**Example:** A doctor is trying to decide if a patient has 1 of 3 diseases. Two tests will be performed. National records have indicated for 10,000 having one of the diseases the distribution of test results appears below.

<table>
<thead>
<tr>
<th>Test Results</th>
<th>+ +</th>
<th>+ -</th>
<th>- +</th>
<th>- -</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Disease 1</strong></td>
<td>2110</td>
<td>301</td>
<td>704</td>
<td>100</td>
</tr>
<tr>
<td><strong>Disease 2</strong></td>
<td>396</td>
<td>132</td>
<td>1187</td>
<td>410</td>
</tr>
<tr>
<td><strong>Disease 3</strong></td>
<td>510</td>
<td>3568</td>
<td>73</td>
<td>509</td>
</tr>
<tr>
<td></td>
<td>3016</td>
<td>4001</td>
<td>1964</td>
<td>1019</td>
</tr>
</tbody>
</table>

Of people that have at least one of the diseases, the relative prevalence is:

- \( \Pr(\text{Disease 1}) = 0.3125 \)
- \( \Pr(\text{Disease 2}) = 0.2125 \)
- \( \Pr(\text{Disease 3}) = 0.4660 \)

If the doctor believes that the patient has one of the three diseases, then the patient is most likely to have Disease 3. Disease 3 is most prevalent among patients that have one of these diseases, more than twice as likely as Disease 2.

For patients known to have Disease 1 it is most likely that they test + +.
- \( \Pr(+ + \mid \text{Disease 1}) = 2110/3016 = 0.6563 \)

For patients know to have Disease 2 it is most likely that they test - +.
- \( \Pr(- + \mid \text{Disease 2}) = 1187/1964 = 0.5586 \)

For patients know to have Disease 3 it is most likely that they test + -.
- \( \Pr(+ - \mid \text{Disease 3}) = 3568/4001 = 0.8918 \)

Put these aren’t the probabilities that the doctor is interested in. The doctor is interested in the probability of the various diseases given the test result. The conditioning needs to be reversed.

- \( \Pr(\text{Disease 1} \mid + +) = 2110/3016 = 0.6996 \)
- \( \Pr(\text{Disease 2} \mid - +) = 1187/1964 = 0.6044 \)
- \( \Pr(\text{Disease 3} \mid + -) = 3568/4001 = 0.8918 \)

The doctor is still not sure what disease the patient has. However, given the different test results the doctor is more confident which disease the patient has.