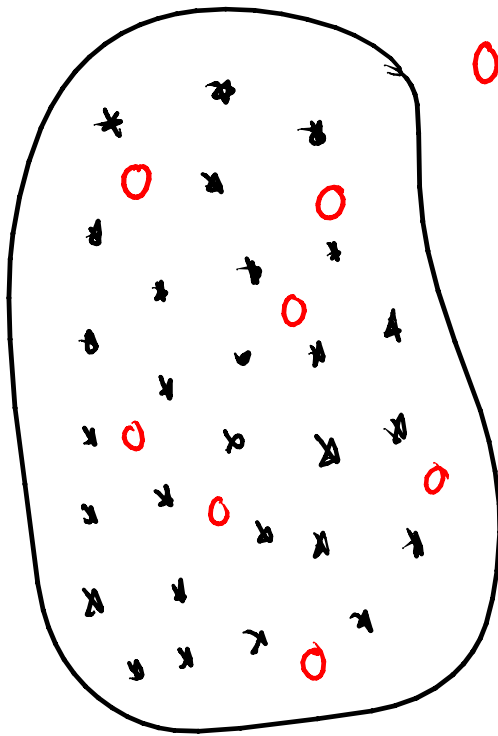


10/8/12

Plant location



* $\equiv$ customer

O $\equiv$ site for
building a
plant

f_j = cost of building
plant j

c_{ij} = cost of supplying
 i from j .

Problem: select sites to
minimize sum of
building and supply cost

Variables: $y_j = \begin{cases} 0 & \text{do not build } j \\ 1 & \text{build } j \end{cases}$

$$x_{ij} = \begin{cases} 0 & \text{do not supply } i \text{ from } j \\ 1 & \text{supply } i \text{ from } j \end{cases}$$
$$\text{Minimise cost} = \underbrace{f_1 y_1 + \dots + f_n y_n}_{\text{building}} + \underbrace{\sum_i \sum_j c_{ij} x_{ij}}_{\text{supply}}$$

s.t.

Can relax $x_{ij} = 0/1$
to $0 \leq x_{ij} \leq 1$.

$$\sum_j x_{ij} = 1 \quad \forall i$$

$$x_{ij} \leq y_j \quad \forall i, j$$
 $\forall i, j$

Set Cover Problem

Given sets $S_1, S_2, \dots, S_n \subseteq S = \{1, 2, \dots, m\}$
and $c_1, c_2, \dots, c_n$

$J \subseteq \{1, 2, \dots, n\}$ is a **cover** if $\bigcup_{j \in J} S_j = S$

$$c(J) = \sum_{j \in J} c_j$$

Problem: choose cover J that
minimizes $c(J)$.

Airline problem:

$$S = \{ \text{flight legs} \}$$

Pittsburgh - Newark

S_i = feasible crew schedule

Pittsburgh - Newark - Heathrow

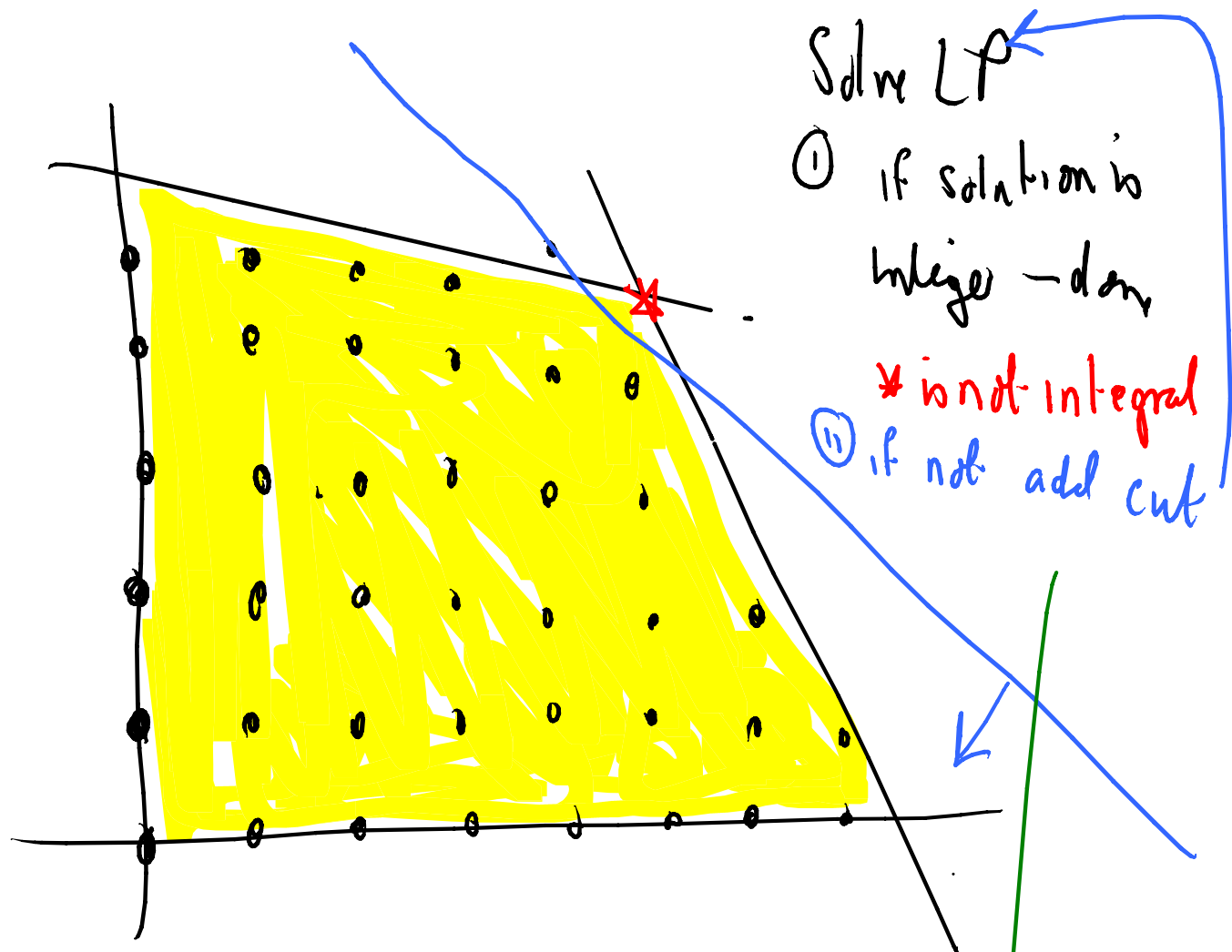
$$x_j = \begin{cases} 0 & j \notin J \\ 1 & j \in J \end{cases}$$

minimise $C_1 x_1 + \dots + C_n x_n$

of chosen
sets that
contain i

$$\Rightarrow a_{i1} x_1 + a_{i2} x_2 + \dots + a_{in} x_n \geq 1, \forall i$$

$$a_{ij} = \begin{cases} 1 & i \in S_j \\ 0 & i \notin S_j \end{cases}$$



- Solve LP
- ① if solution is integer - done
 - * is not integral
 - ② if not add cut

All variables integer.

cuts away *
but no ●