WADI-PROGRAM

Business School Magdeburg GmbH

Guest Lecturer: Dr. John E. Brennan

Name: ______________________

Student Number: ____________

SS 2009 Final Exam: 2889
Information Management & Decision Making

All **Five** (5) of the examination questions must be answered. These questions are worth **twenty** (20) points each making the total number of possible points equal to 100. This examination consists of **three** (3) pages.

Question 1 Business Managers seek relevant information in order to enhance the accuracy of the decisions they make in the course of their daily activities. Bayes' Theorem gives us a logical framework for analyzing the impact of this information on this decision process.

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

where the multiple δ is:

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

a. Explain the idea behind the "before" (prior) probabilities and the "after" (posterior) probabilities and how they relate to decisions regarding some variable of interest.

b. Explain in detail under what conditions the information contained in the random variable $X = x$ is of no use in decision-making regarding $Y = y$ [Hint: Under what conditions is the $\Pr(X \mid Y = y) = \Pr(X)$].

Question 2 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 relevant numerical information, $X = x$, where $(X, Y) \sim f(x, y)$.

a. When the Conditional Expectation Function, CEF, is assumed to be linear, $E(Y \mid X = x) = \alpha + \beta x$, then the Linear Probability Decision Model is used. What information is provided by the number $E(Y \mid X = x)$?

b. The Linear Probability Decision Model is easy to use but it has some serious limitations. Explain these limitations in detail.

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Question 3 <u>NOTE:</u> This problem MUST be solved using the tables provided below and not by some other solution method.

A group of forty-year-old women have agreed to participate in a test designed to determine if they have breast cancer. Within this group of women, 1% actually has breast cancer. The test consists of a mammography and 80% of the women who actually have breast cancer will test positive. The test, however, is not perfect. Of the women who do not have breast cancer, 9.6% of them will also test positive.

		X		$f_2(y)$
		1	0	
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

a. What is the probability that a woman who tests positive actually has breast cancer?

b. What is the probability that a woman that has a negative test actually has breast cancer?

c. What is the probability that a woman who has breast cancer will test negative?

d. What is the probability that woman who tests positive actually does not have breast cancer?

Question 4 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	0.11	0.10	0.05
2.4	0.07	0.15	0.15
3.6	0.0	0.12	0.25

a. Compute E(X)

b. Compute the V(X)

c. Compute C(X, Y)

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Question 5 Consider the random variables $Y \sim f_2(y)$, where $Y = y$, and $X \sim f_1(x)$, where $X = x$, with joint pdf: $(X, Y) \sim f(x, y)$.

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

b. What is learned from the conditional expected value, $E(Y \mid X = x)$?

c. What is learned from the conditional variance, $V(Y \mid X = x)$?

d. 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. Explain why truncated random variables can be considered to be conditional random variables.

This is the end of the examination
GOOD LUCK !