

Material for  
**Operation Research Laboratory**  
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## A simple investment problem

You want to choose investments among a list of ten (A,...,J).

Suppose that you need to pay a given amount  $c_i$  if you decide to invest and you have back, after a prefixed time, a greater value  $r_i$ . The values of  $c_i, r_i$  are in the following table.

investments	A	B	C	D	E	F	G	H	I	J
pay	24	30	18	30	56	15	22	21	26	15
get	38	50	27	51	86	22	33	35	46	23

You have a budget of 100 euros. You want to maximize the overall profit given by the revenue of the investment and remainder in cash (=budget - costs)

## The mathematical model

- *Parameters.*  $n = 10$ ,  $c_i, r_i$  for  $i = 1 \dots, n$  and  $b$ .
- *Decision variables.*

$$x_i = \begin{cases} 1 & \text{if investment } i \text{ is selected} \\ 0 & \text{otherwise} \end{cases} \quad i = 1, \dots, n$$

- *Objective function.* We want to maximize

$$\sum_{i=1}^n r_i x_i + (b - \sum_{i=1}^n c_i x_i)$$

- *Constraints.*

$$\sum_{i=1}^n c_i x_i \leq b$$

The full model is

$$\begin{aligned} \max \quad & \sum_{i=1}^n r_i x_i + (b - \sum_{i=1}^n c_i x_i) \\ & \sum_{i=1}^n c_i x_i \leq b \\ & x_{ij} \in \{0, 1\} \quad i = 1, \dots, n \end{aligned}$$

It is an integer linear programming problem.