lecture 18
SLA

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Transportation problem :

- The transportation problem deals with the transportation of the products manufactured at different factories to different destinations.
- The objective is to satisfy the demand requirements, within the capacity constraints at a minimum transportation cost.
- A transportation problem is completely defined by the following table :

destination

	D_0	D_1	.....	D_n	
O_1	c_{11}	c_{12}	. . .	c_{1n}	a_1
O_2	c_{21}	22	. . .	c_{2n}	a_2
⋮	⋮	⋮	. . .	⋮	⋮
O_m	c_{m1}	c_{m2}	. . .	c_{mn}	a_m
demand	b_1	b_2	....	b_n	

origin

constraints

c_{ij} : cost of transportation
a_i : availability
b_j : demand / requirement

Remarks :

- A transportation problem is always a minimization problem.
- The solution to the transportation problem is given by an $m \times n$ matrix :

$$X = \begin{pmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ \vdots & \vdots & & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{pmatrix}_{m \times n} \qquad x_{ij} \geq 0$$

where $x_{ij} \geq 0$ is the quantity transported from origin O_i to destination D_j.

constraints :

$$\sum_{j=1}^{n} x_{ij} = a_i$$

$$\sum_{i=1}^{m} x_{ij} = b_j$$

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For a balanced system,

$$\boxed{\text{total demand} = \text{total supply}}$$

$$\therefore \sum_{j=1}^{n} \sum_{i=1}^{m} x_{ij} = \sum_{j=1}^{n} b_j \equiv \sum_{i=1}^{m} a_i = \sum_{i=1}^{m} \sum_{j=1}^{n} x_{ij}$$

- The number of basic variables in a transportation problem ~~is a~~ is atmost $\boxed{m+n-1}$.
- As it is a minimization problem, it can never have an unbounded sol^n. It always has a feasible solution.

Methods for finding IBFS :

	D_1	D_2	D_3	D_4	a_i (supply)
O_1	6 / 21	5 / 16	25	13	~~11~~ ~~5~~
O_2	17	5 / 18	8 / 14	23	~~13~~ ~~8~~
O_3	32	27	4 / 18	15 / 41	~~19~~ 15
b_j (demand)	~~6~~	~~10~~ ~~5~~	~~12~~ ~~4~~	~~15~~	

cell (1, 1) = min (a_1, b_1)

i) North-west corner method

$$X = \begin{pmatrix} 6 & 5 & 0 & 0 \\ 0 & 5 & 8 & 0 \\ 0 & 0 & 4 & 15 \end{pmatrix}$$

← IBFS

6 of these need to be non-zero

$\sum a_i = 43 = \sum b_j \Rightarrow \therefore$ a balanced system

Also, no. of basic variables $= 3 + 4 - 1 = 6$

$\therefore$ Total cost $= 6 \times 21 + 5 \times 16 + 5 \times 18 + 8 \times 14 + 4 \times 18 + 15 \times 41 = 1095/-$

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