

The Knapsack Problem

Ben Dover, an exuberant mountain climber, is preparing for a lengthy hike up a dangerous slope. He can manage up to W pounds in his knapsack that he carries on his back. He has n different types of items that he can include in his pack, and each unit of Item j weighs w_j pounds. For every Item j , he has calculated a numerical value R_j representing the survival utility of each unit of the item. To illustrate, if he packs five units of Item 3 and six units of Item 7, then his survival utility is $5R_3 + 6R_7$.

Develop a mathematical model to assist Ben Dover in deciding what to carry in his knapsack.