Exercises

Exercise 1: This exercise uses the paper by Jean-François Cordeau on the web-site for the course.

The exercise asks you to find a violated inequalities in fractional solutions. The fractional solution is shown in figures 1. The rectangles in the figures represent the start and end terminal. The ellipses represent pickups and the triangles represent deliveries. The number in the parenthesis is the node number (as defined in the paper by Cordeau). The last numbers in the pickup and delivery nodes are the amount picked up (indicated with a "+") or amount delivered (indicated with a "-"). The weight of an edge (i, j) represents the value of the variable x_{ij} in the fractional solution (or alternatively: the value of $\sum_{k \in K} x_{ij}^k$ if you think in terms of x_{ij}^k variables).

Hints to this exercise can be found at the end of the document: I recommend that you try to solve the exercise without using the hint first, though. That is most fun!

Exercise

Find a violated generalized order constraint (see section 4.5 in the paper) in the fractional solution shown in figure 1.

Exercise 2

Write an integer programming model for the pricing problem arising from solving the set partitioning model of the Pickup and Delivery Problem with Time Windows (that is, no ride time constraints) by column generation (see page 19-22 in the slides or the paper by Savelsbergh and Sol, the section named "A branch-and-price algorithm for the GPDP").

Exercise 3

Describe a heuristic for solving the pricing problem from exercise 2. Explain how the heuristic works (use pseudocode for example) and descbribe the advantages and drawbacks of the heuristic. Your answer should not be too long (max one or perhaps two pages).

Hint, exercise 1

A violated inequality with $m = 3$ can be found. One of the subsets in the violated inequality is {2,11}.

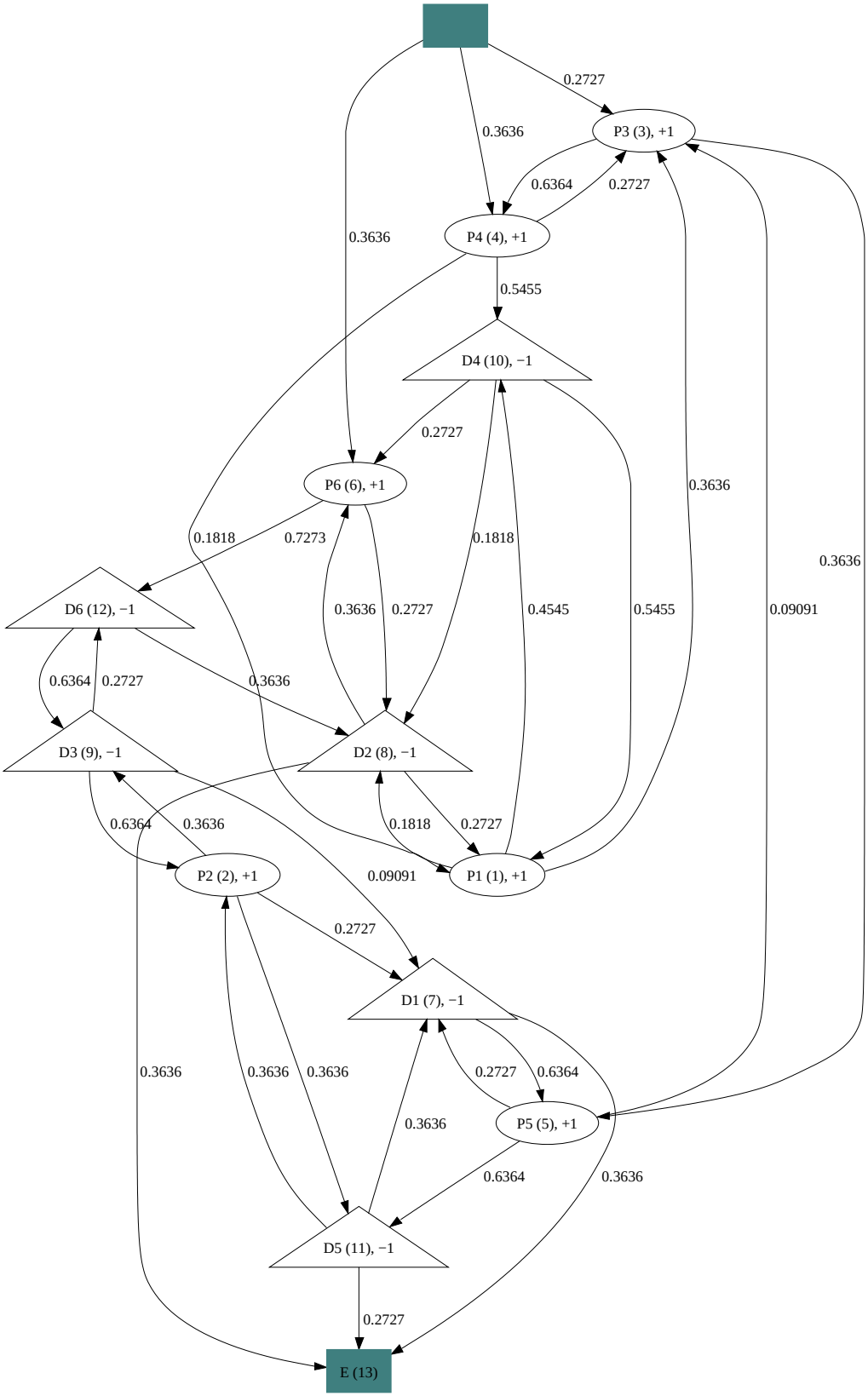

Figure 1: Fractional solution to a DARP problem with 6 requests.