Imagine you work for a bank and you want to predict whether a loan applicant will default on their loan or not based on some demographic and financial data. Here is a sample dataset containing 10 loan applicants and whether they defaulted on their loan or not:

Applicant ID	Age	Income	Education Level	Defaulted
1	25	20,000	High School	No
2	35	50,000	Bachelor's	No
3	45	80,000	Master's	No
4	28	22,000	High School	No
5	32	45,000	Bachelor's	Yes
6	46	70,000	Master's	No
7	24	18,000	High School	Yes
8	38	60,000	Bachelor's	No
9	32	48,000	Bachelor's	No
10	29	25,000	High School	Yes

Applicant ID	Age	Income	Education Level	Defaulted
11	31	55,000	Bachelor's	?

In this example, we have a new applicant who is 31 years old, has an annual income of $55,000, and has a Bachelor's degree. The question mark in the Defaulted column indicates that we do not know whether this applicant will default on their loan or not. We can use our Naive Bayes classifier to predict the value of the Defaulted column for this new applicant based on the values of the other columns.

Age	Income
10-19	< 20,000
20-29	20,001 - 39,999
30-39	40,000 - 59,999
40-49	60,000 - 80,000

Class :

C_1 : Defaulted = 'yes'

C_2 : Defaulted = 'no'

Data to be Classified :

$X = (\text{age} = 31,\ \text{Income} = 55,000,\ \text{Education} = \text{Bachelor's})$

$P(\text{Defaulted} \mid \text{age} = 30\text{-}39,\ \text{Income} = 40,000\text{-}59,999,\ \text{Education} = \text{Bachelor's})$

"Yes"

Prior

$P(\text{Defaulted}) = \frac{3}{10} = 0.3$

Likelihood

$P(\text{age} = 30\text{-}39,\ \text{Income} = 40,000\text{-}59,999,\ \text{Education} = \text{Bachelor's})$

$P(\text{age} = 30\text{-}39) \times P(\text{Income} = 40,000\text{-}59,999) \times P(\text{Education} = \text{Bachelor's}) = \left(\frac{1}{3}\right) \times \left(\frac{1}{3}\right) \times \left(\frac{1}{3}\right) = 0.037$

"No"

Prior

$P(\text{Defaulted}) = \frac{7}{10} = 0.7$

Likelihood

$P(\text{age} = 30\text{-}39,\ \text{Income} = 40,000\text{-}59,999,\ \text{Education} = \text{Bachelor's})$

$P(\text{age} = 30\text{-}39) \times P(\text{Income} = 40,000\text{-}59,999) \times P(\text{Education} = \text{Bachelor's}) = \left(\frac{3}{7}\right) \times \left(\frac{2}{7}\right) \left(\frac{3}{7}\right) = 0.053$

$P(X \mid C_1) = 0.3 \times 0.037 = 0.011$

$P(X \mid C_2) = 0.7 \times 0.053 = 0.037$ ✅

∴ ผู้สมัครที่มีอายุในช่วง 31-39 ปี ที่มีรายได้ในช่วง 40,000-59,999 และมีการศึกษาเป็น Bachelor's มีการคาดการณ์ว่าจะเป็น "No"