Linear programming

* Products : carpets
* # of employees : 30
* Salary / employee : ₹ 20,000
* each employee makes 20 carpets / month } Rs 1000 / carpet; 600 carpets / month
* monthly demands: $d_1, d_2, \ldots, d_{12}$ (Jan, Feb, ..., Dec)

$$440 \leq d_i \leq 920$$

Overtime : 80 % extra $\Rightarrow$ Rs 1800 / carpet

overtime limit : 30 % per worker $\Rightarrow$ $20 + \frac{30}{100} \times 20$

= 26 carpets / month at most for a worker

Hiring / worker : Rs 3200

Firing / worker : Rs 4000

storage / carpet / month : Rs 80

Month i $\quad 1 \leq i \leq 12$

w_i = # of workers in month i

x_i = # of carpets made in month i

o_i = # carpets made in overtime in month i (included in x_i)

h_i = # of workers fired at start of month i

f_i = # of workers fired at start of month i

s_i = surplus carpets after month i

$w_0 = 30$, $s_0 = 0$] extra variables

Total # of variables = $6 \times 12 + 2 = 74$ variables

Constraints

all variables ≥ 0

$x_i = 20 w_i + o_i$

$w_i = w_{i-1} + h_i - f_i$

$s_i = s_{i-1} + x_i - d_i$

$o_i \leq 6 w_i$

(≤ 6 per worker
- # of overtime capped)

Cost

$20{,}000 (w_1 + \dots + w_{12})$ Regular salary

$+ 3200 (h_1 + \dots + h_{12})$ Hiring costs

$+ 4000 (f_1 + \dots + f_{12})$ Firing costs

$+ 80 (s_1 + s_2 + \dots + s_{12})$ storage costs

$+ 1800 (o_1 + \dots + o_{12})$ overtime costs.

$= C(w_i, h_i, f_i, s_i, o_i)$

Simplex algorithm : * Ans must live in a corner of feasible region

* Find a corner, if nearby corners better, move there else return this answer and terminate

What if answers → fractions ?

- Round off, revaluate
- Sometimes, rounding off can affect optimality of solution

Requiring sol. to be integers from the start — computationally intractable

"Integer Linear Programming"