Example Project Topics Offered to Students

Interstate Batteries: Plan for Every Part - Network Flow Optimization

Problem: At Interstate Batteries, we have a large distribution network that spans the entire country, in the form a local market distributors and larger regional distribution centers. We need to determine what the optimal flow of product from our supplier to ours dealers should be in order to minimize cost.

Deliverables: What is the optimal flow of product through our distribution network in order to satisfy demand with supply while meeting customer service requirements and minimizing cost? What should we stock and where? We're expecting the model to be a linear/non-linear/quadratic optimization model.

Data sets: We have product, sales, purchases, inventory, market, and cost information for these models. We also have contractual vendor terms which will act as constraints to the model.

Possible tools: Tableau for data visualization, Alteryx for modeling and automation, and Exasol as database

Harvest Hill Beverage Company: Cycle Time Reduction

Focus is on reducing changeover downtimes via SMED kaizen. Can integrate Assembly Line Balancing into the kaizen, if team finds it beneficial, to minimize operator idle time and ensure "flow to work."

This improvement project is aimed at reducing our changeover setup times according to Shigeo Shingo's Single-Minute Exchange of Dies (SMED) approach.

1. Identify internal and external activities
2. Convert internal to external
3. Streamline activities
4. Repeat

We have four main types of changeovers: Flavor, Case, Size, Size and Flavor. Within those four types of changeovers, we have numerous Brand-Code-to-Brand-Code changeovers. We will mine the data to determine which of these changeovers occur with the greatest frequency and/or will have the biggest positive impact to our Overall Equipment Effectiveness (OEE).

Uplift Education: Financial Aid Analysis and Forecasting

Uplift Education is the largest public charter school network in North Texas. Established in 1996 with a single school in Irving, the network now serves over 18,000 scholars in pre-K through 12th grade on 20 campuses across the D/FW metroplex. Each school provides free, college-

preparatory education in a community that has limited high quality public education options. One of Uplift's goals is to completely close the achievement gap between students, regardless of their ethnic or socio-economic background, while ensuring that 100% of their students graduate and enroll in college. Another important goal is for 70% of Uplift graduates to earn a college degree within six years.

Project Goals

1. Develop a model that takes as input academic-performance, demographic, and financial data for an Uplift senior, and a target college or university, and produce as output a forecasted range for the amount the student's family will be asked to contribute towards tuition. In other words, forecast the gap between the cost to attend that college or university and the amount of financial aid the student is likely to be offered.
2. Implement the model as a "dash board widget" that Uplift staff can use to advise families and conduct comparisons of aid offers from different college and universities (e.g., have universities A and B been offering comparable aid packages to Uplift students with similar profiles?).
3. Develop a decision-support tool to help compare admission/financial aid offers that considers factors such as graduate rate and job placement after graduation in addition to the cost to the Uplift student's family to determine which college/university offers the best "return on investment".

Notes

Uplift has data from the last two, possibly three, years that the SMU team can work with provided they sign a nondisclosure agreement (NDA). Uplift uses Tableau for data analytics, but an Excel-based solution would be acceptable. Goal 3 is a long-term goal to provide context for Goals 1 and 2, which are the deliverables for the project.

American Airlines: Traffic Flow for Connecting Passengers (Original)

Help improve operations at the airport by providing an enhanced view of customer traffic flows between connecting flights. Currently, we do not have a good idea of how long it truly takes passengers to connect from one gate to the next. This information could be useful for optimizing gate assignments, anticipating when passengers may not make their connection, and numerous other applications.

An accurate solution might involve conducting time studies at DFW, considering the time needed to deplane, the time from gate to gate if in the same terminal, and the time from terminal to terminal otherwise. Absent time studies, one might estimate the time needed to travel from one gate to another, either by making assumptions or by exploring historical passenger data and constructing connection time distributions. Some valuable end products might include a detailed write-up of the methodology that could be scaled to other airports beyond DFW, the insights derived from the study, visualizations or dashboards depicting traffic flow between gates in the airport, or even predictive models to anticipate passenger misconnects.

BaylorScottWhite: Capacity Analysis and Process Flow Simulation

BSW operates the Jekot Women's Imaging Center in Richardson, TX, which specializes in the early detection of breast disease. The demand for the center exceeds its capacity to provide rapid response and BSW is seeking ways to reduce the current one-month appointment wait time down to several days. Capacity can be expanded by identifying more efficient patient flows and may require additional resources, including equipment, staff, and space.

This project centers around mapping out patient flows, building a simulation model of the existing process, and testing process changes to identify the most effective means of expanding capacity.

Krisha has begun collecting observation data at the clinic and expects to have demand data in terms of physicians, instruments, and rooms. This is an urgent project for BSW and should fit within our available time span.

In terms of simulation software, they use Arena but are open to other languages that we are more familiar with. For on-site visits, men must be escorted but women do not.

LimeLight Networks: Content Delivery Network Optimization

Limelight Networks[1] operates Content Delivery Networks (CDNs) that deliver web pages, video, audio, images, and other content over the Internet to browsers, gaming platforms, and devices from a network of computer servers. Servers are located around the world and respond to content requests from clients. A description of how CDNs work is attached.

Limelight would like to optimize their operations by building models to determine where to locate content, what requests should be handled by which server, and how many extra servers are needed to handle the load while doing off-line maintenance work on other servers.

Efficient and deterministic placement of content and maintenances ultimately affects the bottom-line for capacity planning, minimizing waste, and higher reliability.

Models for some of these questions have been published and a team could test them out on Limelight data. Other questions are extensions with some extra variables. This work would probably be done in AMPL, GAMS, or some other optimization modeling language. Faculty member would be involved to guide the model development.

[1] Top tier CDN, with a video platform & object storage on top, 20 Tbps egress with our own international backbone, global footprint with 100+ data centers

After the kickoff with the client, the team completes this form for approval by the client and professor.

PROJECT SUMMARY AND APPROVAL FORM

Project Name: The Effect of Weather on Sales at Chilli's in DFW
Project Team Members: Kelly Brunstein, Sarah Klein, Daniel Munoz, Maya Nair

Problem/Opportunity

In 2017 Brinker reported a profit of $150.8 million, down nearly 25 percent from $200.6 million in 2016. In the fourth quarter of 2017, the company posted both a revenue and sales decline of 8.1 percent. In response, Chilli's cut down its menu by 40 percent and focused on improving its food and customer experience.

In 2018 executives blamed the decline in Chili's comps largely on bad weather, and noted that its guest counts represented an improvement from the same period of the prior year, when traffic fell 6.2%.

"Adjusting for weather, our comps would have been positive," said Wyman Roberts, CEO of parent company Brinker International. He noted that the weather during the second quarter in 2018 was particularly bad in areas where franchised stores are located, a major reason why comps for those units were down 3.2%.

https://www.restaurantbusinessonline.com/operations/casual-dining-rebound-hasnt-pulled-chilis-along
https://www.foodnewsfeed.com/fsr/chain-restaurants/chilis-gets-its-mojo-back
https://www.foodnewsfeed.com/fsr/chain-restaurants/what-you-need-know-about-chilis-turnaround-plan

Goal

Build a dynamic model that isolates and analyzes the impact of weather on Chili's sales and profits in the DFW metroplex. Forecast sales and use these predictions to increase customer traffic.

Objectives

1. Estimate the impact of weather on sales at DFW Chilli's locations
2. Build a model to forecast sales given historical weather and sales data
3. Recommend solutions to mitigate the effect of weather on sales
4. Extend model to other regions

Success and Completion Criteria

1. Extract and clean DFW Chilli's sales data and external weather data from 2016-2018
2. Identify sales metrics to use in predictive model (traffic, sales, profits, etc.)
3. Build regression model in R to isolate the impact of weather on declining sales
4. Test model against current weather and restaurant data to predict sales/demand up to 1 week in advance