



This histogram represents the permutation distribution of the difference between the two sample means, $\bar{X}_1 - \bar{X}_2$. This null distribution shows how this difference between the sample means would behave if there was no treatment (level of insulation) effect.

The observed difference in the sample means is here.

This is quite far away from the center of the null distribution giving evidence that level of insulation does have an effect on mean gas consumption. The P-value is below.

Histogram of Null Distribution -- Energy example either design

The vertical line marks the observed value of the statistic. The P-value is nondirectional. The second row gives the t-test P-value as an approximation of the permutation P-value

obsdiff	pvalue
-2.895238	0.01

t-test pvalue as an approximation of permutation pvalue

obsdiff	sediff	df	tcalc	tpvalue
-2.895238	1.0511752	24	-2.754287	0.011038

The observed difference in the means is $\bar{X}_{1} - \bar{X}_{2} = -2.8952$

The randomization P-value .01 shows that 1% of the 10,000 random assignments of the observations to the two groups yielded a difference at least 2.8952 units away from 0, that is, a difference less than or equal to -2.8952 or greater than or equal to 2.8952.

The Student's t P-value .0110 can be viewed as an approximation of the permutation P-value.