Study Material: Constraints in Optimization Problems

# Session: Constraints in Optimization Problems

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# Learning Objectives

By the end of this session, you will be able to:  
• Define the optimization Constraints  
• Discuss different types of optimization Constraints  
• Define the mathematical implementation of different types of constraints in a feasible region  
• Discuss the role of constraints in optimization

# Types of Optimization Constraints

Constraints are conditions that restrict the possible solutions of an optimization problem.  
Different types of constraints include:  
1. Equality Constraints  
2. Inequality Constraints  
3. Box Constraints  
4. Linear and Non-Linear Constraints  
5. Hard and Soft Constraints

# Constraint Types and Their Effects

|  |  |  |
| --- | --- | --- |
| Constraint Type | Effect on Solution Space | Difficulty in Solving |
| Equality | Restricts to a lower-dimensional subspace | Medium |
| Inequality | Defines a feasible region but allows flexibility | Low |
| Box Constraints | Restricts each variable to a range | Low |
| Linear | Forms a convex feasible region | Low |
| Nonlinear | Creates complex, non-convex regions | High |
| Integer/Binary | Discrete feasible space (requires special solvers) | High |
| Complementarity | Causes non-convexity, limiting methods | Very High |

# Academic Poll Practice Questions

1. What happens to the feasible region when more constraints are added to an optimization problem?

* A. It always increases in size
* B. It always decreases in size or remains the same ✅
* C. It remains unchanged
* D. It becomes unbounded

1. In a linear programming problem, what is the effect of an inactive constraint?

* A. It does not affect the optimal solution ✅
* B. It changes the optimal solution
* C. It eliminates all feasible solutions
* D. It makes the problem infeasible

1. If a linear optimization problem has conflicting constraints, what is the most likely outcome?

* A. Multiple optimal solutions
* B. A unique optimal solution
* C. No feasible solution ✅
* D. An unbounded solution

1. Which of the following is true about inequality constraints in optimization problems?

* A. They define boundaries but do not restrict feasible solutions
* B. They must always be active at the optimal solution
* C. They create a feasible region that may be bounded or unbounded ✅
* D. They are equivalent to equality constraints