1 Partition

$$\begin{aligned}
\text{maximize} & \sum_{j=1}^{n} w_j x_j \\
\text{subject to} & \sum_{j=1}^{n} w_j x_j \leq \frac{1}{2} \sum_{j=1}^{n} x_j \\
& x_j \in \{0,1\}, \quad j \in \{1,\dots,n\}.
\end{aligned}$$

2 Subset-sum

$$\begin{aligned}
\text{maximize} & \sum_{j=1}^{n} w_j x_j \\
\text{subject to} & \sum_{j=1}^{n} w_j x_j \leq b \\
& x_j \in \{0,1\}, \quad j \in \{1,\dots,n\}.
\end{aligned}$$

P_{nb}: Probability of n numbers has a subset which sums exactly b, considering M as maximum integer (over uniform distribution).

$$P_{0b} = 0$$

$$P_{nb} = \begin{cases} 1 & \text{, if } b = 0 \\ \frac{1}{M} \sum_{i=1}^{M} P_{(n-1)(b-i)} & \text{, if } 0 < b \leq nM \\ 0 & \text{, otherwise} \end{cases}$$

3 Knapsack

$$\begin{aligned}
\text{maximize} & \sum_{j=1}^{n} p_j x_j \\
\text{subject to} & \sum_{j=1}^{n} w_j x_j \leq b \\
& x_j \in \{0,1\}, \quad j \in \{1,\dots,n\}.
\end{aligned}$$

4 Multidimensional Knapsack

$$\begin{aligned} \text{maximize} \sum_{j=1}^{n} p_j x_j \\ \text{subject to} \sum_{j=1}^{n} w_{ij} x_j \le b_i \quad i \in \{1, \dots, m\} \\ x_j \in \{0, 1\}, \quad j \in \{1, \dots, n\}. \end{aligned}$$