Examination: 20298

Advanced Methods in International Marketing

Winter Semester 2010 / 2011

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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: The two discrete random variables X= x and Y= y, have a known joint probability distribution, (X, Y) ~ f (x, y).

a. Explain how the univariate marginal distributions are derived.
b. By normalizing the columns of the joint probability distribution the univariate conditional distribution of the random variable (Y|X=x) is derived. What does the conditional variance, V(Y|X=x), tell us about the variable of interest, Y?

Question 2: When the range of a random variable, Y= y $\{y \geq a\}$ is restricted, we say that the random variable is truncated at point a.

a. Explain why a truncated random variable is a conditional random variable.
b. Consider the discrete random variable Y= y that takes on the six values {2, 4, 6, 8, 10, 12} with associated discrete uniform probabilities {1/6, 1/6, 1/6, 1/6, 1/6, 1/6}. If this random variable is now truncated at the point 6 (therefore, y > 6), what are the truncated probabilities that y = 4 and that y = 10?

Question 3: 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 | X= 4)
b. Compute C(X, Y) and explain whether X and Y are stochastically independent.

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Question 4: NOTE: This problem MUST be solved using the table method that was presented in this lecture course. Other statistical methods for the solution of this problem will not be accepted.

A group of basketball players are tested in order to determine whether they have been using any ability enhancing substances. The random variable Y= y indicates the presence of such a substance, y = 1, or absence thereof, y = 0. Within this group of players it is known that 1.2% of the players are drug users. When the players are tested, only 92% of those who are actual drug users will test positive. The random variable X= x is the test result, x = 1 indicates a positive test and x = 0 negative. The test is not perfect because only 96% of those players, who do not use any drugs at all, will receive a negative 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 player who tests positive is not using drugs?

b. What is the probability that a player that has a negative test actually is a drug user?

Question 5: Bayes' Theorem provides a logical framework for analyzing this human thought process and shows the usefulness of information.

$$\Pr (Y \mid X= x) = \delta \Pr (Y), \text{ where } \delta = \Pr (X \mid Y= y) / \Pr (X).$$

a. What are the posterior probabilities in Problem 4 above.

b. Explain in detail under what conditions the multiple $\delta = 1.0$.

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Question 6: Decision-makers often make a yes / no type decision. This decision can be modeled using a 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. Assuming, $E(Y \mid X = x) = \alpha + \beta x$, what are the shortcomings of this model?

b. In this case, the conditional random variable $(Y \mid X = x)$ has the Bernoulli distribution and the conditional expectation is equal to, $E(Y \mid X = x) = ?$

Question 7: 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 AAA (with Bass Model parameters $p = 0.12$, $q = 0.42$) and the other has a brand name BBB (with $p = 0.02$, $q = 0.42$). Which product would sell the fastest any why?

Question 8: 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 are these two random variables the same?

This is the End of the Examination
GOOD LUCK !