Intelligent Systems: Reasoning and Recognition

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You may answer questions in English or in French. Illustrate your answers with mathematics.

You are a political analyst. You have been asked to identify sectors of the population that can be targeted for a publicity campaign for an upcoming referendum. For this task you have conducted a survey composed of 5 questions. Each question has a fixed, finite set of possible answers. The questions and answers are as follows:
1) What is your age? A) 18-29, B) 30-39 C) 40-49 D) 50-59, E) 60 or higher
2) What is you gender? A) Male, B) Female
3) What is your most recent diploma? A) High school B) Bachelor, C) Master D) Doctor E) other
4) What is your annual Salary? A) < 15 000 B) 15 000 - 29 999 C) 30 000 - 60 000 D) more than 60 000.
5) How do you plan to vote? A) "Yes" B) "No" C) Undecided. D) Will not vote.

a) For the group who have responded A or B to question 5, Explain how to use a ratio of histograms to predict the most probable vote of a voter as a function of age?

b) Explain how to use a ratio of histograms to predict the response to question 5, given the responses to questions 1, 2, 3, and 4. How many responses to the survey do you need? How can you determine the probability of error for such a prediction?

c) (2 points) Explain how to use quadratic discrimination functions to predict the response to question 5 given the responses to questions 1, 2, 3, and 4. How many functions do you need? What is the equation for the functions? How would you determine the parameters?

d) (2 points) Explain how the EM algorithm could be used to discover categories of voters who are likely to vote non given their responses to questions 1, 2, 3, and 4. How would you initialize the algorithm? How would you determine the number of categories?