Permutation Test

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You can see presentation from below link.

https://www.jwilber.me/permutationtest/

```
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --

## v ggplot2 3.3.5     v purrr   0.3.4
## v tibble  3.1.6     v dplyr   1.0.8
## v tidyr   1.2.0     v stringr 1.4.0
## v readr   2.1.2     v forcats 0.5.1

## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
treat <- c(5.8,8.3,6.2,4.3,7.7,7.2,7.1,4.8,7.4,8.3,4.1,4.4)
control <- c(5.1,4.4,3.9,4.6,5.4,4.6,5.6,5.8,2.8,4.2,4.1,3.8)

z <- c(treat,control)

r <- sample(1:24,12)
r
```

```
##  [1] 11 10  1  5 19  6 23  7 22 24  8  9
```

```
z[r]
```

```
##  [1] 4.1 8.3 5.8 7.7 5.6 7.2 4.1 7.1 4.2 3.8 4.8 7.4
```

```
z[-r]
```

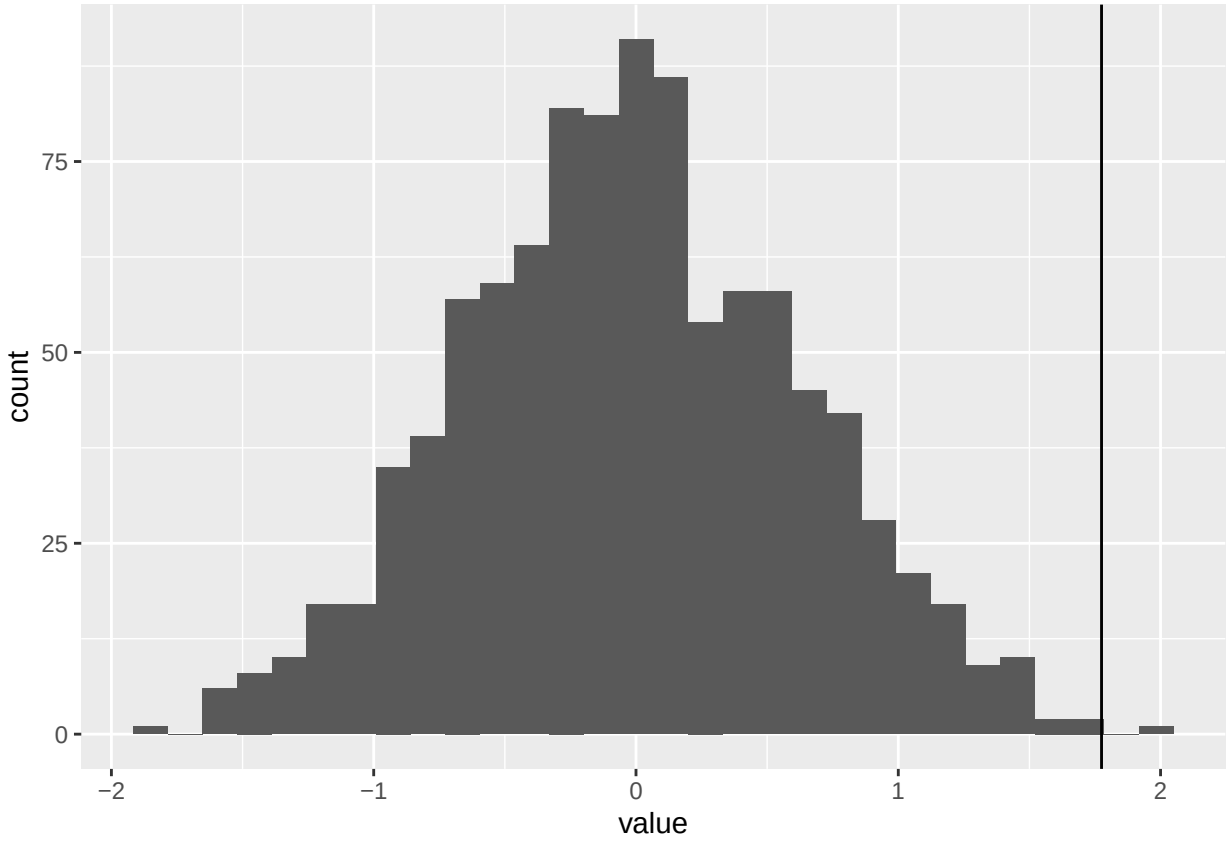
```
##  [1] 8.3 6.2 4.3 4.4 5.1 4.4 3.9 4.6 5.4 4.6 5.8 2.8
```

```
d <- c()

n <- 1000

for (i in 1:n)
{
  r <- sample(1:24,12)
  d <- c(d,mean(z[r]) - mean(z[-r]))
}

orginal_mean <- mean(treat) - mean(control)
d[1:20]
```

```
##  [1]  1.17500000  0.54166667 -0.49166667 -0.62500000  0.12500000  0.92500000
##  [7]  0.92500000  0.09166667 -0.54166667  0.12500000 -0.30833333  0.20833333
## [13] -0.19166667  0.22500000  0.22500000  0.82500000  1.54166667  1.22500000
## [19]  0.77500000  0.09166667
```

```
d = as_tibble(d)
ggplot(d,aes(value))+
  geom_histogram()+
  geom_vline(xintercept = orginal_mean)
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



```
p_val = sum(d >= orginal_mean) / n
p_val
```

```
## [1] 0.001
```

You can see other options for `perm.test` by using R help `?prem.test`

```
library(jmuOutlier)
```

```
## Warning: package 'jmuOutlier' was built under R version 4.1.3
```

```
#?perm.test
perm.test(treat,control,stat=mean)
```

```
## [[1]]
## [1] "Unpaired two-sample permutation test was performed."
##
## [[2]]
## [1] "p-value was estimated based on 20000 simulations."
##
## $alternative
## [1] "two.sided"
##
## $mu
## [1] 0
##
## $p.value
## [1] 0.0028
```

```
t.test(treat,control)
```

```
##
##  Welch Two Sample t-test
##
## data:  treat and control
## t = 3.4149, df = 16.937, p-value = 0.003314
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  0.6780525 2.8719475
## sample estimates:
## mean of x mean of y
##     6.300     4.525
```

```
wilcox.test(treat,control)
```

```
## Warning in wilcox.test.default(treat, control): cannot compute exact p-value
## with ties
```

```
##
##  Wilcoxon rank sum test with continuity correction
##
## data:  treat and control
## W = 117.5, p-value = 0.009298
## alternative hypothesis: true location shift is not equal to 0
```