Examination: 20616

<u>International Marketing</u>

Summer Semester 2012

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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). **<u>All</u>** of the **<u>seven</u>** (7) examination questions must be answered. This examination consists of **<u>three</u>** (3) pages and must be completed within 60 minutes.

Question 1 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-making 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 in detail under what conditions the numerical information delivered by the stochastic variable $X=x$ is of no use in predicting the variable Y.

b. Explain the idea of prior (before) probabilities and posterior (after) probabilities. If the posterior probabilities differ from the priors, explain why?

Question 2 Decision-makers make (yes / no) type decisions very often. These choices can be modeled as a dichotomous random variable, $Y=y_j$ with $y_j = 0, 1$. Furthermore, assume that this decision-maker has been provided with a highly relevant numerical source of information, $X = x_i$ where $i = 1, 2, \ldots, n$.

a. Assume the conditional expectation is a linear function of the information variable: $E(Y \mid X=x_i) = \alpha + \beta x_i$. What are the shortcomings of this model specification, if any?

b. The conditional random variable $(Y \mid X=x_i)$ has a Bernoulli distribution with parameter p, therefore, the value of the conditional expectation, $E(Y \mid X=x_i)$, provides what information?

Question 3 Consider the concept of the Conditional Variance, $V(Y \mid X=x_i)$.

a. Is it likely to be the same number for all values of $X=x_i$, $i = 1, 2, \ldots, n$?

b. If scenarios are defined according the value $X=x_i$, what sort of marketing information do we gain from the Conditional Variance?

Please turn to page 2

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

A group of middle-aged men have participated in a test designed to determine if they have a particular disease. The dichotomous random variable Y= y indicates its presence, y = 1, or absence thereof, y = 0. Within this group of men, 3.8% actually have the disease. A blood test is used and 88% of the test subjects who actually have it will test positive. The random variable X= x is the test result, x = 1 (positive) and x = 0 (negative). Unfortunately, the test is not perfect. Consequently, 5.6% of those who do not have the disease, the blood test will give a positive result.

Situation

		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 man who tests positive does not have the disease?

b. What is the probability that a man that has a negative test actually has it?

c. What information is contained in the conditional distributions: (X | Y= y)?

d. Calculate the number in Bayesian Multiple Table for x = 1 and y = 1?

Question 5 Consider two random variables X= x and Y= y, (X, Y) ~ f (x, y).

a. Explain how the univariate marginal distributions for X and Y are derived from the joint distribution, f (x, y).

b. Explain how the univariate conditional distributions are derived by "normalizing" the columns and the rows of the joint probability distribution.

Please turn to page 3

Question 6 Below is 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	0.15	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)

Question 7 When the range of a random variable, Y= y {y ≥ a} is restricted, we say that the random variable is truncated at point a. Consider a discrete random variable, Y= y, where y = {2, 4, 6, 8, 10}, with associated discrete uniform probabilities {1/5, 1/5, 1/5, 1/5, 1/5}.

a. If this random variable is truncated at a = 4 (therefore, y > 4), what are the truncated probabilities that y = 2 and y = 8?

b. Compute the E(Y) before truncation.

c. Compute the E(Y | Y= y > 4) after truncation. Explain why your answer differs from that of part "b" of this question.

This is the end of the examination
GOOD LUCK !