

Mixed Integer Programming Formulations

Lecture 3

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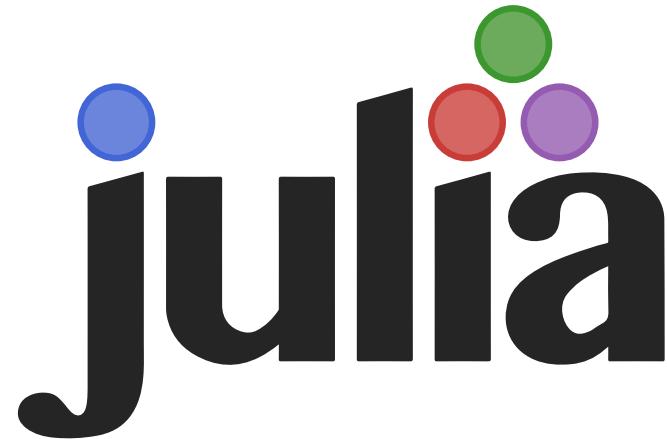
Massachusetts Institute of Technology

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Audience poll

- AMPL
- GAMS
- AIMMS
- OPL
- CVX
- YALMIP
- PuLP
- Pyomo
- Gurobi Python API
- JuMP (or Julia)

What is Julia?



- 21st century programming language
- MIT licensed: free and open source
- (Almost) as fast as C and as easy as Matlab
- <http://julialang.org>



juliacon.org

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computing

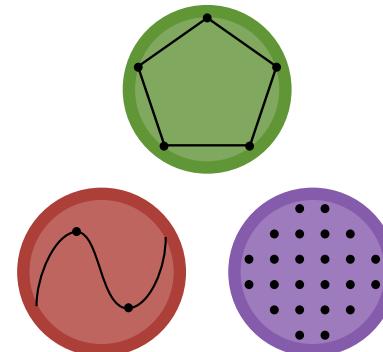
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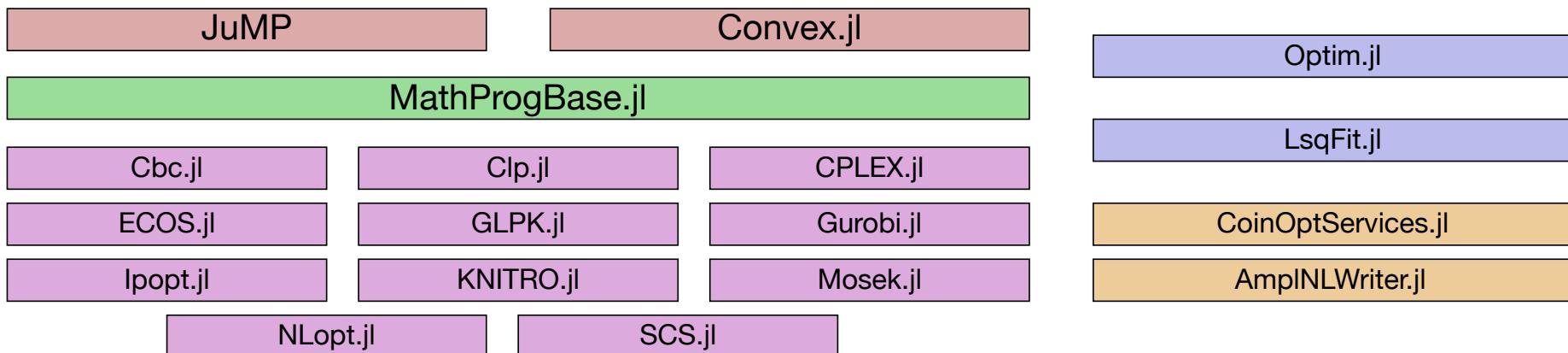
Why choose Julia for optimization?

- “I want to model and solve a large LP/MIP within a programming language, but Python is too slow and C++ is too low level”
- “I want to implement optimization algorithms in a fast, high-level language designed for numerical computing”
- “I want to create an end-user-friendly interface for optimization without writing MEX files”
- Lubin and Dunning, “Computing in Operations Research Using Julia”, INFORMS Journal on Computing (27), 2015, pp. 238–248

Optimization and Julia



JuliaOpt



<http://www.juliaopt.org>

Why JuMP?

- Speed: Model generation should not be a bottleneck
- Programmability
 - Extensibility (JuMPeR, JuMPChance, MultiJuMP, JuGP, etc)
 - Embeddability (e.g. StochDynamicProgramming.jl)
- Solver independence
- Advanced features
 - Branch & bound callbacks
 - Automatic differentiation + user-defined functions
- Interactivity and visualization
 - Requires speed and programmability
- **Dunning, Huchette and Lubin**, “JuMP: A Modeling Language for Mathematical Optimization”, 2015, arXiv:1508.01982

But Really ... Why Should I Use Julia / JuMP

- What is the fastest MINLP solver written in?
 - Yes, Julia!
 - Wednesday session 3, Miles will introduce [Pajarito](#)
 - OK, not all in Julia, because it relies on state-of-the-art linear MIP and NLP solvers
 - Calling C libraries easily is one of the advantages of Julia
- Most importantly
 - Julia is version 0.4
 - JuMP is version 0.13