- **Non-negative constraints**: x ≥ 0, y ≥ 0.
- **Feasible solution**: saari constraints satisfy karne wala point. **Optimal solution**: sabse achha Z dene wala feasible point.

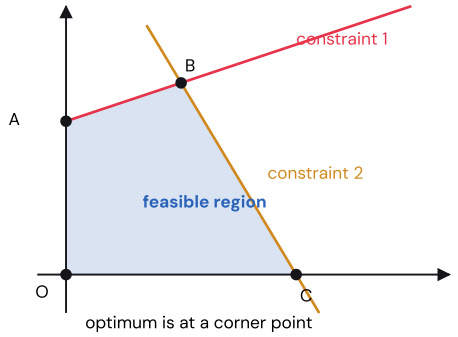
02 LPP likhna

1. x aur y ko shabdon me saaf define karo.
2. Z (profit/cost) ko x, y me likho.
3. Har seema (time, material, budget) ko inequality me badlo.
4. x, y ≥ 0 jodo.

Example: dealer fans (₹360) aur sewing machines (₹240) khareed sakta, budget ₹5760, jagah 20 cheezon ki, profit ₹22 aur ₹18. Max Z = 22x + 18y; 360x + 240y ≤ 5760, x + y ≤ 20, x, y ≥ 0.

03 Feasible region

Har constraint ko line ki tarah banao, jo side satisfy kare use shade karo ((0, 0) test). Common region = **feasible region**. Ye hamesha convex polygon hota (unbounded bhi ho sakta).



Feasible region OABC aur uske corner points

04 Corner point method

FUNDAMENTAL THEOREM

Optimal value exist kare to wo feasible region ke kisi **corner point** (vertex) pe hoti.

1. Feasible region aur uske saare corner points nikalo (lines ke jode solve karo).
2. Har corner pe Z nikalo.
3. Bounded region: sabse bada Z = max, sabse chhota = min.
4. Do corners same optimum dein to unhe jodne wale segment ka har point optimal.

05 Unbounded feasible regions

Region unbounded ho to max ya min exist na kare aisa ho sakta. Maano corners pe sabse bada Z = M: ax + by > M banao. Is open half-plane ka region se **koi** common point na ho to M maximum; warna maximum nahi. Minimum ke liye ax + by < m se same.

06 LPP ke types

Type	Aam goal
Manufacturing	Machine hours, labour ke saath max profit
Diet	Nutrients poore karte hue min cost
Transportation	Factories se depots tak min transport cost
Allocation	Zameen, paise ka best use

07 Exam me kaise likhein (poore marks)

- "Maana x = … aur y = …" shabdon me.
- Objective function aur saari constraints box me.
- Saaf graph, har line labelled, region shaded.
- Table: corner point | Z ki value.
- Aakhri line me sawaal ka jawab (jaise "8 fans aur 12 machines se max profit ₹392").

08 JEE Extra + Tricks

JEE LEVEL

- LPP ka optimal value feasible region ke corner point pe (corner point theorem).
- Unbounded region: max/min hai ya nahi, extra inequality (jaise Z < value) se check karo.
- Iso-profit line method: Z = k line ko parallel khisakao jab tak region ko aakhri baar chhoo-e.

09 Solved examples

Q1. $x + y \le 4$, $x, y \ge 0$ ke saath $Z = 3x + 4y$ maximise karo.

Corners (0,0): 0; (4,0): 12; (0,4): 16 ⇒ max **16** (0, 4) pe.

Q2. $x + 2y \le 8$, $3x + 2y \le 12$, $x, y \ge 0$ ke saath $Z = -3x + 4y$ minimise karo.

Corners (0,0): 0; (4,0): -12; (2,3): 6; (0,4): 16 ⇒ min **−12** (4, 0) pe.

Q3. Upar wala fan/sewing machine sawaal.

Constraints: $3x + 2y \le 48$, $x + y \le 20$. Corners (0,0): 0; (16,0): 352; (8,12): 392; (0,20): 360 ⇒ max ₹**392**, 8 fans, 12 machines.

10 Common mistakes

- Koi corner point chhoot jaana (boundary ke har intersection check karo).
- Unbounded region me half-plane check kiye bina max bata dena.
- Galat side shade karna (hamesha point test karo).
- x, y ≥ 0 bhool jaana.

11 Practice questions

1. Max Z = 5x + 3y: 3x + 5y ≤ 15, 5x + 2y ≤ 10, x, y ≥ 0.
2. Min Z = 200x + 500y: x + 2y ≥ 10, 3x + 4y ≤ 24, x, y ≥ 0.
3. LPP ka optimum kahan ho sakta?

ANSWERS

1) 235/19, (20/19, 45/19) pe · 2) 2300, (4, 3) pe · 3) Feasible region ke corner point pe

12 Quick revision: exam se 5 minute pehle

SETUP

- x, y define karo.
- Z + constraints + x, y ≥ 0.

GRAPH

- (0, 0) test karke shade.
- Common region = feasible.

SOLVE

- Har corner pe Z.
- Sabse achha = optimum.

UNBOUNDED

- Z > M half-plane check.

Koi doubt? padhaiadda.netlify.app pe AI Doubt Solver se poocho, ya is chapter ka mock test do.