

## 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.