0/1 Knapsack

maximize
$$\sum_{j=1}^{n} p_{j}x_{j}$$
 (1)
subject to
$$\sum_{j=1}^{n} w_{j}x_{j} \leq c,$$
 (2)
$$x_{i} \in \{0, 1\}, \quad i = 1, \dots, n$$
 (3)

subject to
$$\sum_{j=1}^{n} w_j x_j \le c,$$

$$x_j \in \{0, 1\}, \qquad j = 1, ..., n.$$
 (3)

$$x_j \in \{0, 1\}, \qquad j = 1, ..., n.$$
 (3)

where

value of jth tx p_j

jth binary variable decision x_j

weight of jth tx w_j

maximum capacity c

nnumber of items

Precedence Constraint Knapsack Problem (PCKP)

$$\max_{j=1}^{n} p_j x_j \tag{4}$$

maximize
$$\sum_{j=1}^{n} p_{j} x_{j}$$
 (4)
subject to
$$\sum_{j=1}^{n} w_{j} x_{j} \leq c,$$
 (5)

$$x_i \ge x_j,$$
 $(i, j) \in E,$ (6)
 $x_j \in 0, 1,$ $j = 1, ..., n.$ (7)

$$x_j \in 0, 1, \qquad j = 1, ..., n.$$
 (7)

where

- p_j value of jth tx
- x_j jth binary variable decision
- x_i ith binary variable decision
- w_j weight of jth tx
- c maximum capacity
- n number of items
- G directed, acyclic graph G(V, E)
- E edge in graph G(V, E)
- $V \qquad \text{node in graph } G(V,E),\, V=\{1,...,n\}$