Thesis Outline
Applied and Industrial Mathematics Program
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I. **Introduction**

A. **Thesis Statement** Here is my thesis statement

II. **Motivation and Background**

A. **Problem Description** Suppliers give us forecasted TV average audience data for their selling titles. We use audience measurement data to come up with forecasted average audience percentages for the selling titles. These forecasted average audience percentages our used by our optimization engine to recommend media plans given certain objectives and constraints. The suppliers give these media plan as recommendations to advertisers and are mostly interested in the outcome of the media plan as a whole.

We need to explain the following terms in the problem description; their explanation should be used cohesively and will help guide the problem description:

i. Selling title
ii. Broadcast week
iii. TV rating
iv. Average Audience
v. Media plan
vi. Telecast
vii. Schedule
viii. Post-Campaign Reporting

B. **Data**

i. **Measurement Data** We are given audience measurement data that provides TV viewing habits of the panel sample. For each

historical telecast, we are given the respondents that were watching and their total seconds of commercial viewing and total viewing.

ii. **Supplier Data** A given supplier provides us with a schedule that list all content airings historically and their tentative future airings. Additionally, for each selling title / week airing in the future

III. **Model Description**

A. Hierarchical Logistic Regression Model

IV. **Model Implementation**

A. pymc3 We use pymc3 to sample from the posterior distribution. pymc3 uses Hamiltonian Monte Carlo sampling techniques. Sampling with this method took upwards of 48 hours so we

i. We approximate sampling using ADVI mini-batch in order to improve sampling speed. ADVI works best when posterior is Gaussian without too many uncorrelations.

V. **Results**

A. Allocation level

B. Media plan level

VI. **Conclusion**