Classical QAP

- **Input**

To help elucidate the problem addressed in this study, let us introduce urban layout problem by classical QAP with an example as shown Fig. 1. In this example, we just consider transportation cost which is represented as the number on physical link in the Fig. 1. For travelers in example, we assume that traveler 1 and 2 live in the home building 101 and traveler 3,4 and 5 live in the home building 102. Traveler 1,3,4 work at the office building 401 and traveler 2,5 work at the office building 402. f_{ij} represents traffic flow between home building i and office building j. Therefore,

$$\begin{array}{rcl} & \text{office building } j & \\ & \begin{array}{cc} 401 & \quad 402 \end{array} & \\ \text{home builidng } i \;\; \begin{array}{c} 101 \\ 102 \end{array} & \begin{bmatrix} 1 & \quad 1 \\ 2 & \quad 1 \end{bmatrix} & = [f_{ij}] \end{array}$$

Given building set I, J, candidate location set K, L, travel demand f_{ij}, fixed cost c_{kl}, g_{jl} and travel cost c_{kl}, the urban layout problem is to assign all buildings to different locations with the aim to minimize the total cost in a given transportation network.

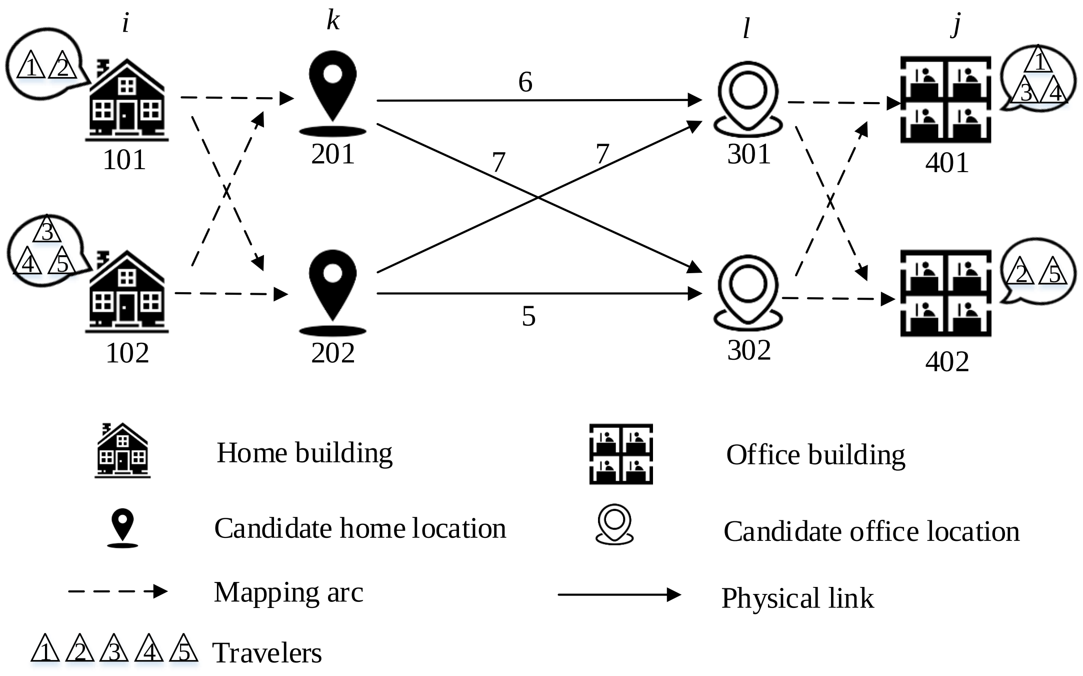

Fig. 1. Urban layout problem of the illustrative example with classical QAP

- **Output**

Fig. 2. provides one optimal solution for illustrative example of QAP and Table 1 shows the optimal path choice of travelers. Home building 101 and 102 are placed candidate home location 201 and 202 respectively. Office building 401 and 402 are placed at candidate office

location 302 and 301 respectively. The total cost is equal to 30.

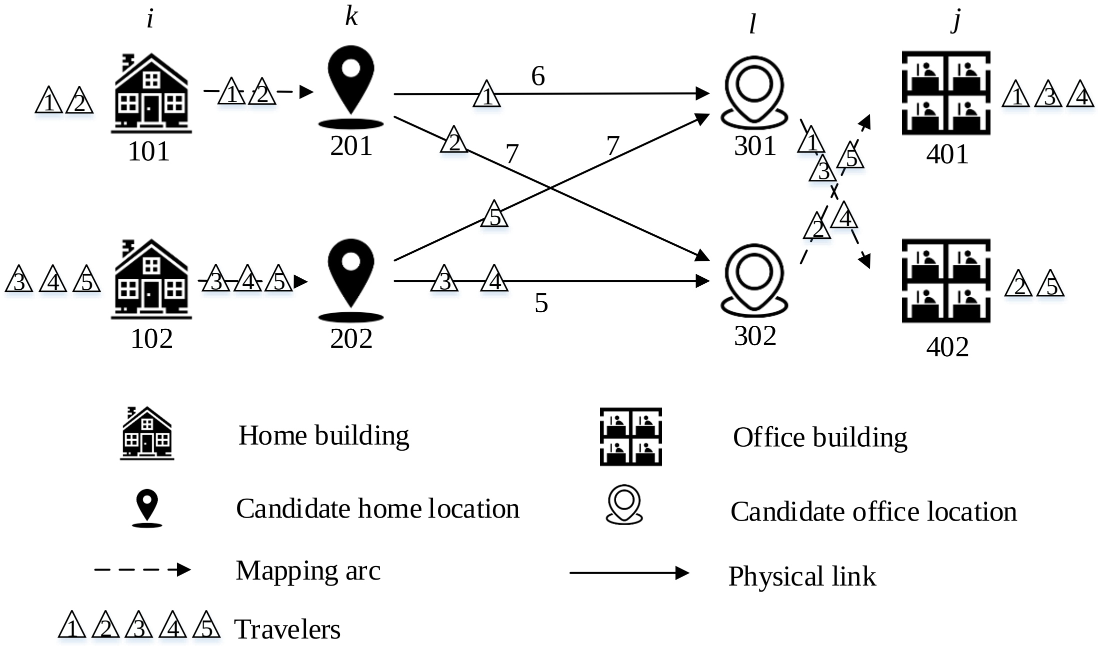

Fig. 2. Optimal solution of the illustrative example with classical QAP

Table 1

The optimal choice of travelers of the illustrative example with classical QAP.

Traveler	Path of traveler
1	101→201→301→402
2	101→201→302→401
3	102→202→302→401
4	102→202→302→401
5	102→202→301→402