Show your working in all calculations.

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

   a) Write down the **Bayes' theorem** and explain briefly what it means. (7 marks)

   b) A doctor can run a test for the horrible disease *Examophobia*, which is known to affect one out of every 2000 students. The test for this disease has two possible outcomes: positive and negative. It is known that:

   - if a student has *Examophobia*, the test comes out positive 99% of the times.
   - if a student does not have *Examophobia*, the test comes out negative 99% of the times.

   If a student tests **positive** for the disease, what is the probability that he of she really has *Examophobia*? How can you interpret this result?

   (8 marks)

   c) Consider the following dataset which represents the voting record of some U.S. members of Congress in 1984 on three key issues; the class is their party.

Handicapped Infants	Physician Fee Freeze	Budget	Party
yes	yes	no	Republican
no	yes	no	Republican
no	no	yes	Democrat
yes	no	yes	Democrat
no	no	yes	Democrat
no	yes	no	Democrat
no	yes	no	Republican
no	yes	no	Republican
yes	no	yes	Democrat
no	no	no	Republican
no	no	yes	Republican
no	no	yes	Democrat
yes	no	yes	Democrat
no	yes	no	Republican
no	yes	no	Republican
yes	no	yes	Democrat
yes	no	yes	Democrat

   For a Congressman with the voting record **(yes, yes, no)**, compute the most probable value for **Party** using the standard Naïve Bayes model.

   (10 marks)

(Total: 25 Marks)

This Examination is Subject to the Examination Regulations for Candidates