DAT-203 Assignment 7

Simulations for Marketing Campaign

Colin Bowers

June 30, 2023

Question 1

Discuss the provided code, and how it is solving the problem at hand.

Here is a re-statement of the provided code in plain English:

1. Start with a list of probabilities that each client will purchase the product.
2. Assume that contacting a client increases this by 10% (this is called "uplift").
3. Choose a target group of those clients where prob is between some min and max.
4. Run a simulation as such:
    a. Randomly determine if each client would purchase (based on their adjusted probability after being called).
    b. Count the number of clients that purchase ("sales").
    c. Count the total number of clients in the target group ("calls").
    d. Calculate the profit (income - cost = 0.8 per sale).
    e. Repeat this random simulation 10 times and calculate the mean profit (total / 10). Store this result.
5. Repeat this whole simulation with varying values of min and max probability.
    a. Min range 0.0 -> 0
    b. Max range 0.1 -> 1.0
6. Sort all of the results by profit and choose the one with the highest profit.

Results

- Min prob: 0.6
- Max prob: 0.7
- Sales: 18,857
- Calls: 49
- Profit: $187,380

Commentary

It would be too expensive to call every single client, we need to select a subset.

Calling clients with very low probability wouldn't be worth it since they still have a low chance of purchasing.

Calling clients with high probability also wouldn't be worth it since they were going to purchase anyway.

Conclusions

(based on this particular simulation run):

Focusing on clients with probabilities between 0.6 and 0.7 should result in maximizing our profit.

Expected profit in this scenario is $187,380 (based on making an expected 18,857 sales).

This will require making 49 calls.

Question 2

Describe in your own words Monte Carlo Simulation and its possible applications.

Monte Carlo simulation is a computational technique used to model and analyze complex systems by using random sampling. It involves creating a simulation of a system and generating numerous random inputs to obtain statistical results. They are particularly useful when the underlying system is too complex to solve analytically and the problem being solved has a probabilistic interpretation.

Here are a few examples of possible applications:

Finance: used in options pricing and risk analysis. By simulating the potential future movements of underlying assets, they can estimate the value of options and assess the associated risks.

Astrophysics: can be used to model and study complex astronomical phenomena. For example, they can generate synthetic data based on a simulation of our current understanding of the creation of stars and galaxies. This can be compared with real observations to refine our understanding of the universe.

Engineering: simulations can be applied to evaluate the structural integrity and reliability of complex systems, such as bridges or aircraft. By taking random inputs such as material properties, load conditions, and environmental factors, engineers can assess the probability of failure and improve their designs.

Question 3

What other techniques can we use instead of Monte Carlo simulation with comparable results?

Any statistical method or modelling technique that can accurately determine how a given simulation should behave and estimate the probabilities, or other information, of the possible outcomes. This could include regression algorithms - particularly by considering confidence intervals to learn about the distribution - or decision trees.