Statistics 747 – Assignment 3

Due 10:30 29th September 2010

Q1 The data found in the data set ‘Assn3.csv’ contains the sales data for shoes for a NZ footwear company in the Australian market for 72 weeks.

The data consists of the following variables:

*Dates* – the date at the beginning of the week of interest

*Season* – a seasonal variable that divides the year into two seasons

*Sales* – the sale values in $NZ

*Pairs* – the actual number of pairs of shoes sold in Australia for that week

*Price* – the average price for the shoes sold for that week

*Mag.spend* - the amount in NZ$ spent on magazine advertising for that week

*Mail.spend* - the amount in NZ$ spent on mailed advertising for that week

*News.spend* - the amount in NZ$ spent on newspaper advertising for that week

*TV.spend* - the amount in NZ$ spent on television advertising for that week

*All.spend* - the amount in NZ$ on total advertising for that week

The shoe company wishes to ascertain how effective each type of advertising (magazine, Mail, newspaper or television) is in terms of sales (if any). Your task is to address this question.

Discuss your output in laypersons terms (executive summary) and for a data analyst (technical appendix).

(Note/Hints: seasonality and price may be useful and/or and interactions could exist between these variables. Advertising effects may have a ‘memory’.)

Hints: this analysis will require the use of a non-linear model -so think about the nature off the response variable. In the technical appendix describe how we formally interpret coefficients for each variable.

**Q2 -**

The table below shows the observed exposure distribution across four issues of the New Zealand Woman’s Weekly.

|  |  |
| --- | --- |
| Number of issues read | Number of people |
| 0 | 1487 |
| 1 | 722 |
| 2 | 241 |
| 3 | 96 |
| 4 | 454 |

i) Fit a beta-binomial model to this data using maximum likelihood. Plot and interpret the resulting beta distribution for the individual probabilities.

ii) Plot the observed and expected frequency counts, and describe any deviations from the fitted model. Is there any indication of systematic model failure?

iii) Fit a modified probability model to the same data, again using maximum likelihood, assuming that the each person’s number of exposures is a binomial random variable but that the exposure probabilities have a beta distribution mixed with a point mass at 1. That is, assume a proportion *w* of people read every issue of the New Zealand Womans Weekly, and the remainder read each issue independently with probabilities following a beta distribution. Interpret the resulting model parameters, comparing this beta distribution with that from part (i), and plot the observed and expected frequency counts.

iv) An advertiser plans to place an ad in each of the next ten issues of the New Zealand Womans Weekly. Use your model from part (iii) above to predict the number of people who would read 0, 1, 2, 3, …, 9, and 10 issues of the magazine, during this 10 week advertising campaign.