

# Trash cans

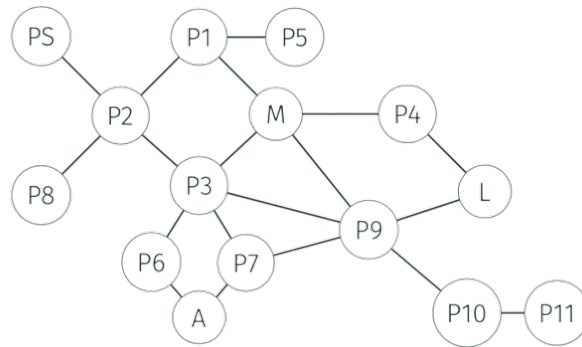
Difficulty level: advanced

## Keywords

- Graph theory
- Undirected graphs
- Integer Linear Programming
- Python+PuLP

## Problem description

The assessor for environmental policies of the Iseo Municipality wants to place new waste bins in front of the buildings and at the main crossroads of the town. In particular, at each point, it is possible to choose whether to put an “all-in-one” trash can for separate waste collection (with different compartments for paper, plastic, glass, and unsorted waste), or a classic one for mixed waste, or nothing. Indeed, at most one item can be put at the beginning or the end of the street. An “all-in-one” trash can costs 190 €, while a classic one costs 20 €. The assessor cannot spend more than 1000 € in total. As further conditions to consider, at least three “all-in-one” trash cans between the IIS Antonietti, the Library, the Municipality, and the Primary School. Where should the trash cans be put to maximize their total number while meeting all constraints?



A = IIS Antonietti; L = Library; M = Municipality; PS = Primary school.

## Tasks

1. Formulate the mathematical model of the problem by applying the Integer Linear Programming paradigm.

2. Implement the mathematical model of the problem in Python and solve it by using the PuLP library. Use `dicts` and `for` loops where possible, for the definition of variables and constraints, respectively.
3. Print the value of the objective function at optimum, that of the variables that are nonzero, and how much the assessor has to spend.
4. How could the model be modified to give more priority to the “dirtiest” parts of the town, where it would be better to place trash cans (always considering the other constraints)?