FACILITY LOCATIONS

- DATA

$N = \{1, \dots, n\}$ POTENTIAL FACILITY LOCATIONS
$I = \{1, \dots, m\}$ CUSTOMER'S LOCATIONS

SITE $j \in N$ HAS CAPACITY U_j & ACTIVATION COST C_j
$b_{i,j} \in I$ IS REQUEST OF CUSTOMER i
h_{ij} COST FOR SERVING CUSTOMER i FROM SITE j
EACH CUSTOMER $\longleftrightarrow$ UNIQUE FACILITY

- VARIABILI DECISIONALI

- $X_{i,j}$ $\begin{cases} 1 & \text{SE CLIENTE } i \text{ SERVITO DA DEPOSITO } j \\ 0 \end{cases}$ $\quad i \in I, \ j \in N$

- Y_j $\begin{cases} 1 & \text{SE USATO DEPOSITO } j \\ 0 \end{cases}$

- VINCOLI

- OGNI CLIENTE SERVITO DA UN SOLO DEP $\rightarrow \sum_{j \in N} X_{ij} = 1 \quad i \in I$
- CAPACITÀ DEPOSITO $\rightarrow U_j \geq \sum_{i \in I} b_i X_{ij} \quad j \in N$
- OGNI CLIENTE SERVITO $\rightarrow$

- OBIETTIVO

COSTI DELLE TRATTE: $\sum_{i \in I} \sum_{j \in N} h_{ij} X_{ij}$ $\quad$ COSTI ATTIVAZIONE: $\sum_{j \in N} C_j Y_j$

$$\min z = \sum_{i \in I} \sum_{j \in N} h_{ij} X_{ij} + \sum_{j \in N} C_j Y_j$$

FIXED CHARGE

- **DATA**

  - n PRODUCTS
  - $K_j > 0$ SET UP COST FOR j-TH PRODUCT
  - C_j UNITARY COST
  - g_j UNITARY REVENUE
  - b_i QUANTITY OF RESOURCES $i = 1, \dots, m$ AVAIBLE
  - a_{ij} USAGE OF QUANTITY i FOR PRODUCT j

  FIND OPTIMAL MIX

- **VARIABILI DECISIONALI**

  X_j NUMB. OF PRODUCTS OF TYPE j

  $$Y_j \begin{cases} 1 & \text{if } X_j > 0 \\ 0 & \text{if } X_j = 0 \end{cases}$$

$$Ax \leq b$$

$$\max \sum_{j=1}^{n} \left[(g_j - C_j) X_j - K_j Y_j \right]$$

$$X_j \leq M Y_j \qquad j = 1, \dots, n$$

$$\max \; X_1 + X_2$$

$$\begin{aligned} X_1 + 2X_2 &\leq 7 \\ X_1 + \quad\; &\geq 1 \\ X_2 &\geq 1 \\ X_1, X_2 &\geq 0 \end{aligned}$$

STANDARD →

$$\begin{aligned} X_1 + 2X_2 + X_3 \quad\quad &\leq 7 \\ X_1 + \quad\quad\quad\; &\geq 1 \\ X_2 \quad - X_4 \quad\; &\geq 1 \\ X_1, X_2 \quad\quad - X_5 \;\; &\geq 0 \\ X_{1,\dots,5} &\geq 0 \end{aligned}$$

X_1	X_2	X_3	X_4	X_5	
1	1	0	0	0	0
1	2	1	0	0	1
1	0	0	-1	0	1
0	1	0	0	-1	1

VAR. ARTIFICIALI

X_1	X_2	X_3	X_4	X_5	a_1	a_2	
-1	-1	0	+1	+1	0	0	-2
1	2	1	0	0	0	0	7
1	0	0	-1	0	1	0	1
0	1	0	0	-1	0	1	1

→

0	1	0	0	1	1	0	-1
0	2	1	1	0	-1	0	6
1	0	0	-1	0	1	0	1
0	1	0	0	-1	0	1	1

→

0	0	0	0	0	1	1	0
0	0	1	1	2	-1	-2	4
1	0	0	-1	0	1	0	1
0	1	0	0	-1	0	1	1

FUORI BASE

TOLGO VAR. ARTIFICIALI →

1	1	0	0	0	z DIVENTA
0	0	0	1	1	-2
0	0	1	1	2	4
1	0	0	-1	0	1
0	1	0	0	-1	1