Paper 428-2011

Increasing Efficiency in Optimization

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ABSTRACT

In marketing optimization, the number of rows in the communications table correlates to the size of the mathematical problem that the optimization algorithm attempts to solve. If you can reduce the number of rows, the "optimization problem" will be solved more quickly and efficiently. At Transamerica Life & Protection, one of our programs set up for optimization using a standard methodology, required over 700 rows on the communication table. Due to size, it required resources beyond what our servers could consistently support. Through some creative brainstorming, we were able to significantly reduce the size of the "optimization problem" and complete the project.

INTRODUCTION

SAS® Marketing Optimization can be utilized to achieve many business objectives. These include assigning the best offer to a customer or prospect from a set of possible offers, producing a forecast outlining offers to be made over a set period of time, and analyzing test results. A successful optimization relies on several factors including models with accurate point estimate predictions, valid assumptions for determining the financial value of each offer, and a plan which produces an efficient optimization.

Models should accurately predict the likelihood of the target variable (response, net response, profit, etc.) and produce comparable values. If the models utilized in optimization are not accurate, a prospect or customer could be assigned to a less financially beneficial product and any financial value calculated by the optimization will not be reliable. In addition to accurate models, it is important that any assumptions associated with an offer be valid. Inaccurate assumptions may also shift offers incorrectly.

The optimization plan must be carefully developed to include the objectives, the constraints, and the setup for the optimization. Discussions with business owners regarding the optimization objective and business rules are critical and should take place prior to setting up the optimization. Once those discussions are completed, determining how to best implement the objectives and constraints utilizing the optimization solution begins.

REASONS TO FOCUS ON EFFECIENCY

An efficient optimization is beneficial in many ways. It decreases the time spent actually running the optimization, increases the number of possible scenarios which can be reviewed in a given time frame, and lessens the burden on the systems producing the optimized solution.

One of the important aspects of setting up an efficient optimization is the communications table. This table defines the possible offers to be considered in the optimization problem.

The number of rows in the communications table correlates to the size of the mathematical problem the optimization algorithm attempts to solve. If you can reduce the number of rows, the "optimization problem" will be solved more quickly and efficiently. The higher the number of possible offers in the optimization, the more important efficiency becomes. Efficiency is also improved by reducing the number of constraints applied during optimization.   A constrained solution is less "optimal" than an unconstrained one. The constraint applies an additional restriction on the possible solutions which makes determining an optimal solution more difficult and therefore less efficient.

Consideration of both of these factors is especially important in forecasting. Forecast scenarios are often quite large because they include every product offered over a long period of time (offers have to be duplicated for each time period) and additional constraints may be needed to apply business rules for each time period.

COMMUNICATION TABLE AND CONSTRAINTS

Based on the SAS Marketing Optimization Users' Guide, the combination of communication code and campaign code define a unique offer within SAS Marketing Optimization. The communication table is a master listing of all the unique parings of these two fields for all campaigns included in the optimization. For each paring various assumptions and other values required for optimization are listed for input into the optimization.

When setting up an optimization input data and project, decisions are made regarding how to best structure the data, including the communications table, so that optimization objectives and business needs are met. Developing a communication table based on SAS's definition of a "unique offer" may result in unique rows for every possible product and population segment combination. Often population segments use different assumptions and models so this path naturally occurs. The communication table further expands when multiple time periods are included. If the number of products is small, system resources are unlimited, or if only one time period is used, this methodology works well. In fact it allows for the most detailed reporting inside of the optimization solution. However, using this methodology is not feasible when there are constraints on resources or when the number of product and population segment combinations increases, thereby increasing the size of the mathematical problem and the stress on the system. This paper is a case study of how we developed a more efficient optimization methodology by creatively minimizing the number of rows in the communication table. The steps listed below outline the process followed.

STEPS TO DEVELOP AN EFFICIENT OPTIMIZATION

STEP 1 – REVIEW FOR IMPROVEMENT

The first step in increasing efficiency was to review the current methodology to find instances where it could be improved. During this exercise, segments in the population were identified that were uniquely defined and mutually exclusive. This exclusivity is the key to the ultimate strategy applied. The original communications table had communication codes at the product and segment level. In order to reduce the size of the table, something had to be adjusted related to the possible combinations of segment and product.

campaign_cd	communication_cd	comm_desc	channel_cd	Periodic Amou	Resprate	Paidrate
Segment1	offer1_seg1	offer1	DM	17.800	1.000	0.600
Segment1	offer2_seg1	offer2	DM	41.000	1.000	1.000
Segment1	offer3_seg1	offer3	DM	24.000	1.000	0.600
Segment2	offer1_seg2	offer1	DM	16.500	1.000	1.000
Segment2	offer2_seg2	offer2	DM	38.000	1.000	0.600
Segment2	offer3_seg2	offer3	DM	25.750	1.000	1.000

Table 1: Original Communications Table

STEP 2 – DETERMINE THE CHANGES

The next step was the decision about what to change. A customer or prospect from the customer table is often eligible for multiple offers. Offers are also available to multiple segments. A unique person on the customer table, however, is only in one segment. This was a clue that segment would be a good variable to treat differently in the communication table. Once this idea surfaced the concept of having product only communications quickly followed. The idea was quickly vetted to determine whether it was possible and found to be a good possible solution for the objective of reducing the number of rows.

STEP 3 – RESEARCH THE POSSIBILITIES

The next step was to research the possibility of product only communications in greater detail. We developed what the table might look like and walked through at a high level how each part of the optimization would be impacted.

STEP 4 – DEVELOP A NEW COMMUNICATIONS TABLE

Next a new communications table was developed using the product only communication strategy. Sets of columns were defined by segment so that assumptions for each segment could be assigned using optional columns in the table.

campaign_cd	communication_cd	comm_desc	channel_cd	Seg1_Periodic_Amt
File	offer1_cd	offer1	DM	17.800
File	offer2_cd	offer2	DM	41.000
File	offer3_cd	offer3	DM	24.000

Seg1_RespRate	Seg1_PaidRate	Seg2_Periodic_Amt	Seg2_RespRate	Seg2_PaidRate
1.000	0.600	16.500	1.000	1.000
1.000	1.000	38.000	1.000	0.600
1.000	0.600	25.750	1.000	1.000

Table 2: Revised Communications Table

STEP 5 – DEFINE THE INDICATOR MEASURES

Inside SAS® Marketing Optimization, indicator measures were defined to identify a record as part of one of the groups.

Figure 1: Indicator Measure

STEP 6 – INCORPORATE THE MEASURES

The indicator measures were incorporated into the calculated measures so that only the assumptions for the independent group were used for the particular record. While this increased the size and complexity of the calculated measure, it decreased the size of the optimization problem.

Figure 2: Calculation Using the Indicator Measure

STEP 7 – COMPARE THE SOLUTIONS

A comparison was conducted of the solution produced using the prior methodology compared to the new one showing that the results were similar.

CONCLUSION

As a result of this exercise, the communications table decreased in size from over 700 rows to about 250. This resulted in a 50% reduction in optimization time (from over 10 hours to about 5 hours.) Additionally the server performance issues seen prior to the change have significantly declined. This has allowed a more production oriented environment and increased time to focus on growth related business objectives.

CONTACT INFORMATION

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