OptimalApplication.jl

Solving the college application problem with Julia

The college application problem

… consists of deciding **which colleges to apply to,** given

- the **utility** associated with each school,
- the **probability of being admitted,**
- each school's **application fee,** and
- a **total budget** to spend on applications.

Maximizing the expected maximum of a portfolio of random variables: a challenging combinatorial optimization problem. NP-hard or NP-complete depending on input encoding.

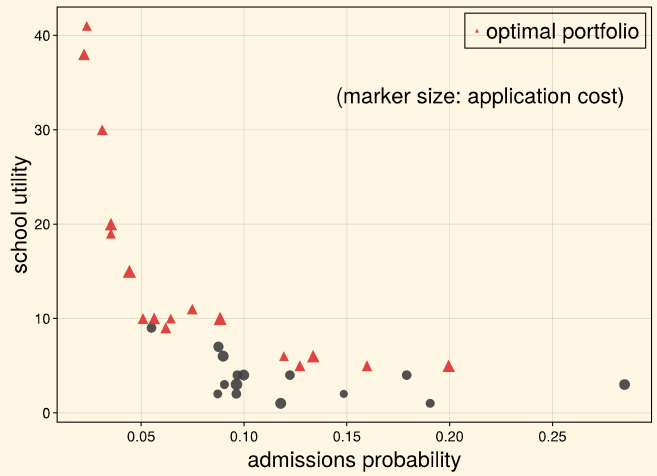
OptimalApplication.jl

… is a Julia package that provides **exact, approximate, and heuristic solvers** for the college application problem.

Special case: All application fees equal. `applicationorder_list()` and `applicationorder_heap()` are **quadratic-time algorithms**.

General case:

- **Exact solution** from `optimalportfolio_dynamicprogram()` or `optimalportfolio_branchbound()`.
- **ε-approximate solution** from `optimalportfolio_fptas()`.
- **Heuristic solution** from `optimalportfolio_simulatedannealing()`.



A typical admissions market and the optimal portfolio.

Why Julia?

Multiple dispatch, parametric types ⇒ easy to accept different kinds of user input and preserve type stability.

Easy to parallelize validation study with `@threads`.

Simplicity of **creating and sharing packages.**

Future work

OptimalApplication.jl could be a lot **more generic**, e.g. accept DataFrames.jl series as input.

Integrate with Bonobo.jl to handle **more sophisticated constraint structures** that arise in real-world admissions markets.

For example, the Korean admissions process prevents students from applying exclusively to top schools, a **diversification constraint.**

Graphical interface/web app.

Links

OptimalApplication.jl:

- `]install OptimalApplication`
- Source code and documentation on GitHub.

Theory: github.com/maxkapur/CollegeApplication hosts an arXiv paper and various conference slides.

Presentation slides.

Presenter info

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