

# A CONCEPTUAL MODEL FOR OPTIMIZATION PROBLEMS

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ABSTRACT.

**Definition 0.1** (Component). *In a combinatorial optimization problem, a component  $c \in C$  is the elementary unity of a solution.*

**Definition 0.2** (Search space). *The search space  $S$  of a combinatorial optimization problem is a subset of the powerset of components  $S_{\leq n}(2^C)$  (only  $S$  for simplicity), in which elements  $x \in S$  can be composed of a maximum of  $n$  components. In practical terms  $S$  is implicitly defined by  $C$  and  $n$ .*

**Example 0.1** (Knapsack problem component). *In a knapsack problem, a component is an item. There are  $n$  available items (components)  $C = \{1, 2, \dots, n\}$ . Therefore, elements  $x \in S$  can be composed of a maximum of  $n$  items.*

**Example 0.2** (Minimum spanning tree component). *In a minimum spanning tree problem, a component is an edge. Considering a undirected complete graph  $G = (V, E)$ , with  $|V| = n$ , there are  $(n^2 + 1)/2$  available edges (components).*