DecisionLab 3.0: Optimization for Good

Beck Edwards | Rice INFORMS

April 4, 2026

Contents

1 DecisionLab 3.0: Optimization for Good

1.1 Introduction

DecisionLab 3.0: Optimization for Good is a 12-week workshop for undergraduates in Operations Research and Applied Math, offering hands-on, experiential learning opportunities through Decision Science and Data Science. It is Rice INFORMS' third consecutive iteration of DecisionLab, which was introduced in 2024, the academic year that Rice INFORMS was founded. Students apply Optimization, Simulation, AI, Stochastic Modeling, and other quantitative methods to tackle real-world challenges, thereby gaining teamwork experience. DecisionLab 3.0

This year, each team is paired with a non for profit partner in the Rice or Houston community. Teams will meet with their sponsors biweekly, and models will be showcased at the DecisionLab Showcase on April 19th, 2026 from 3-5pm in the Cambridge Office Building, Room 130.

1.2 Organizers

DecisionLab 3.0 was curated by:

- Beck Edwards (DecisionLab Coordinator)
- Gavin Daves (DecisionLab Sandbox[1] Coordinator)

1.3 Resources

For a deeper dive into the DecisionLab program, we encourage you to explore the following:

1. DecisionLab webpage
2. DecisionLab 2026 Handbook

This document outlines the projects for DecisionLab 3.0, which students received upon admission into the program.

[1] DecisionLab Sandbox is a biweekly optimization and modeling workshop, held in parallel with DecisionLab for underclassmen new to optimization; students are mentored by Rice INFORMS upperclassmen.

2 DecisionLab 2026 Project Outlines

2.1 RNEF Portfolio Optimization

Team:

- Holt Klineberg (Team Lead)
- Jenny Cao (Optimizer)
- Ruohan Wang (Optimizer)
- Mark Leaf (Developer)
- Grace Yuan (Developer)

Roles are subject to change per agreement between teammates.

2.1.1 Project Overview

Rice New Energy Fund (RNEF) is a student-managed investment fund that manages a portfolio of public stocks related to the energy transition. Their 6 securities span 3 sectors: transportation, power, and industry. RNEF currently uses deep analysis and due diligence along with help from an algorithm to determine the appropriate amount of shares to buy, but they have not incorporated portfolio optimization analysis yet.

2.1.2 Partner

Your RNEF liason is Anmol Mital.

2.1.3 Mentors

Optimization mentor: Beck Edwards || (bae5@rice.edu)
Development mentor: Tayten Bennetsen || (tmb15@rice.edu)

2.1.4 Model

Your task is to use optimization techniques to optimize RNEF's portfolio of publicly traded New Energy stocks. Your objective is to maximize returns subject to stochastic constraints. Some techniques you may find useful are:

- Mean-Variance Portfolio optimization
- Hedging strategies & robust optimization
- Simulation modeling & dynamic optimal control theory

2.1.5 Data

For this project, you will be given access to RNEF's portfolio on Excel. You will also be given a FactSet account, which provides access to RNEF's portfolio management software, including Investment Research, Portfolio Analytics, Data Solutions, and more (basically a junior version of Bloomberg). *Note that you are also free to use any other data you find is useful for your product.*

2.2 HARC Large-Scale Urban Forestry Optimization

Team:

- Devin Abraham (Team Lead)
- Ashwin Rao (Developer)
- Lakshanyaa Rajkumar Sudhakar (Optimizer)
- Melody Cui (Developer)
- Michael Bradley (Optimizer)

Roles are subject to change per agreement between teammates.

2.2.1 Project Overview

Houston is a hot city, and there are a myriad of health issues that come with high heat exposure. Some communities in Houston are more prone than others to high temperatures due to industrial activity levels, a lack of green spaces, lack of shade, and several other factors. There is clearly a need for heat relief in various locations across Houston.

One of the best and cheapest ways to provide heat relief is by planting more trees. The problem is, Houston is large and there are astronomically many possible locations to plant and sizes of trees to consider. Also, planting trees is not free — there is a planting and maintenance cost associated with every one.

Your task is to create an optimal tree planting plan for the Houston Advances HARC. While organizations like the Harris County Flood Control District and Houston Wilderness are involved in planting trees, HARC is a non-profit that has been conducting higher-level research to discover where these trees should be planted. You should look at HARC's website at harcresearch.org to familiarize yourself with the organization.

Your objective is to minimize heat risk across all Houston communities subject to budget and geospatial constraints.

2.2.2 Partner

For this project, your team lead is responsible for coordinating with with **Ryan Bare** from the Houston Advanced Research Center **(rbare@harcresearch.org)** regarding the scope and specifications for the project.

2.2.3 Mentors

Optimization mentor: Gavin Daves || (gbd2@rice.edu)
Development mentor: Hosung Kim || (hk63@rice.edu)

2.2.4 Model

Some optimization techniques you might find interesting are:

- MILP with Lagrangian & Binary Relaxation
- Facility Location & Covering Models (p-center, capacitated facility location, etc.)
- Greedy algorithms (e.g. impose diminishing returns with overlapping coverage)
- Simulated Annealing (since the dataset is very large)

2.2.5 Data

Data is geospatial (GIS) captured from LIDAR and is in raster format (a grid of cells [pixels] organized in a matrix, where each pixel holds a value representing information). You will likely need to download QGIS to use it. *Note that you are also free to use any other data you find is useful for your product.*

- Tree canopy coverage
- Tree canopy height
- Tree canopy density
- Heat exposure (HARC Afternoon Heat Watch Data), (2)

2.3 Equitable Park Sector Optimization

Team:

- Xinying Bi (Team Lead)
- Jeanne Manteau (Developer)
- Sevyn Liu (Optimizer)
- Selina Gu (Developer)
- Vincent Chang (Optimizer)

Roles are subject to change per agreement between teammates.

2.3.1 Project Overview

Houston currently allocates park dedication fees through 21 park sectors whose boundaries are largely shaped by highway infrastructure rather than by park need, environmental conditions, or ecological systems. This framework has produced persistent funding imbalances, with some sectors accumulating substantial reserves while others remain underfunded despite having fewer parks, lower-quality park assets, higher heat exposure, and greater historic disinvestment. These disparities are reflected in city data on fee collection, park acreage, and park conditions, as well as in recent public reporting.

This project proposes a data-driven optimization of park sector boundaries that intentionally redraws these lines to better align where park dedication fees are collected with where park investments are most needed. The optimization logic integrates multiple objective inputs, including patterns of fee generation from development activity, existing parks acreage per capita, park quality scores from HPARD assessments, and measures of unmet park need derived from the HPARD Master Plan and vegetation indices such as NDVI. Watershed boundaries are incorporated as a core constraint to reflect underlying ecological systems and to strengthen the legally required nexus between development impacts and the geographic areas in which mitigation funds are spent.

Using GIS-based optimization techniques, the project evaluates alternative sector configurations that rebalance fee accumulation and expenditure while maintaining contiguity, administrative practicality, and legal defensibility. Rather than relying on scenario comparisons alone, the approach seeks to identify boundary arrangements that minimize disparities in parks acreage and quality, prioritize neighborhoods with low canopy and limited park access, and better align park finance with hydrological and environmental conditions. Boundary design is treated as an adjustable policy variable that can be optimized to improve equity outcomes.

Ultimately, this work reframes gerrymandering as a constructive planning tool. By applying optimization logic to park sector boundaries, the project aligns fiscal policy with measurable park need, existing park conditions, environmental data, and watershed systems, replacing legacy infrastructure-based boundaries with a park finance framework designed to advance equity, climate resilience, and legal compliance.

Your task is to formulate a model that draws park sector boundaries to maximize fairness subject to budgeting, neighborhood, and balancing constraints.

2.3.2 Partners

Your team lead is responsible for coordinating with with:

- **Ed Pettitt** from the *Friends of Columbia Tap* **(edpettitt@gmail.com)**
- **Taylor Valley** from the *Coalition for Environment, Equity, and Resilience (CEER)* **(taylor@ceerhouston.org)**

regarding the scope and specifications for the project.

2.3.3 Mentors

Optimization mentor: Samuel Garvin || (samuel.w.garvin@rice.edu)
Development mentor: Snikitha Kassey || (sak11@rice.edu)

2.3.4 Model

Some optimization methods you might want to look into are:

- Mixed Integer Programming
- Simulated Annealing
- Markov chains for gerrymandering
- Check out GerryChain for inspiration

2.3.5 Data

- Patterns of fee generation from development activity
- Existing parks acreage per capita (ArcGIS online map)
- Measures of unmet park need derived from the Houston Parks and Recreation Master Plan
- Park quality scores from HPARD assessments (see HPARD Master plan pg 47 and Appendix V-VII)
- Vegetation indices such as NDVI (250m resolution), (or you can use precomputed NDVI from Landsat Level-2 Surface reflections for 30m resolution found here)

You are also free to use any other data you find is useful for your product.

Note — Students may need to file a Public Information Act (PIA) request (the Texas equivalent of a Freedom of Information Act request) to get the most updated Park Sector Dedication Fund (fees collected) data from Houston Parks and Recreation Department. There's an office in the basement of Fondren Library that helps with that.

2.4 Columbia Tap "OptiFlow"

Team:

- Colt Adams (Team Lead)
- Aigerim Zhadikbay (Developer)
- Rayaan Damani (Optimizer)
- Scott Chen (Developer)
- Jonathan Plavnik (Optimizer)

Roles are subject to change per agreement between teammates.

2.4.1 Project Overview

The Columbia Tap Trail is a paved, rail-to-trail corridor in southeast Houston that runs roughly four miles from Dixie Drive northward to East Downtown (near Emancipation Ave / Shell Energy Stadium area), passing key anchors such as Texas Southern University and connecting at its southern end to the Brays Bayou Greenway trail system (a regional spine for walking and cycling). Due to trail's alignment through low-lying, topographically flat, and intensely urbanized parts of Houston makes it structurally prone to ponding and overbank impacts during heavy rainfall. As a result, the ***Friends Of Columbia Tap*** have proposed the replacement of the trail's current drainage ditches with bioswales.

Bioswales are vegetated systems intended to slow and filter stormwater, especially in narrow linear spaces typical of sidewalks/road edges—exactly the geometry the trail encounters at crossings and alongside roadways. Such bioswales are needed along the trail because they directly address the two main stormwater problems a linear corridor like Columbia Tap faces: (1) fast runoff from adjacent streets/parking lots and (2) limited storage/infiltration capacity in the right-of-way. Properly designed bioswales slow flows, promote infiltration where soils allow, and filter pollutants before water reaches inlets and causes flooding on the trail surface while improving downstream water quality. Along Columbia Tap specifically, "green infrastructure corridor" concepts have been advanced in local resilience discussions, and nearby/related projects have already used rain gardens and detention features to improve site hydrology — bioswales are the scalable, corridor-wide version of that same approach.

For a comprehensive dive into bioswales and the context behind your project you MUST READ the following document: Technical Report: Geospatial Suitability Analysis and Hydraulic Engineering Framework for Bioswale Implementation along the Columbia Tap Trail.

Your task is to find the optimal placement for bioswales along the Columbia Tap Trail to mitigate flooding risk under constraints regarding budget, existing subsurface infrastructure, geography, and conveyance capacity (maximum flow per bioswale) constraints.

2.4.2 Partner

For this project, your team lead is responsible for coordinating with with:

- **Ed Pettitt** from the *Friends of Columbia Tap* **(edpettitt@gmail.com)**

regarding the scope and specifications for the project.

2.4.3 Mentors

Optimization mentor: Benjamin Pope || (bkp2@rice.edu)
Development mentor: Nursultan Asilbekov || (na81@rice.edu)

2.4.4 Model

Some optimization methods you may want to look into are:

- Mixed Integer Programming
- p-median, k-median, & p-center minimization
- Maximum coverage / set covering
- Capacitated facility location

2.4.5 Data

See the document listed in the Project Overview for Data Sources. You are also free to use any other data you find is useful for your product.

2.5 Final Exam Scheduling

Team:

- Ben Freidinger (Team Lead)
- Ian Chen (Optimizer)
- Cuewon Kim (Developer)
- Faye Lin (Optimizer)
- Mike Negrych (Developer)

Roles are subject to change per agreement between teammates.

2.5.1 Project Overview

Final exam scheduling is one of the most complex logistical puzzles Rice faces each semester. It's really just a giant constraint satisfaction problem — hundreds of courses must be assigned to a limited number of time slots and rooms, all within a compressed window of just a few days. But what makes it truly difficult isn't the sheer volume of courses; it's the intricate web of student conflicts introduced by majors, courses that tend to have high co-enrollment, and double majors.

The challenge deepens when you account for the diversity of Rice's academic programs themselves. Different majors have different course structures: engineering programs rely on sequential, prerequisite-heavy curricula where many students take the same courses in lockstep, creating huge shared conflicts. Humanities programs, by contrast, offer broader elective freedom, scattering students across dozens of course combinations that are harder to predict but no less prone to collisions. Interdisciplinary majors — those sitting at the intersection of two or more departments — are particularly vulnerable, inheriting the scheduling pressures of multiple programs at once.

Your task is to create an optimal exam scheduling model, using student schedule data from the Rice Registrar.

2.5.2 Partners

For this project, you may be put in contact with **the Rice Registrar**, by request.

2.5.3 Mentors

Optimization mentor: Yifan Xu || (yx76@rice.edu)
Development mentor: Jack Dizalo || (jd125@rice.edu)

2.5.4 Model

Some optimization methods you may want to look into are:

- Mixed Integer Linear Programming (MILP)
- Lagrangian Relaxation and Bender's Decomposition
- Tabu Search

2.5.5 Data

- Rooms and capacities
- Reservations
- Room schedules and capacities
- Past years student schedules (provided)
- Classes + Enrollment + whether they have final or not (courses.rice.edu)

Note that you are also free to use any other data that you find useful for your project.