

# 通用MIP求解技术

MIP:混合整数(线性)规划

# 通用MIP求解技术

- Presolve: 缩减MIP问题规模+提升MIP问题下界
- Primal Heuristics: 高效获取MIP问题高质量上界
- Cuts: 提升MIP问题下界
- Branch: Divide and Conquer思想的体现
- LP relaxation: 线性规划是基础

# Overview

We will briefly talk about **primal heuristics for MIP**, and order them based on how **expensive** they are.

	LP-Free	LP-Based	MILP-Based
Starting Heuristics	Feasibility Jump Fix-and-Propagate Shift-and-Propagate Walk-SAT Local-ILP	Rounding Diving Heuristic Feasibility Pump OCTANE	Zero-Obj RENS
Improving Heuristics	1-OPT 2-OPT Tabu Search LNS Adaptive LNS		RINS Local branching Crossover DINS GINS



Computational Costs

# Overview

We will briefly talk about **cuts for MIP**

	General-purpose	Structure
<b>Cuts</b>	Gomory cuts Mixed integer rounding cuts Strong Chvatal-Gomory cuts Zero-half cuts Mod-k cuts Disjunctive cuts Lift-and-project cuts Conflict cuts Reformulation-linearization techniques cuts Relax-and-lift cuts Learned cuts Reduced cost strengthening	Cover cuts Flow cover cuts GUB cuts Implied bound cuts Clique cuts Network cuts

# Overview

We will briefly talk about **Branch for MIP**

<b>Branch</b>	Most Infeasible Branching Least Infeasible Branching Pseudocost Branching Strong Branching Hybrid Branching Reliability Branching Inference Branching

# Overview

We will briefly talk about **Presolve for MIP**

	Fast	Medium	Exhaustive
LP Presolve			
MIP Presolve	Coefficient tightening Domain propagation Colum singleton	Dual fix Fix continuous Parallel columns Parallel rows Simple probing Stuffing	Dominated column Implied integer Probing Sparsity Substitution

Computational Costs



# 通用MIP求解技术重要性

- Presolve: 20%-30%
- Primal Heuristics: 5-10%
- Cuts: 40-50%
- Branch: 10-50%
- LP relaxation: 15-20%

# 通用LP求解算法

- Simplex method:
- Dual Simplex method:
- Interior-Point method(Barrier):
- PDLP/cu-PDLP(First-order method):
- Shifting(Column Generation):
- Network Simplex:
- Concurrent: