

Bayes Theorem links the degree of belief in a proposition before and after accounting for evidence. The  $P(H)$ , prior, is the initial degree of belief of  $H$ .  $P(H|E)$ , the posterior, is the updated degree of belief having accounted for  $E$ .  $P(E|H)$ , the quotient is the amount of support  $E$  contributes to  $H$ .

CS3440 Data Mining

3. This question is concerned with the **Naïve Bayes** classifier.

a) Write down the **Bayes' theorem** and explain briefly what it means. (5 marks)

b) Refer to the data contained in the following table:

Magazine Promotion	Watch Promotion	Credit Card Insurance	Sex	Life Insurance Promotion
Yes	No	No	Male	No
Yes	Yes	Yes	Female	Yes
No	No	No	Male	Yes
Yes	Yes	Yes	Male	Yes
Yes	No	No	Female	Yes
No	No	No	Female	No
Yes	Yes	Yes	Male	Yes
No	No	No	Male	No
Yes	No	Yes	Male	No
Yes	Yes	No	Female	No

Copy the table presented below to your answer book. Fill in the counts and probabilities in the table. The output attribute is '*life insurance promotion*'. (5 marks)

	Magazine Promotion		Watch Promotion		Credit Card Insurance		Sex	
Life Insurance Promotion	Yes	No	Yes	No	Yes	No	Male	Female
Counts								
Yes								
No								
Probabilities								
Yes								
No								

(question continues on next page...)

*(Question 3 continued. . .)*

- c) Use the completed table in Part (b) together with the Naïve Bayes classifier to determine the value of life insurance promotion for the following instance:

Magazine Promotion = Yes  
Watch Promotion = Yes  
Credit Card Insurance = Yes  
Sex = Female  
Life Insurance Promotion = ?

(9 marks)

- d) Repeat Part (c), but assume that the gender of the customer is unknown.

(4 marks)

- e) Comment on the results obtained in Part (c) and Part (d).

(2 marks)