

2. The table below gives details of symptoms that patients presented and whether they were suffering from meningitis.

ID	HEADACHE	FEVER	VOMITING	MENINGITIS
1	true	true	false	false
2	false	true	false	false
3	true	false	true	false
4	true	false	true	false
5	false	true	false	true
6	true	false	true	false
7	true	false	true	false
8	true	false	true	true
9	false	true	false	false
10	true	false	true	true

Using this dataset calculate the following probabilities:

- a. $P(\text{VOMITING} = \text{true})$

This can be calculated easily by counting: $P(\text{VOMITING} = \text{true}) = \frac{6}{10} = 0.6$

- b. $P(\text{HEADACHE} = \text{false})$

This can be calculated easily by counting: $P(\text{HEADACHE} = \text{false}) = \frac{3}{10} = 0.3$

- c. $P(\text{HEADACHE} = \text{true}, \text{VOMITING} = \text{false})$

This can be calculated easily by counting: $P(\text{HEADACHE} = \text{true}, \text{VOMITING} = \text{false}) = \frac{1}{10} = 0.1$

Or using the product rule:

$$P(\text{HEADACHE} = \text{true}, \text{VOMITING} = \text{false}) = P(\text{HEADACHE} = \text{true} \mid \text{VOMITING} = \text{false}) \times P(\text{VOMITING} = \text{false}) = \frac{1}{4} \times \frac{4}{10} = 0.1$$

- d. $P(\text{VOMITING} = \text{false} \mid \text{HEADACHE} = \text{true})$

This can be calculated easily by counting: $P(\text{VOMITING} = \text{false} \mid \text{HEADACHE} = \text{true}) = \frac{1}{7} = 0.1429$

e. $P(\text{MENINGITIS} \mid \text{FEVER} = \text{true}, \text{VOMITING} = \text{false})$

This can be calculated easily by counting. First,

$$P(\text{MENINGITIS} = \text{true} \mid \text{FEVER} = \text{true}, \text{VOMITING} = \text{false}) = \frac{1}{4} = 0.25.$$

Then,

$$P(\text{MENINGITIS} = \text{false} \mid \text{FEVER} = \text{true}, \text{VOMITING} = \text{false}) = \frac{3}{4} = 0.75$$

So,

$$\mathbf{P}(\text{MENINGITIS} \mid \text{FEVER} = \text{true}, \text{VOMITING} = \text{false}) = \langle 0.25, 0.75 \rangle$$