


On the permutation test

Matthew Brett

A mosquito problem

Beer Consumption Increases Human Attractiveness to Malaria Mosquitoes

Thierry Lefèvre , Louis-Clément Gouagna, Kounbobr Roch Dabiré, Eric Elguero, Didier Fontenille, François Renaud, Carlo Costantini, Frédéric Thomas

Published: March 4, 2010 • <https://doi.org/10.1371/journal.pone.0009546>

With thanks to John Rauser: Statistics Without the Agonizing Pain

The data

Beer				Water			
27	20	21	26	21	22	15	12
27	31	24	21	21	16	19	15
20	19	23	24	22	24	19	23
28	19	24	29	13	22	20	24
18	20	17	31	18	20		
20	25	28	21				
27							

The t-test

Independent t-test formula

- Let A and B represent the two groups to compare.
- Let m_A and m_B represent the means of groups A and B, respectively.
- Let n_A and n_B represent the sizes of group A and B, respectively.

The **t test statistic value** to test whether the means are different can be calculated as follow :

$$t = \frac{m_A - m_B}{\sqrt{\frac{S^2}{n_A} + \frac{S^2}{n_B}}}$$

S^2 is an estimator of the common **variance** of the two samples. It can be calculated as follow :

$$S^2 = \frac{\sum (x - m_A)^2 + \sum (x - m_B)^2}{n_A + n_B - 2}$$

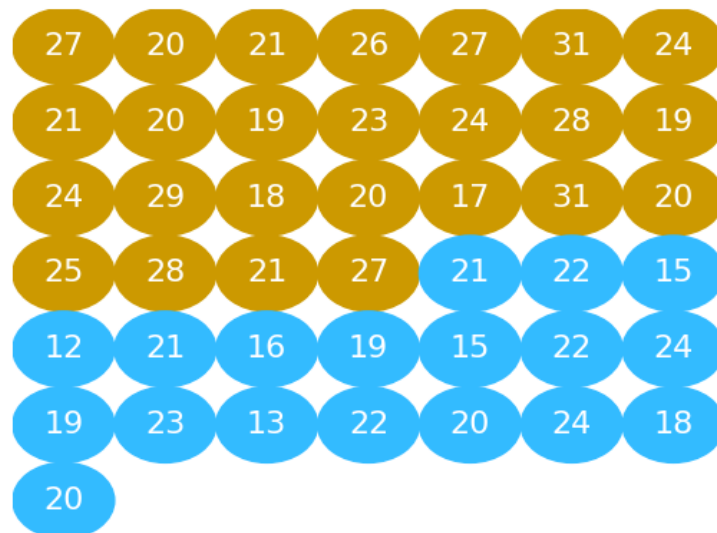
Once **t-test statistic value** is determined, you have to read in **t-test table** the **critical value of Student's t distribution** corresponding to the **significance level alpha** of your choice (5%). The **degrees of freedom** (df) used in this test are :

$$df = n_A + n_B - 2$$

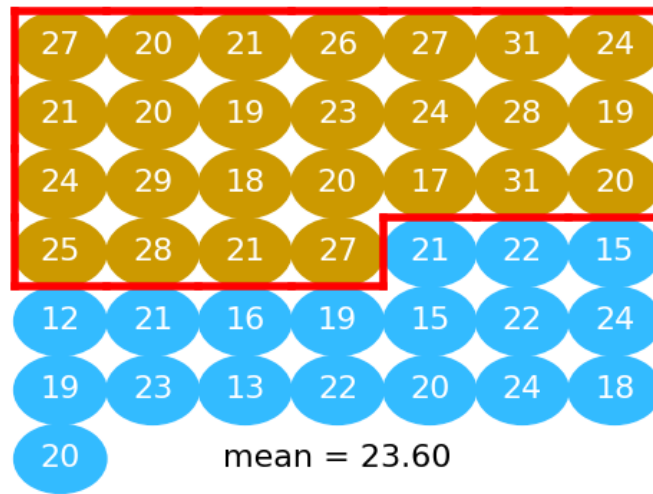
The permutation way

- Calculate difference in means
- Pool
- Repeat many times:
 - Shuffle
 - Split
 - Recalculate difference in means
 - Store

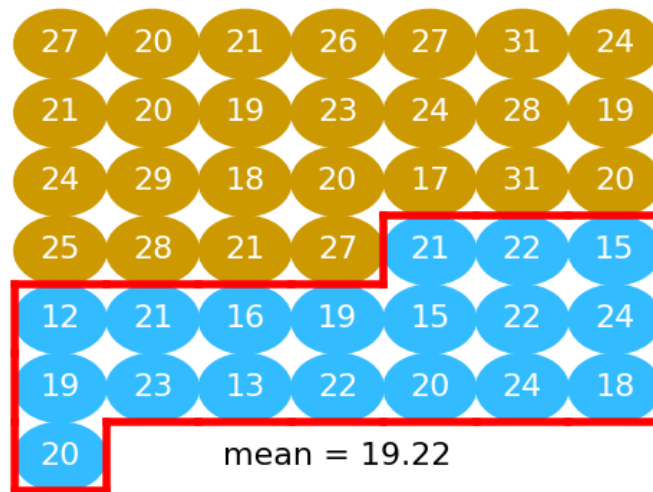
On balls



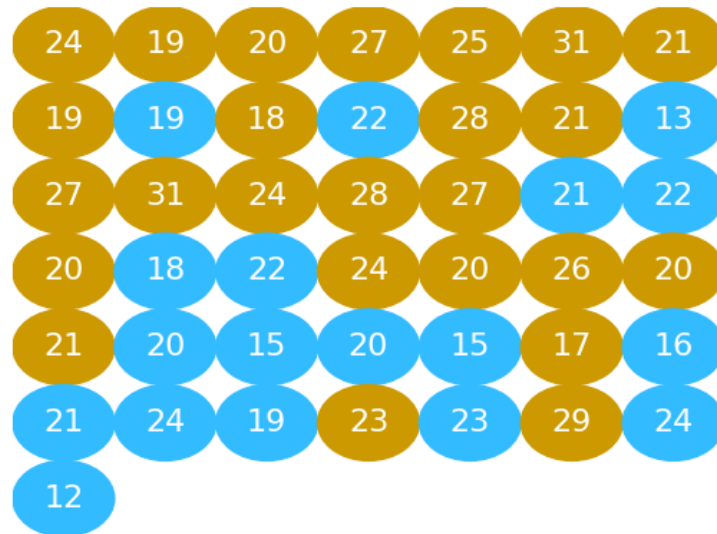
The difference in means



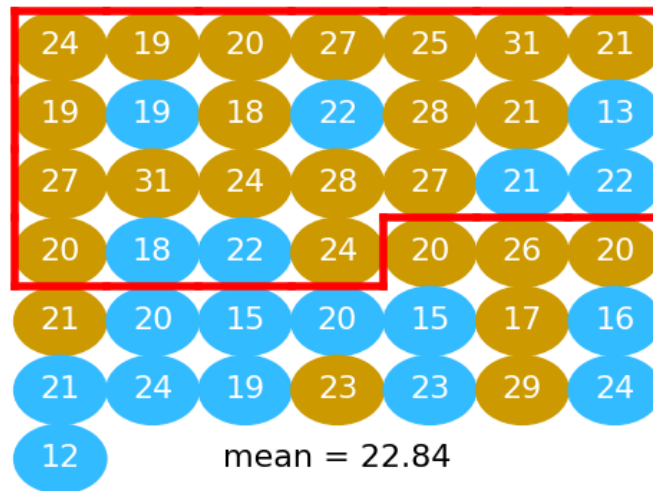
The difference in means: $23.60 - 19.22 = 4.38$



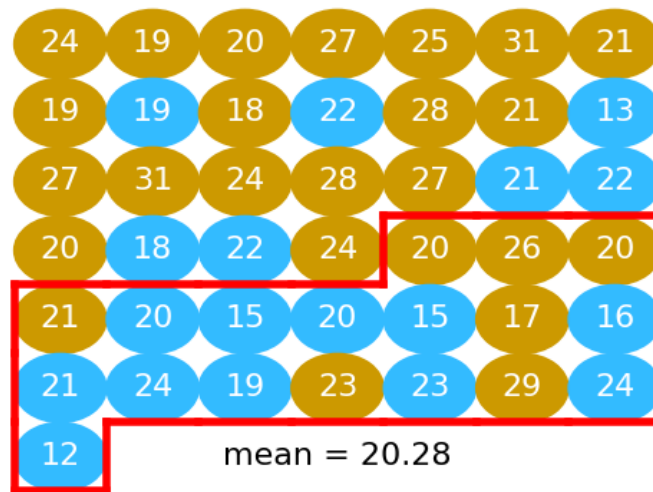
Shuffle



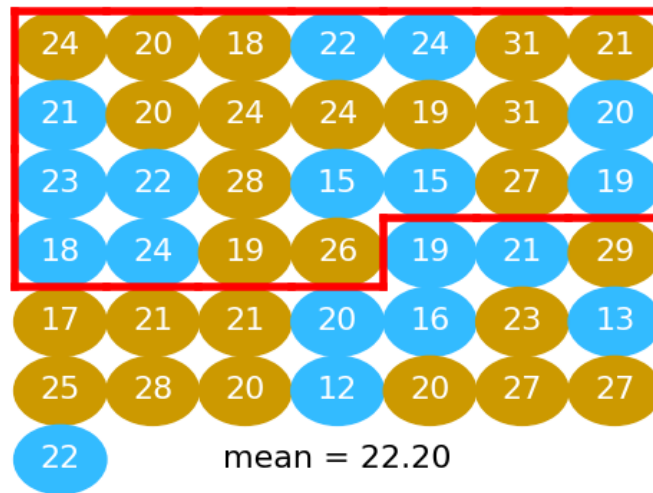
A difference if the null is true



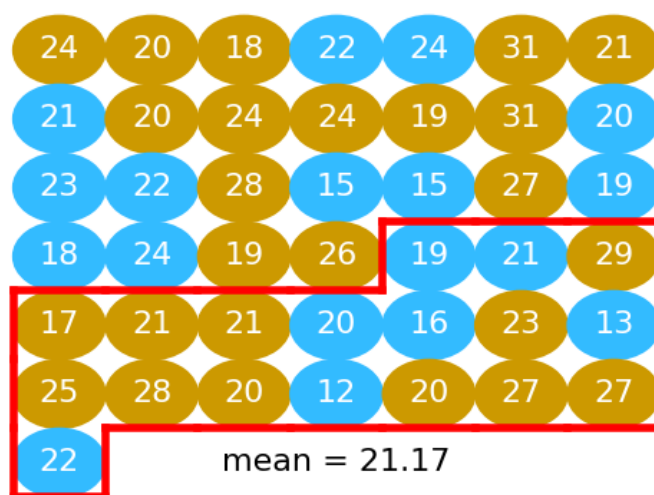
One difference on null: $22.84 - 20.28 = -1.26$



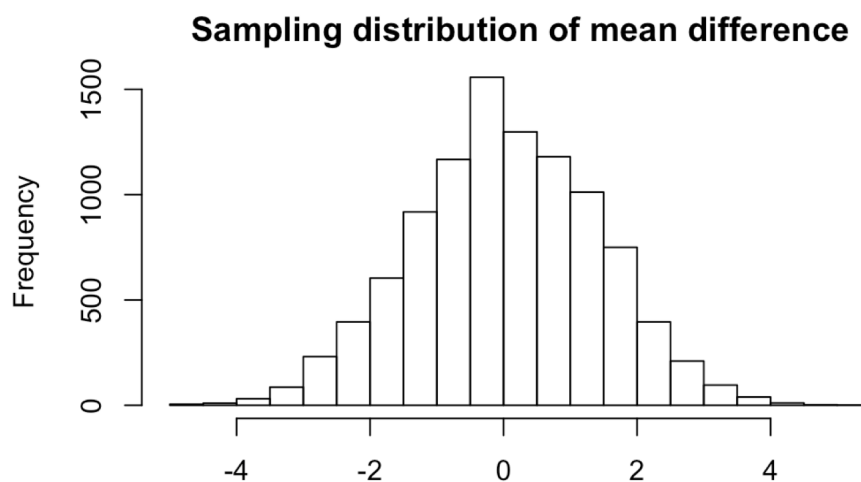
And again



Another difference on null: $22.20 - 21.17 = 1.03$



And so on, 10000 times



But how?

On to the notebooks.