Graph Optimization
Lab session 7

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Exercise 1: continuous relaxation for Bin Packing

Consider the Bin Packing problem. Write a .mod and a .run files to solve the the continuous relaxation of the Bin Packing problem with a polynomial size formulation. Compute the continuous relaxation of the instances available online. Use the parameters name as defined in the file `ex7-parameters.mod`.

Are there alternative polynomial size formulations? Implement them and evaluate their continuous relaxation for the available instances.

Exercise 2: Column Generation for Bin Packing (**** to be submitted)

Consider the Bin Packing problem. Write a .mod and a .run files to solve the continuous relaxation of the Bin Packing problem with the column generation applied to the cluster-based formulation. Solve the instances available online. As initial solution assign each item to a different bin. Use the parameters name as defined in the file ex7-parameters.mod. Upload the .mod and .run files.

Column generation for the continuous relaxation of bin packing problem

(Restricted) Master problem

$$\min \quad \sum_{s \in \mathcal{S}} \lambda_s$$

$$\text{s. t.} \quad \sum_{s | i \in s} \lambda_s \geq 1 \quad i = 1, \dots, N$$

$$\lambda_s \geq 0 \qquad \forall s \in \mathcal{S}$$

Pricing problem

$$\max \quad \sum_{i=1}^{N} \pi_i u_i$$

$$\text{s. t.} \quad \sum_{i=1}^{N} w_i u_i \leq B$$

$$u_i \in \{0, 1\}, i = 1, \dots, N$$

Column generation scheme

1. Define an initial set of cluster $\mathcal{S}$
2. Solve the restricted master problem on $\mathcal{S}$
3. Build the pricing problem (π_i is the optimal dual variable)
4. Solve the pricing problem
5. Compare the optimal solution of the pricing with 1
6. If the optimal solution of the pricing is greater than 1 then a new cluster must be added
7. If one cluster has been added, go to 1

Exercise 3: comparison

Compare the continuous relaxation of the two formulations. Consider an instance where the two formulations do not provide the same objective function, analyse the solutions and explain why the two results are different.