

MATH 381 Project Proposal

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Profit optimization for marketing agency

Phenomenon: Rainfactory is a company that offers three different advertising services to the clients: two types of crowd funding projects and one type of regular advertising project. The crowd funding projects take 4 months to complete and regular advertising projects take 5 months. Each project earns a fixed amount of profit plus a percentage of revenue that the advertisement generates for the client. Each of those generate different profit and have different labor resource requirements for each month of on-going project. Right now, the company is just taking on any project they get. The company has different number of clients each month and it is hard to find a good strategy on which projects to take given the labor constraints.

Goal: Find an optimal strategy to maximize profit over all potential customer types given minimum and maximum constraints on labor and on customer availability in the presence of unknown revenue factor and fixed fees.

Impact: Help the company better allocated their resources and generate more profit.

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Plan: We are trying to maximize profit which not only depends on the number of projects, but also the revenue generated by the project for the client. We would like to attack the simple case first, which is maximizing profit function without the uncertain factor, which is the percent of revenue generated by the advertisement for the client. This problem will be solved by linear programming. Then, we would like to use Monte Carlo simulation on the uncertain variables to better approximate their impact on the profit.

Sample Problem:

Company offers 3 services: Plans A, B and C. Plan A generates 60\$, B generates 70\$, C

generates 77\$ per two months. They have two types employees. For employee type 1, A requires 5 hours of work, B requires 2 hours of work and C requires 3.5 hours of work in the first month. A requires 4 hours of work, B requires 2.5 hours of work and C requires 3 hours of work in the second month. For employee type 2, A requires 10 hours of work, B requires 7 hours of work and C requires 6 hours of work in the first month. A requires 0 hours of work, B requires 2 hours of work and C requires 4 hours of work in the second month. The company has 3 employees of type 1 and 2 of type 2. Each employee can work maximum of 160 hours per month. How many projects they should take each month to maximize their profit?

Mathematical Model:

Decision variables: Let x_A, x_B, x_C , be number of projects of A, B and C for month 1 and let y_A, y_B, y_C be the number of projects of A, B and C for month 2.

Objective Function: Maximize $60*(x_A+y_A)+70*(x_B+y_B)+77*(x_C+y_C)$

Constraints:

$$5*x_A+2*x_B+3.5*x_C+4*y_A+2.5*y_B+3*y_C \leq 480$$

$$10*x_A+7*x_B+6*x_C+0*y_A+2*y_B+4*y_C \leq 320$$

$$5*y_A+2*y_B+3.5*y_C+4*x_A+2.5*x_B+3*x_C \leq 480$$

$$10*y_A+7*y_B+6*y_C+0*x_A+2*x_B+4*x_C \leq 320$$

*Note that this is a two-month cycle that repeats.

Solution: Solving this problem by linear programming we get:

$$x_A = 0, x_B = 28, x_C = 10, y_A = 0, y_B = 32, y_C = 0$$

Max Value for objective function = 4790\$.

Interpretation: At the first month, the company should take on 28 plan B and 10 plan C. In the second month, they should take 32 plan B only. Then first month projects will be done, so take 28 plan B and 10 plan C again. The company should repeat this process to maximize profit which is 4790\$

References: Operations Research by Winston