

Two-sample t-test

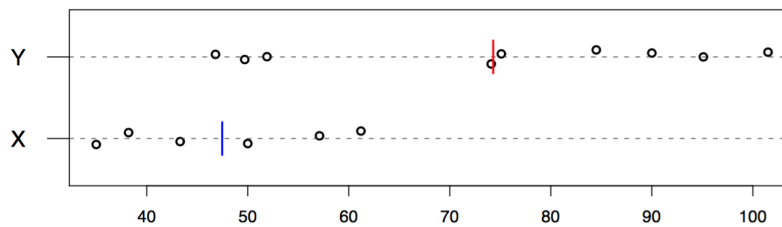
X_1, \dots, X_n iid Normal(μ_A, σ) Y_1, \dots, Y_m iid Normal(μ_B, σ)

Test $H_0 : \mu_A = \mu_B$ vs $H_a : \mu_A \neq \mu_B$

Test statistic: $T = \frac{\bar{X} - \bar{Y}}{s_p \sqrt{\frac{1}{n} + \frac{1}{m}}}$ where $s_p = \sqrt{\frac{s_A^2(n-1) + s_B^2(m-1)}{n+m-2}}$

→ Compare to the t distribution with $n + m - 2$ d.f.

Two-sample t-test



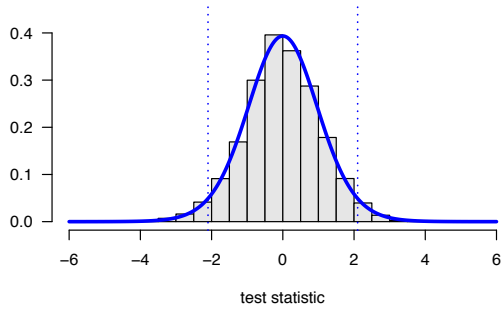
$$\bar{X} = 47.5 \quad s_A = 10.5 \quad n = 6$$

$$\bar{Y} = 74.3 \quad s_B = 20.6 \quad m = 9$$

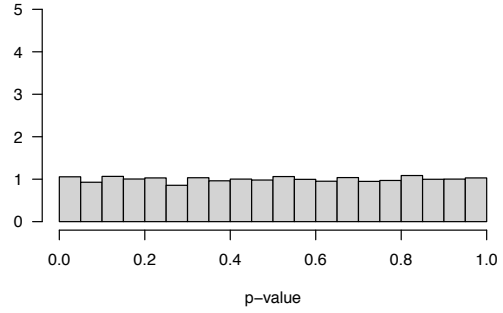
$$s_p = 17.4 \quad T = -2.93$$

$$\rightarrow P = 2 * pt(-2.93, 6+9-2) = 0.011.$$

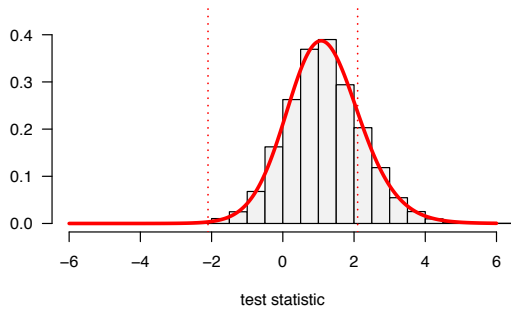
Under the null



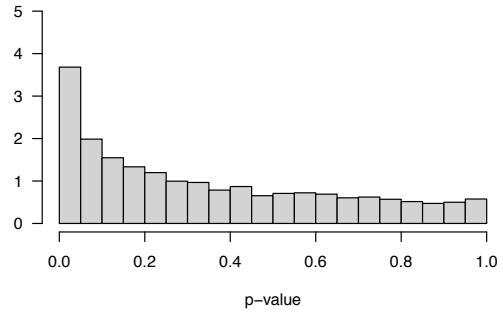
Significance level : 0.05



Under an alternative

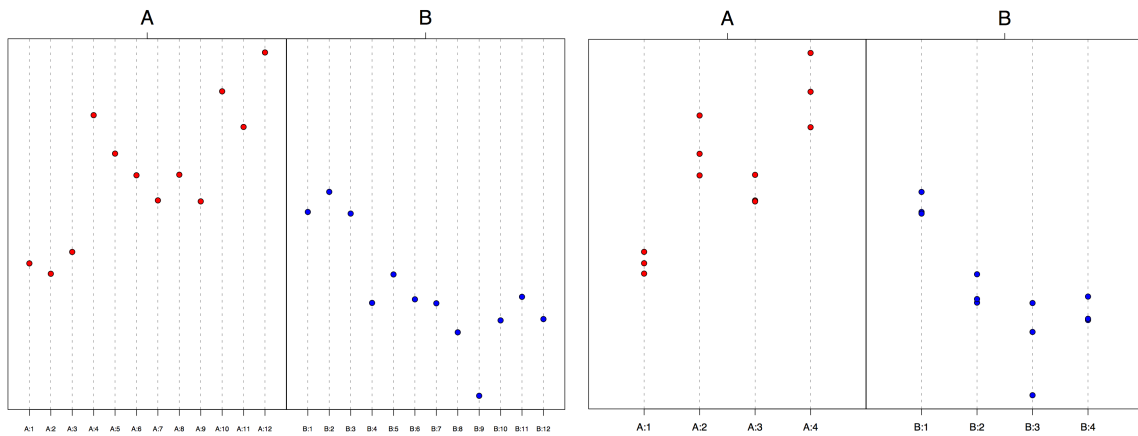


Power : 0.18

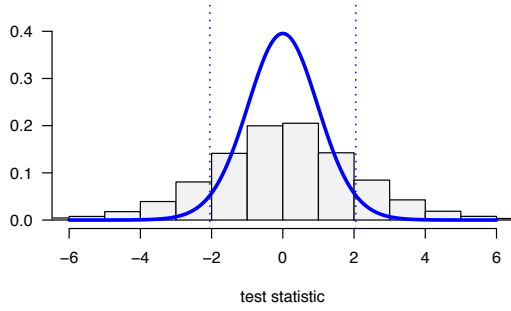


10 observations per group.
 Alternative: difference in means is one half within-group standard deviation.

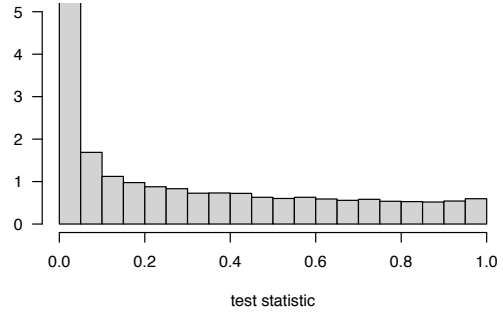
Technical replicates



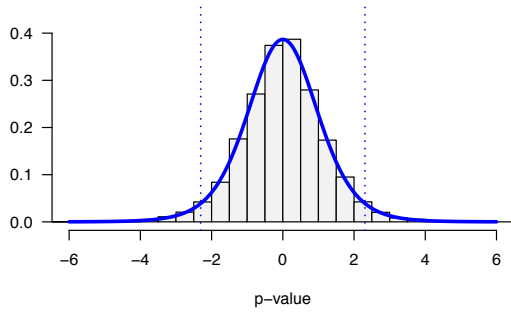
Ignoring dependence



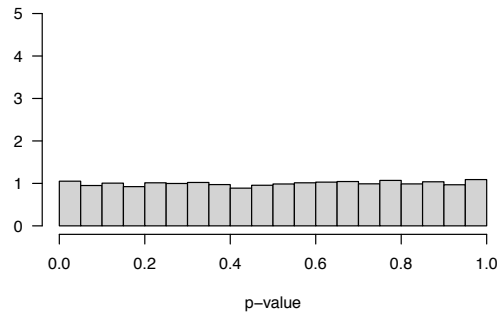
Significance level : 0.30



Accounting for dependence

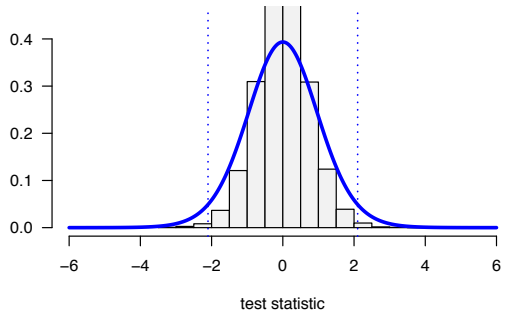


Significance level : 0.05

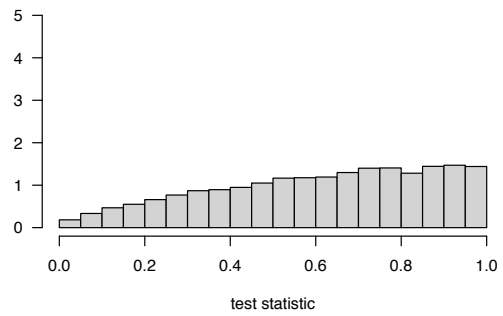


5 biological replicates per group, with 3 technical replicates each.
Biological variability (SD) ten times larger than technical variability.

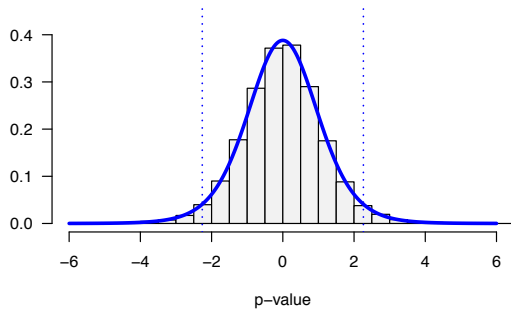
Ignoring dependence



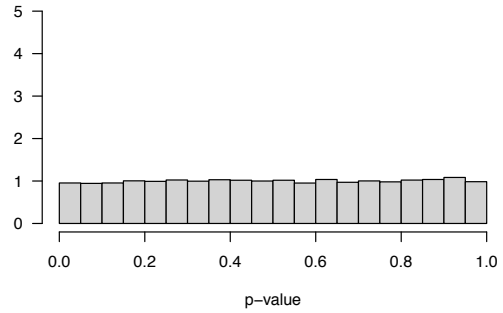
Significance level : 0.01



Accounting for dependence

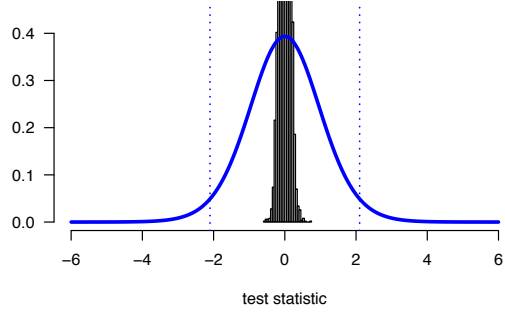


Significance level : 0.05

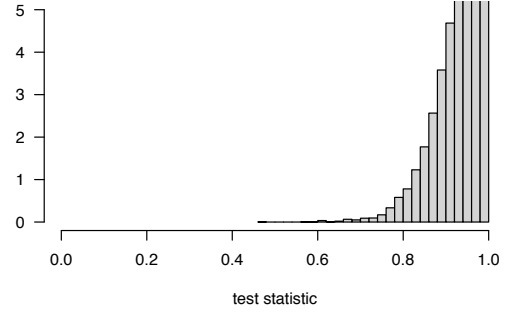


Paired data in ten observations.
Between subject variability (SD) equal to error.

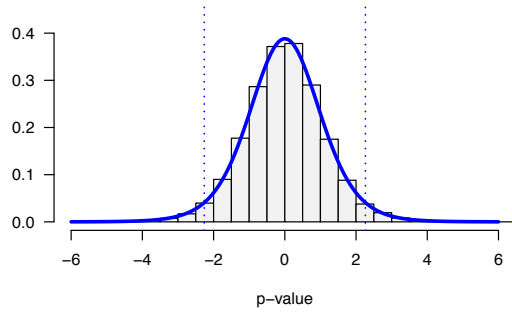
Ignoring dependence



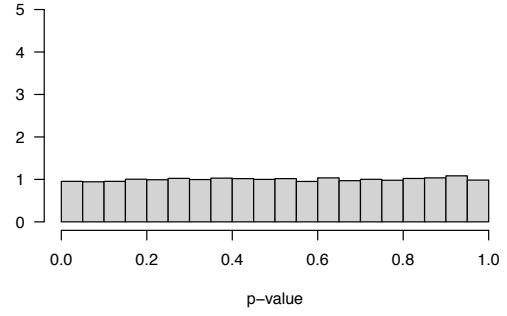
Significance level : 0.00



Accounting for dependence



Significance level : 0.05



Paired data in ten observations.
Between subject variability (SD) ten times larger than error.