See Syllabus

2x2 (contingency) table

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>b</th>
<th>a+b</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>10</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>y</td>
<td>15</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>total</td>
<td>25</td>
<td>35</td>
<td>60</td>
</tr>
</tbody>
</table>

Simpson's paradox

Definitions: given a set of n elements, each distinct subset of size k is called a combination of elements, and therefore \( \binom{n}{k} \) ways to choose k.

Birthday Case Study

Let K = 26 people, in total 365 days.

Sample space, \( S^n \), has \( S^n \) equally likely outcomes.

\( \text{not A) = } P_{\text{not A}} = \frac{n!}{(n-k)!} \)

\( P(A) = 1 - P(\text{not A}) = 1 - \frac{365}{365^2} \)

Stirling's approximation: \( \frac{1}{2} \log(n!) = n \log(n) - n \)

Common function: permutation of n!

\( n! = \int_{e}^{n} \log(\xi) \, d\xi \)

Definition: a multinomial coefficient is of the form

\( \frac{n!}{n_1!n_2!...n_k!} \)

Multinomial probability distribution