Examination: 20052

International Marketing

Summer Semester 2010

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 **eight** (8) examination questions must be answered. This examination consists of **three** (3) pages and must be completed within 60 minutes.

Question 1: Consider two discrete random variables Y= y and X= x, $(X, Y) \sim f(x, y)$.

a. Explain in detail how the univariate random variable Y differs from the univariate conditional random variable $(Y \mid X= x)$.

b. Under what conditions will these two random variables be the same?

Question 2: Marketing Managers use information to improve their decision-making process. Bayes' Theorem provides a logical framework for analyzing this human thought process and shows the usefulness of information.

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

where the multiple δ is:

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

a. Explain the idea of before (prior) probabilities and after (posterior) probabilities. If these probabilities differ from each other, explain why?

b. Explain in detail under what conditions the multiple $\delta = 1.0$ and what does the value of this multiple tell us about the information source?

Question 3: Consider the two discrete random variables X= x and Y= y, $(X, Y) \sim f(x, y)$.

a. Explain how the univariate marginal distributions are derived. Explain how the marginal probabilities are used as weights in calculating variance.

b. Explain why normalizing the columns or rows of the joint probability distribution derive the univariate conditional distributions. What does conditional variance tell us about the variable of interest?

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Question 4: <u>NOTE:</u> This problem MUST be solved using the table method taught in this lecture course and NOT by some other method!

A group of students have agreed to participate in a test designed to determine if they have a particular ability. The random variable Y= y indicates the presence of this ability, y = 1, or absence thereof, y = 0. Within this group, 2.8% actually have this ability. A test is used to select students and 91% of the test subjects who actually have this ability will test positive. The random variable X= x is the test result, x = 1 positive and x = 0 negative. Unfortunately, the test is not a perfect one. Consequently, 8.6% of those students who do not possess this ability, will also receive a positive test result.

f (x, y)

		X		
		1	0	$f_2(y)$
Y	1			
	0			
	$f_1(x)$			1.0

$(X \mid Y= y)$

		X		
		1	0	
Y	1			1.0
	0			1.0

$(Y \mid X= x)$

		X	
		1	0
Y	1		
	0		
		1.0	1.0

Bayesian Multiple Table

		X	
		1	0
Y	1		
	0		

a. What is the probability that a student who tests positive does not have the ability?

b. What is the probability that a student that has a negative test actually has the ability?

c. What information is contained in the conditional distribution table: $(X \mid Y= y)$?

Question 5: Consider a decision-maker who must make a yes / no type decision. This decision can be modeled using the dichotomous random variable, Y= y where y = {0, 1}. Furthermore, assume that this decision-maker has been provided with some highly relevant information, X= x, $(X, Y) \sim f(x, y)$.

a. The Linear Probability Decision Model is $E(Y \mid X= x) = \alpha + \beta x$. What are the shortcomings of this model?

b. In this model, what is the interpretation of the number obtained for a particular value of x, $\alpha + \beta x = ?$ What does it mean?

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Question 6: A joint bivariate population pmf for $X = x_i$ and $Y = y_j$, $f(x_i, y_j)$:

$Y = y_j$ \ $X = x_i$	**3**	**4**	**5**
1.2	0.045	0.080	0.045
2.4	0.120	0.120	0.120
3.6	0.085	0.300	0.085

a. Compute $E(Y)$ and $E(Y \mid X = 4)$
b. Compute $C(X, Y)$ and explain if X and Y are stochastically independent.

Question 7: When the range of a random variable, $Y = y\ \{-\infty \leq y \leq \infty\}$ is restricted, $y \geq a$, we say that the random variable is truncated at point a.

a. Explain why a truncated random variable becomes a conditional random variable.
b. If the continuous random variable $Y = y$ that can range over the complete set of real numbers, $Y \sim f_2(y)$, is now truncated at the point -2.5 (therefore $y \geq -2.5$), how do we calculate the truncated probability that $Y = y$ is between $+1.0$ and $+1.5$?

Question 8: Diffusion Models have been used extensively in marketing to forecast the 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.
b. Assume that two different products are launched on the market at the same time. One of these products has a brand name AGAX (with Bass Model parameters $p = 0.02$, $q = 0.41$) and the other has a brand name WUPO (with $p = 0.12$, $q = 0.42$). Explain how the development of sales of these products would differ over time using a diagram.

This is the End of the Examination
GOOD LUCK !