

Examination: 20038
Advanced Methods in International Marketing
 Winter Semester 2009 / 2010
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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: NOTE: 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

$(X | Y = y)$

		X		
		1	0	
Y	1			1.0
	0			1.0

$(Y | X = x)$

		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: $(X | Y = y)$?

Please turn to page 2

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

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

where the multiple δ is:

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

- Explain the idea of before (prior) probabilities and after (posterior) probabilities. If these probabilities differ from each other, explain why?
- Explain in detail under what conditions the information contained in the random variable $X=x$ is of no use in the decision model, when is $\Pr(X | Y=y) = \Pr(X)$.

Question 3: 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, $X=x$, with the random pair $(X, Y) \sim f(x, y)$.

- The Linear Probability Decision Model is $E(Y | X=x) = \alpha + \beta x$. What are the shortcomings of this model and the number $E(Y | X=x)$ equals what?
- What advantages do the LOGIT and PROBIT models exhibit.

Question 4: Consider the two random variables $X=x$ and $Y=y$, $(X, Y) \sim f(x, y)$.

- Explain how the univariate marginal distributions are derived (discrete as well as continuous) simply by "summing" the rows or columns of the joint distribution.
- Explain how the univariate conditional distributions are derived by "normalizing" columns or rows of the joint probability distribution.

Question 5: A 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	0.045	0.080	0.045
2.4	0.120	0.120	0.120
3.6	0.085	0.300	0.085

- Compute $E(Y)$ and $E(Y | X=4)$
- Compute $C(X, Y)$ and explain if X and Y are stochastically independent.

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Question 6: 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 truncated random variables become conditional random variables.
- b. If the continuous random variable $Y = y$ that can range over the complete set of real numbers, $Y \sim f_2(y)$, is truncated at the point -2.5 (therefore $y \geq -2.5$), how do we calculate the probability that $Y = y$ is between $+1.0$ and $+1.5$?

Question 7: 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.

Question 8: Consider the 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 $(Y | X = x)$.
- b. Under what conditions will these two random variables be the same?

**This is the End of the Examination
GOOD LUCK !**