# An important conference

**Difficulty level**: advanced

## Keywords

- Knapsack
- Integer Linear Programming
- Python+PuLP

## Problem description

The organizers of an important international conference have to decide which talks to include in the schedule on the opening day. Fifteen speakers have already registered for the conference, but not everyone will be able to give a presentation on the first day. The opening session is scheduled at 9:00 a.m. and the closing one at 5:00 p.m., but the organisers want to reserve 2 hours for a welcome cocktail during the day, and half an hour for a coffee break in the afternoon. Each speaker has been asked to estimate the time (in minutes) needed for their speech. The organizers then have rated the originality of each contribution from 1 to 10. These data are listed in Table **??** below.

| **Talk ID** | **Estimated duration (min)** | **Originality score** |
|---|---|---|
| 1 | 20 | 5 |
| 2 | 25 | 9 |
| 3 | 40 | 5 |
| 4 | 10 | 6 |
| 5 | 40 | 7 |
| 6 | 45 | 8 |
| 7 | 10 | 1 |
| 8 | 45 | 8 |
| 9 | 25 | 2 |
| 10 | 27 | 8 |
| 11 | 15 | 9 |
| 12 | 20 | 3 |
| 13 | 45 | 7 |
| 14 | 10 | 4 |
| 15 | 30 | 6 |

Table 1: List of the candidate talks for the first day of the conference with their estimated durations and their originality scores.

## Tasks

1. Formulate a mathematical model by applying Integer Linear Programming to help the organizers decide which talks to include on the first day of the conference, maximizing the overall originality score.

2. Implement the mathematical model in Python and solve it by using PuLP. In the script, also include the instructions to print the value of the variables and the objective function at optimum.

3. Formulate the following additional constraints:

    a) the organizers want to select a maximum of three talks evaluated with a score lower than or equal to 5;

    b) if talk 14 is not chosen, then talk 15 is not selected either;

    c) the organizers want to select an even number of talks.