



## Why<sup>1</sup>

### Definition

We want to allocate a resource among  $n$  entities to maximize some measure of “return” or “profit.”

Let  $B \in \mathbf{R}$ . Let  $R_i : \mathbf{R} \rightarrow \mathbf{R}$  be a function which gives the return for allocating entity  $i$  the amount  $x_i$  of the resource. Let  $\mathcal{X} = \{x \in \mathbf{R}^n \mid x \geq 0, \sum_i x_i = B\}$ . Define  $f : \mathbf{R}^n \rightarrow \mathbf{R}$  by  $f(x) = \sum_{i=1}^n R_i(x_i)$ . We call the optimization problem  $(\mathcal{X}, f)$  a *single-resource allocation problem*. In this case we call  $x \in \mathbf{R}^n$  an *allocation* and we call  $B$  the *budget*.

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<sup>1</sup>Future editions will include. For now this sheet serves as an example of a continuous optimization problem.



