

# The Task Assignment Problem

Given

- a set of  $N$  tasks,
- a set of  $M$  processors,
- the execution cost  $e_{ij}$  of task  $i$  if it is assigned to processor  $j$ , and
- the communication cost  $c_{ijkl}$  between tasks  $i$  and  $j$  if they are respectively assigned to processors  $k$  and  $\ell$ .

The Task Assignment Problem consists in finding an assignment of the tasks to the processors such that the total execution and communication cost is minimized.

The Task Assignment Problem can be formulated by the following quadratic 0-1 problem, where  $x_{ij} = 1$  iff task  $i$  is assigned to processor  $j$ .

$$(TASS) : \min F(x) = \sum_{i=1}^N \sum_{j=1}^M e_{ij} x_{ij} + \sum_{i=1}^{N-1} \sum_{j=1}^M \sum_{k=i+1}^N \sum_{\ell=1}^M c_{ijkl} x_{ij} x_{k\ell} \quad (1)$$

s.t.:

$$\sum_{j=1}^M x_{ij} = 1 \quad i = 1, \dots, N$$
$$x \in \{0, 1\}^{N \times M}$$

This problem is also called Task Assignment Problem with non-uniform communication costs.