國立臺北大學自然資源與環境管理研究所

九十七學年度第二學期

『環境系統分析』課程講義(八)

進度:非線性規劃與演算法

• NONLINEAR PROGRAMMING -- INTRODUCTION

- □ Formulations of the Models and Complexity
- □ Chong and Zak (2001): An Introduction to Optimization
- Local Optima vs. Global Optima
- Convexity and Convex Programming
 - ⇒ Convexity of a Function: Convex, Concave and Un-determinant
 - ⇒ Convex Region vs. Non-convex Region
- Analytical Solutions vs. Numerical Solutions
 - ⇒ Linearization of Nonlinear Objective Function => Seem not necessary nowadays!
 - \Rightarrow Software Package => Lingo, What'sBest, GAMS, etc.
- UNCONSTRAINED OPTIMIZATION
 - D Minima, Maxima and Saddle Points
 - ⇒ Necessary Conditions and Sufficient Conditions
 - □ Gradient of a Function (First Derivatives)
 - □ Hessian Matrix (Second Derivatives)
 ⇒ Positively Definite: All the Eigenvalues are Positive

• LAGRANGE MULTIPLIERS AND OTHER METHODS

- Lagrange Multiplier Method
 - ⇒ Constraints with All Equalities
 - ⇒ Properties of the Lagrange Multipliers
- Kuhn-Tucker Conditions: Constraints with Inequalities
- □ Gradient Search Procedure => Danger of Being Trapped at Local Optima

• ALGORITHMS FOR NONLINEAR PROGRAMS

- □ Numerical Methods (Chang, 2002, Chap.5)
- ⇒ Newton Method, Conjunctive Direction and Conjunctive Gradient Methods
- □ Heuristic Algorithms: Eureka! => Soft Computation
 - ⇒ Emulation of Natural Phenomena
 - ⇒ Artificial Neural Network
 - ⇒ Genetic Algorithms
 - ⇒ Simulated Annealing
 - ⇒ Tabu Search
 - ⇒ Ant Search, Ant Colony Algorithm, Swarm Intelligence, etc.