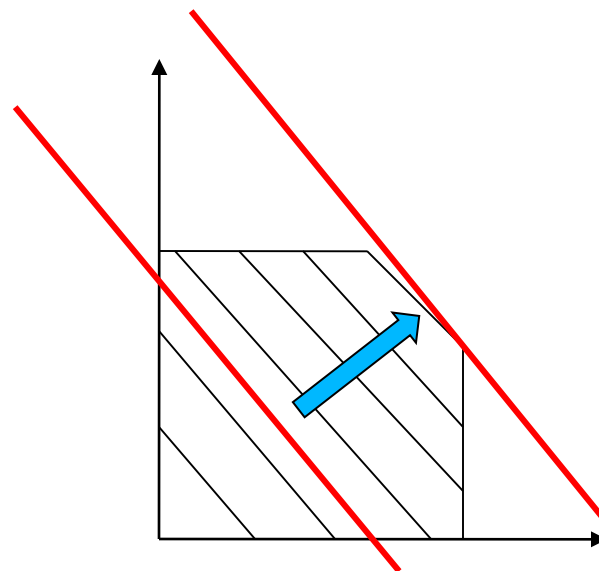


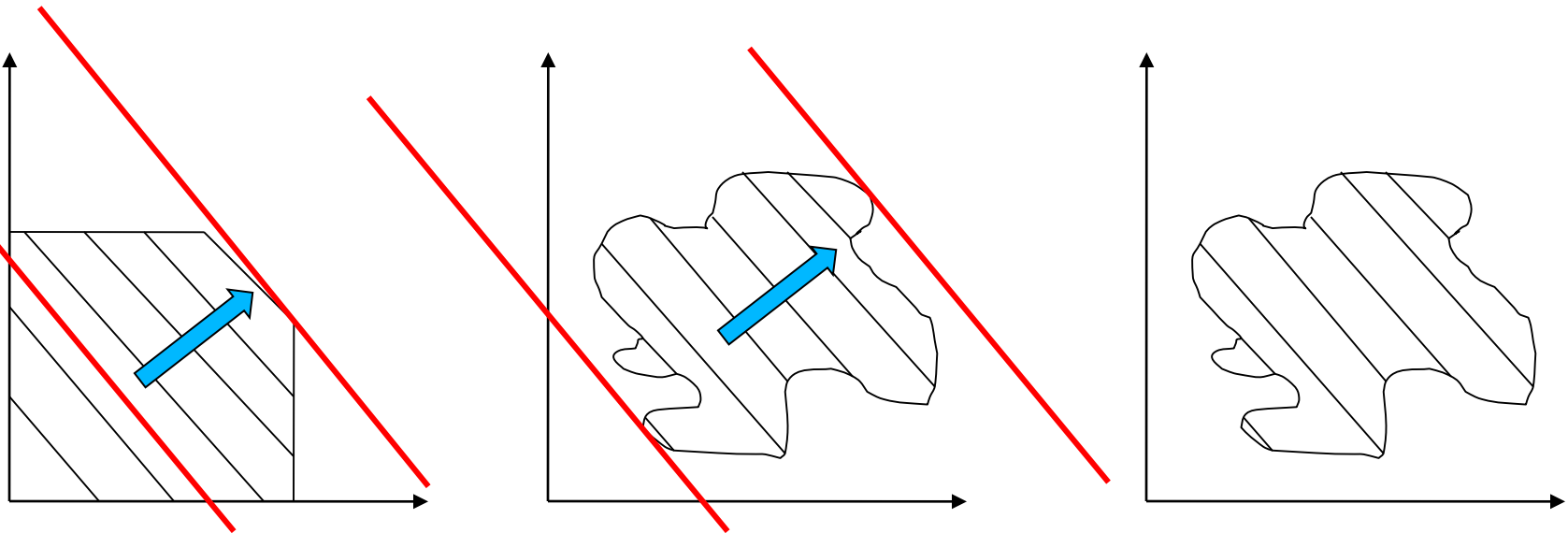
# Operations Research



HYUNSOO LEE

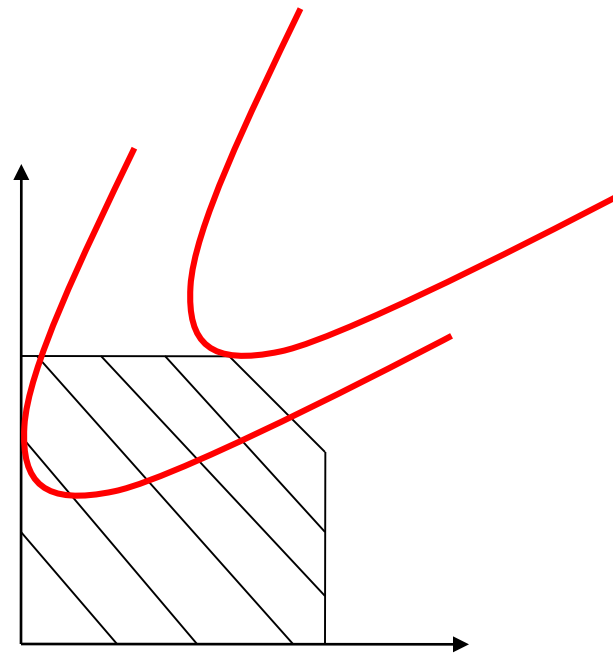
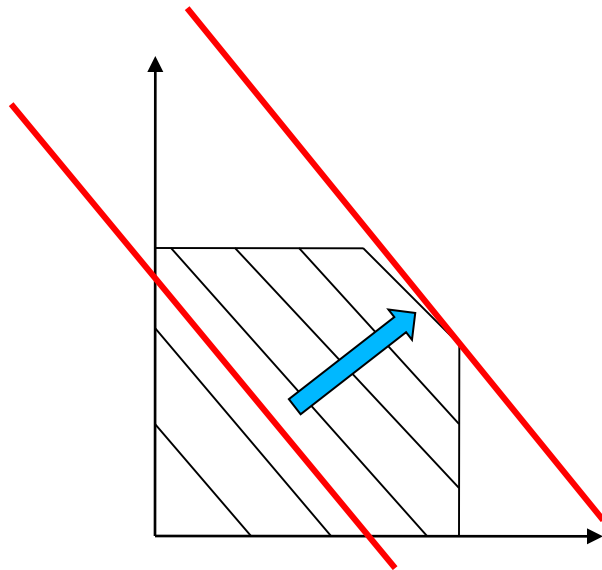
# Part 2. Non-Linear Programming (1)

- Case 1



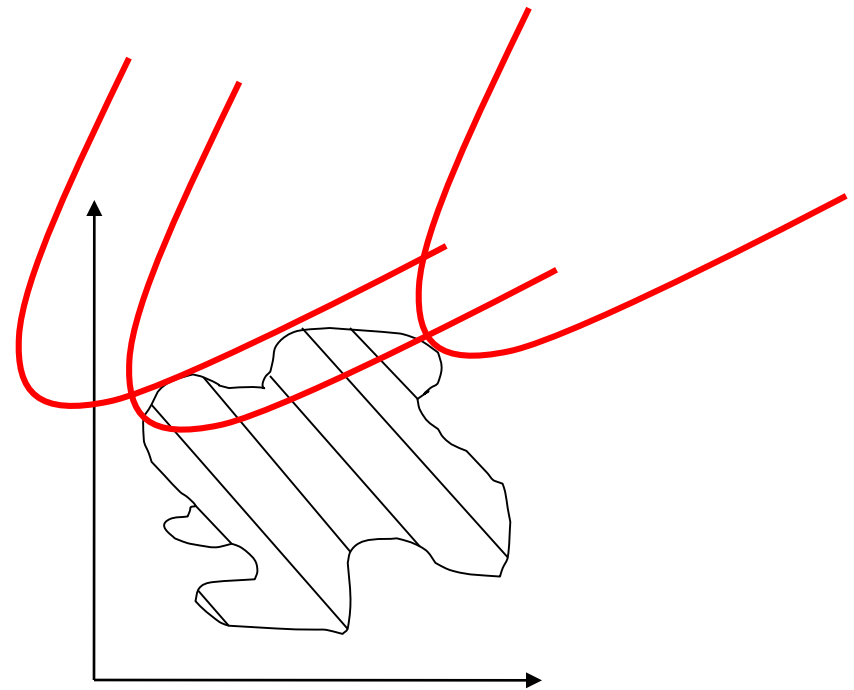
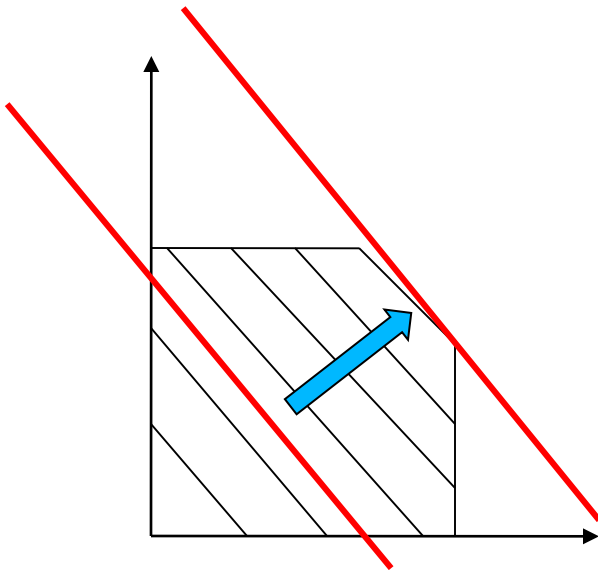
## Part 2. Non-Linear Programming (2)

- Case 2



## Part 2. Non-Linear Programming (3)

- Case 3



# Basic Idea of N.L.P (1)

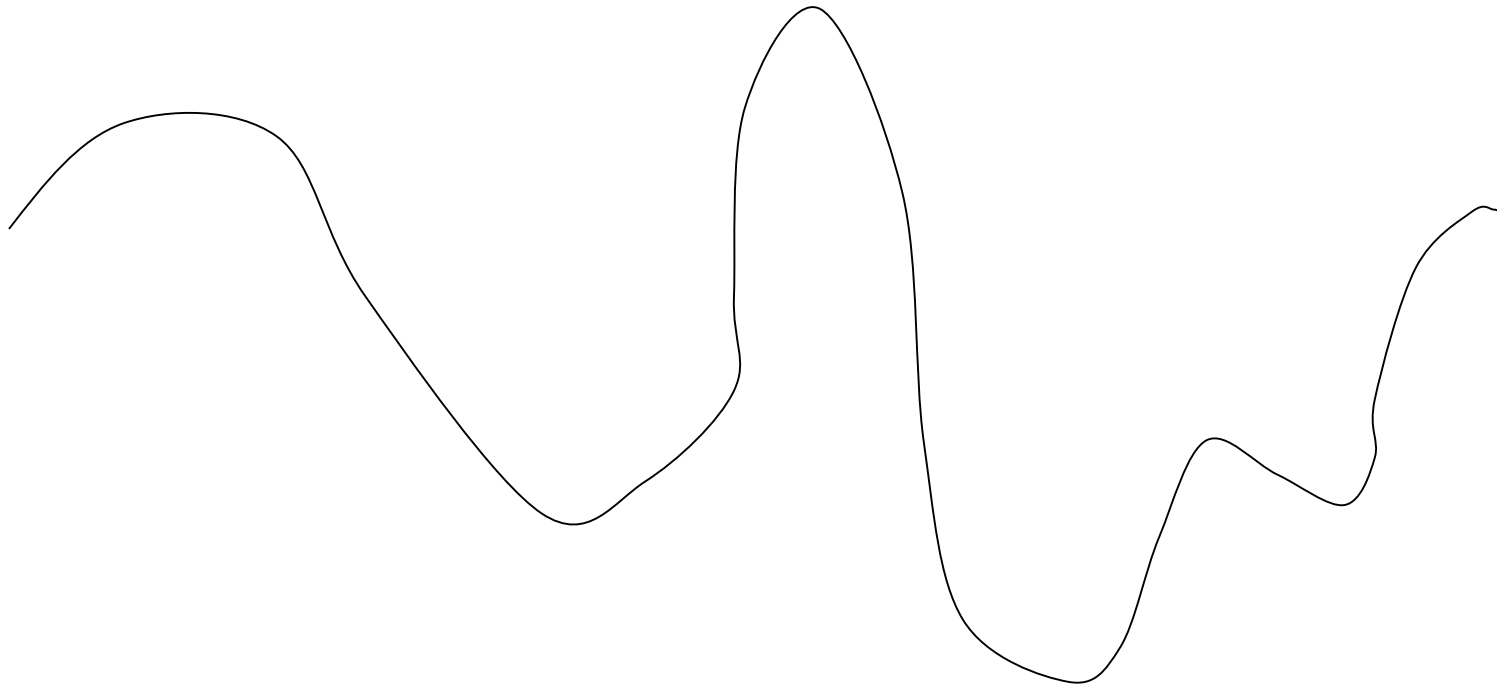
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- Basic Idea
  - Starting point → Searching

# Basic Idea of N.L.P (2)

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- Local Optimum V.S. Global Optimum



# Basic Idea of N.L.P (3)

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- Local Optimum (In Minimization)

$$|x - x^*| \leq \varepsilon \quad f(x) \geq f(x^*)$$

- Global Optimum (In Minimization)

$$f(x) \geq f(x^*)$$

# Unconstrained Case

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- Max or Min
  - FONC

$$d^T \cdot \nabla f(x^*) \geq 0$$

- SONC

$$d^T \cdot F(x^*) \cdot d \geq 0$$



# Constrained Case (1)

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- Example

$$\min (x_1 - 1)^2 + x_2^2 - 2$$

$$s.t. \quad x_2 - x_1 = 1$$

$$x_1 + x_2 \leq 2$$

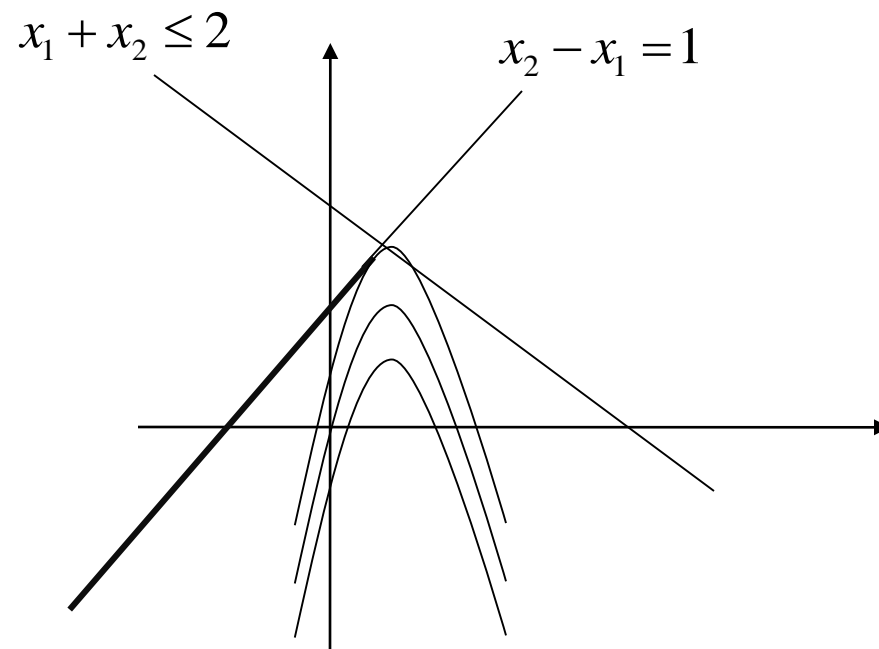
# Constrained Case (2)

- Graph

$$\min (x_1 - 1)^2 + x_2^2 - 2$$

$$s.t. \quad x_2 - x_1 = 1$$

$$x_1 + x_2 \leq 2$$



$$k = (x_1 - 1)^2 + x_2^2 - 2$$

$$x_2^2 = -(x_1 - 1)^2 + k + 2$$

$$x_2 = \sqrt{k + 2 - (x_1 - 1)^2}$$

# Constrained Case (3)

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- In Graph

$$\min f(x)$$

$$s.t. \quad h(x) = 0$$

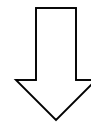
# Constrained Case (4)

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- General Solution

$$\min f(x)$$

$$s.t. \quad h(x) = 0$$



# Homework #2 (1)

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- 1.1) Convert two inequalities to two equations

$$\begin{array}{ll} \text{Min} & 2x_1 - x_2 \\ \text{S.t.} & -x_1 + x_2 \leq 2 \\ & 2x_1 + x_2 \leq 6 \\ & x_1, x_2 \geq 0 \end{array}$$

- 1.2) Let  $x_1, x_2$  be  $X_B$ . What are the value of  $x_1, x_2$  ?
  - Calculate it with  $X_B, X_N, B, N, b$

## Homework #2 (2)

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- 1.3) In this case, what is the value of Objective function?
  - Calculate it with  $C_B, C_N, X_B, X_N, B, N, b$
  
- 1.4) In  $X_N$ , which is changed to  $X_B$  ?  
In  $X_B$ , which is change to  $X_N$  ?