Chapter 2 Model formulation

2.1 Phase of an OR study

- Defining the problem
- Formulating a mathmatical model
- Deriving a solution procedure
- Establishing control over solution
- Implementation

2.2 Defining the Problem

A problem statement

- appropriate objectives
- constraints of environment
- possible alternatives
- time limits

B Objectives

- analysis and edit decision maker’s objectives
- specify the objectives
- system - wide
    - owner
    - employee
    - customers
    - suppliers
    - government

C Major tasks

- data collection
- subject approach
- future condition

2.3 Formulating a mathematical model

Mathematical model

- ideal representation
- in terms of mathematical symbols and expression

- form： Max $f(x)$

st $ax \le br$

A advantage

-describe more concisely

-reveal cause-and-effect relationship

-bridge to use exist mathematical technology and computer software

B disadvantage

- proximation and simplity

C criterion of a model

- ability to predict relative effectiveness

2.4 Deriving a solution procedure

A Objective

- to search perfect

- to reach satifactory

B Solution method

- algorithms

step 0 initialization

1 interactive procedure to

⋮ construct or improve solution

$n-1$

n stopping rule

- types

-optimal

-heuristics

C Validation of method

- logical assessment

- sensitivity test

2.5 Test and validation of model and solution

- check for error/mistake
- case studies
- retrospective test
- sensitivity test

2.6 Establish control over solution

A. Confident application

- based on assumption and theory to determine valid application

B. Data monitoring system

- updata solution or model by data detecting procedure

2.7 Implementation

- solid implement procedure documentation
- consise resource and responsility allocation

2.8 Model principal

- be simple
- model for problem solving
- vigor development procedure
- for what it intend
- vadid input
- decision support

2.9 Type of model

A. classifications

- by form - physical
  - abstract — analog、schematic、mathematics
- by characteritics - determine

- probablitic
- by object - descriptive
- normative
- perscripitive

B. evaluation（MOE）

- siplicity
- accuracy
- validation
- constancy
- availability

C. solution technique

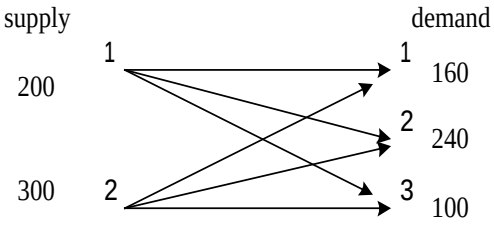
（a）numerical

- optimal $\begin{cases} a\lg orithm \\ enumeration \end{cases}$
- non-optimal $\begin{cases} simulation \\ heuristic \end{cases}$

（b）analytic

- optimal
- non-optimal

Example：



Plant \ DC	1	2	3	supply
1	4/6	8/3	7/12	200
2	5/3	3/4	5/2	300
demand	160	240	100	500

Sol：—decision variables

X_{ij}：amount form i to j

—object：Max. proft

min. cost

—constraints：supplier limit

demand limit

$$\text{Max} \quad 6X_{11}+3X_{12}+2X_{13}+3X_{21}+4X_{22}+2X_{23}$$

$$\text{or} \quad \text{min} \quad 4X_{11}+8X_{12}+7X_{13}+5X_{21}+3X_{22}+5X_{23}$$

$$\text{st} \quad X_{11}+X_{12}+X_{13} \le 200$$

$$X_{21}+X_{22}+X_{23} \le 300$$

$$X_{11}+X_{21} \ge 160$$

$$X_{12}+X_{22} \ge 240$$

$$X_{13}+X_{23} \ge 100$$

$$X_{ij} \ge 0; \forall i, j$$