Group 9 Project Proposal

Proposal 1: Optimization Model for Van Routing for Baggage Delivery

Introduction

The purpose of this project is to develop an optimization model for a small company that provides dispatching services to airlines for picking up and delivering lost or delayed baggage to customers in the Bay area. The objective is to determine the minimum number of vans required and the optimal assignment of customers to vans, considering the travel time and delivery time constraints.

Problem Statement:

The company has seven vans and a contract with several airlines to pick up baggage from SFO airport at 11 a.m. and deliver it to customers by 1 p.m. The goal is to determine the most efficient van routing plan to minimize the number of vans needed. Each van can carry all the baggage to be delivered within the two-hour period, and there are no capacity limitations on the vans. No two vans can have the same routes.

Model Formulation:

The optimization model will be formulated as an Integer Linear Programming (ILP) problem.

Proposal 2: Optimization Model for Minimizing Layoffs and Reducing Costs

Introduction:

This project aims to develop a workforce optimization model that minimizes layoffs, optimizes recruitment and retraining, and explores cost reductions for a company facing changing labor needs and economic challenges.

Problem Statement:

A company is changing how it runs its business, and therefore its staffing needs are expected to change. Through the purchase of new machinery, a company is expecting reduced need for unskilled labor and more need for skilled and semi-skilled labor. Also,

a lower sales forecast - driven by an economic slowdown that is predicted to happen in the next year - is expected to further reduce labor needs across all categories. The forecast for labor needs over the next three years are -

	Unskilled	Semi-skilled	Skilled
Current Strength	2000	1500	1000
Year 1	1000	1400	1000
Year 2	500	2000	1500
Year 3	0	2500	2000

	Unskilled (%)	Semi-skilled (%)	Skilled (%)
< 1 year of service	25	20	10
≥ 1 year of service	10	5	5

The company needs to determine recruitment, retraining, layoffs and part-time vs. full-time employees for each of the next three years. The rate of attrition is relatively high in the first year after a new employee is hired and relatively low in subsequent years as in the above table. Each year, it is possible to hire a limited number of employees in each classification from outside the company - 500 Unskilled, 800 Semi skilled and 500 Skilled employees.

Each year, it is possible to train up to 200 unskilled workers to make them into semi-skilled workers. This training costs the company $400 per worker. It is possible to train semi-skilled workers to make them into skilled workers. However, this number can not exceed 25% of the current skilled labor force and this training costs $500 per worker. Lastly, downgrading workers to a lower skill level can be done. However, 50% of the downgraded workers will leave the company, increasing the natural attrition rate.

Each laid-off worker is entitled to a separation payment at the rate of $200 per unskilled worker and $500 per semi-skilled or skilled worker. It is possible to have workers in excess of the actual number needed, up to 150 workers in total in any given year, but this will result in the following additional cost per excess employee per year - $1500 for unskilled, $2000 for semi-skilled and $3000 for skilled employees.

Up to 50 employees of each skill level can be assigned to part-time work. The cost of doing so is $500 for unskilled, $400 for semi-skilled and $400 for a skilled employee per year. A part-time employee is only half as productive as a full-time employee.

- If the company's objective is to minimize layoffs, what plan should they adopt in order to do this?
- If their objective is to minimize costs, how much could they further reduce costs?
- How can they determine the annual savings possible across each job?

Both models have been inspired by the book Model Building in Mathematical Programming by H. Paul Williams.