Examination: 2769

Quantitative Methods in International Marketing

Summer Semester 2008

Dr. John E. Brennan

You are allowed to use a non-programmable calculator (in accordance with the instructions given by the examination office) and a translating dictionary from your native language to English (without any notes written into it). **All** of the **ten** (10) examination questions must be answered. This examination consists of **three** (3) pages and must be completed within 120 minutes.

1. (10 points) When a Marketing Decision-Maker is asked to make a yes - no decision, this decision can be modeled using a Bernoulli random variable, $Y = y$ where $y = \{0, 1\}$. Furthermore, assume that the marketing information system of the company provides the decision-maker with some decision relevant information in the form of the random variable, $X = x$.
   a. $(X, Y) \sim f(x, y)$. When the Conditional Expectation Function is assumed to be linear, then the Linear Probability Decision Model is used, $CEF = E(Y \mid X = x)$, where $E(Y \mid X = x) = \alpha + \beta x$. What information is provided to us by the number $E(Y \mid X = x)$?
   b. The Linear Probability Decision Model is an easy one to use but it has some severe limitations. Explain these limitations in detail.

2. (10 points) Consider the two random variables $X = x$ and $Y = y$, $(X, Y) \sim f(x, y)$.
   a. Explain how the univariate marginal distribution of the random variable $X \sim f_1(x)$ can be derived (discrete as well as continuous).
   b. Explain how the univariate conditional distribution of the random variable $(Y \mid X = x) \sim g_1(y \mid X = x)$ can be derived.

3. (10 points) Marketing Models are used to assist Marketing Managers in their everyday decision-making responsibilities. Bayes' Theorem provides a logical framework for analyzing the human thought process involved:

$$Pr(Y \mid X = x) = \delta \, Pr(Y)$$

$$\delta = Pr(X \mid Y = y) / Pr(X)$$

   a. Using the expression of Bayes' Theorem above, explain how information is used in decision-making.
   b. Explain in detail under what conditions the information contained in the random variable $X = x$ is of no use in the decision model.

Please turn to page 2

4. (10 points) NOTE: This problem MUST be solved using the table approach presented in lecture! The purpose of this question is to demonstrate your knowledge of this solution method and not just to calculate some numbers.

A group of business management students here at KU-Ingolstadt can be categorized in the following manner. Twenty-eight percent (28%) of them are students from foreign countries. Concerning only those students from countries other than Germany, seventy-four percent (74%) of them live in apartments located on the campus. Sixty-eight percent (68%) of the students from Germany live in rented apartments off the campus. What is the probability that a business management student selected at random is:

a. A student from a foreign country who is living off campus.
b. A German student who is living on the campus or a student from a foreign country living off campus.
c. A business management student who is living on the campus.

5. (10 points) A Market Research Company has conducted a survey of the customers departing a Rossmann retail shop in Ingolstadt. Shoppers were stopped and asked how much they spent, Y= y, and what is the amount of their monthly income, X= x.

a. For each possible value of the random variable X= x, What would be learned by analyzing the numbers V(Y | X= x) and Skew(Y | X= x)?
b. If you were to select a functional form for the CEF = E(Y | X= x), where E(Y | X= x) = h (x), what type (shape) of function do you think would be best in this case to show the relationship?

6. (10 points) A discrete joint bivariate population pmf for X= x_i and Y= y_j, f (x_i, y_j)

$Y= y_j \setminus X= x_i$	3	4	5
1.2	0.15	0.10	0.05
2.4	0.10	0.15	0.10
3.6	0.05	0.15	0.15

a. Compute E(Y) and E(Y | X= 4)
b. Compute C(X, Y)

7. (10 points) When a random variable is not allowed to range over the full range of numbers from minus infinity to plus infinity, we say that the random variable is truncated.

a. Explain why truncated random variables are conditional random variables.
b. If the continuous random variable Y= y that can range over the complete set of real numbers, Y ~ f_2 (y), is truncated at the point – 2.5 (therefore y ≥ – 2.5), how would you calculate the probability that this random variable is between + 1.0 and + 1.5?

Please turn to page 3

8. (10 points) Diffusion Models have been used extensively in marketing to forecast the number of first purchases of a new product. The general structure of diffusion models is:

$$S_t = g(t)\,[N^* - N_t].$$

The Bass Model specifies a functional form for g(t) that proves to be very useful.

(a) In the Bass formulation, the total sales quantity sold in time period t, S_t, is the sum of sales to two different groups of consumers. Describe the differences in the consumption behavior of these groups and how a communication strategy might take this into account.

(b) Assume that two different products are launched on the market at the same time. One of these products has a brand name FLAIR (with Bass Model parameters $p = 0.02$, $q = 0.41$) and the other has a brand name DUMBO (with $p = 0.12$, $q = 0.42$). Explain how the sales of these products would develop over time using a diagram.

9. (10 points) What do we mean by the "Conditional Variance Function?" Does it need to produce the same number for all values of $X = x$, $CVF = V(Y \mid X = x)$? What kind of marketing information do we gain from these numbers?

10. (10 points) We have spent eleven weeks together considering the subject "Quantitative Methods in Marketing". What does the quotation by Prof. Kotler mean to you now?

"...marketing can now exhibit its scientific muscle and move from opinions-based decision-making to data-based decision-making."
Professor Philip Kotler, Northwestern University.

This is the end of the examination
GOOD LUCK !