

q1)

V_1	E	V_2	
① Torino	→	Torino	①
	→	Inno	②
② Genova	→	Genova	③
	→	Milano	④
③ Milano	→	Brescia	⑤
	→	Piacenza	⑥
④ Bologna	→	Bologna	⑦
	→	Padova	⑧

Parametri:

$$f_1 = 70000 \text{ €}$$

$$d_1 = 600$$

$$d_5 = 250$$

$$f_2 = 90000 \text{ €}$$

$$1, 2, 3, 4 \in \bar{V}_1$$

$$d_2 = 200$$

$$d_6 = 300$$

$$1, 2, 3, 4, 5, 6, 7, 8$$

$$f_3 = 100000 \text{ €}$$

$$d_3 = 500$$

$$d_7 = 350$$

$$\in \bar{V}_2$$

$$f_4 = 50000 \text{ €}$$

$$d_4 = 700$$

$$d_8 = 250$$

$$q_1 = 1600$$

$$q_2 = 1400 \quad 1, 2, 3, 4 \in \bar{V}_1$$

$$q_3 = 1700$$

$$q_4 = 1500$$

$$C_{ij} = 0,45 \times \begin{bmatrix} \textcircled{1} & \textcircled{2} & \textcircled{3} & \textcircled{4} & \textcircled{5} & \textcircled{6} & \textcircled{7} & \textcircled{8} \end{bmatrix} \begin{matrix} 30 & 140 & 180 & 140 & 230 & 180 & 330 & 370 \\ 180 & 50 & 20 & 145 & 230 & 150 & 300 & 370 \\ 140 & 180 & 145 & 40 & 100 & 75 & 215 & 250 \\ 330 & 340 & 300 & 215 & 205 & 150 & 30 & 120 \end{matrix} \begin{matrix} \textcircled{1} \\ \textcircled{2} \\ \textcircled{3} \\ \textcircled{4} \end{matrix} \begin{matrix} \in \bar{V}_2 \\ \\ \in \bar{V}_1 \\ \end{matrix}$$

Var decisionali:

$$y_i = \begin{cases} 1 & \text{se il nodo "i" è attivato} \\ 0 & \text{altrimenti} \end{cases} \quad \forall i \in V_1$$

$$x_{ij} = \text{frazione di } d_j \text{ da parte di } i \quad \forall (i,j) \in E$$

$$\min \sum_{i \in V_1} f_i y_i + \sum_{(i,j) \in E} \bar{c}_{ij} d_j x_{ij}$$

$$\sum_{i \in V_1: (i,j) \in E} x_{ij} = 1 \quad \forall j \in V_2$$

demands must be satisfied for the

$$\sum_{j \in V_2: (i,j) \in E} d_j x_{ij} \leq q_i y_i \quad \forall i \in V_1$$

max capacity

$$0 \leq x_{ij} \leq 1 \quad \forall (i,j) \in E$$

$$y_i \in \{0,1\} \quad \forall i \in V_1$$