STAT 351 Homework 2

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STAT 351-001

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Problem 1

```
rm(list=ls())
library(perm)
group1 <- c(2.9736,0.9448,1.6394,0.0389,1.2958)
group2 <- c(0.7681,0.8027,0.2156,0.0740,1.5076)
group3 <- c(4.8249,2.2516,1.5609,2.0452,1.0959)
data <- data.frame(obs=c(group1,group2,group3),group=factor(c(rep(1,length(group1)),rep(2,length(group2)
anova(lm(obs~group,data=data))                                                    # Problem 1a
```

```
## Analysis of Variance Table
##
## Response: obs
##           Df  Sum Sq Mean Sq F value  Pr(>F)
## group      2  7.1354  3.5677  2.9907 0.08834 .
## Residuals 12 14.3153  1.1929
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
permKS(data$obs~data$group,exact=TRUE,control=permControl(nmc=90000,p.conf.level=.95)) # Problem 1b
```

```
##
##  K-Sample Exact Permutation Test Estimated by Monte Carlo
##
## data:  data$obs by data$group
## p-value = 0.07301
##
## p-value estimated from 90000 Monte Carlo replications
## 95 percent confidence interval on p-value:
##  0.07130870 0.07471888
```

```
kruskal.test(list(group1,group2,group3))                                         # Problem 1c
```

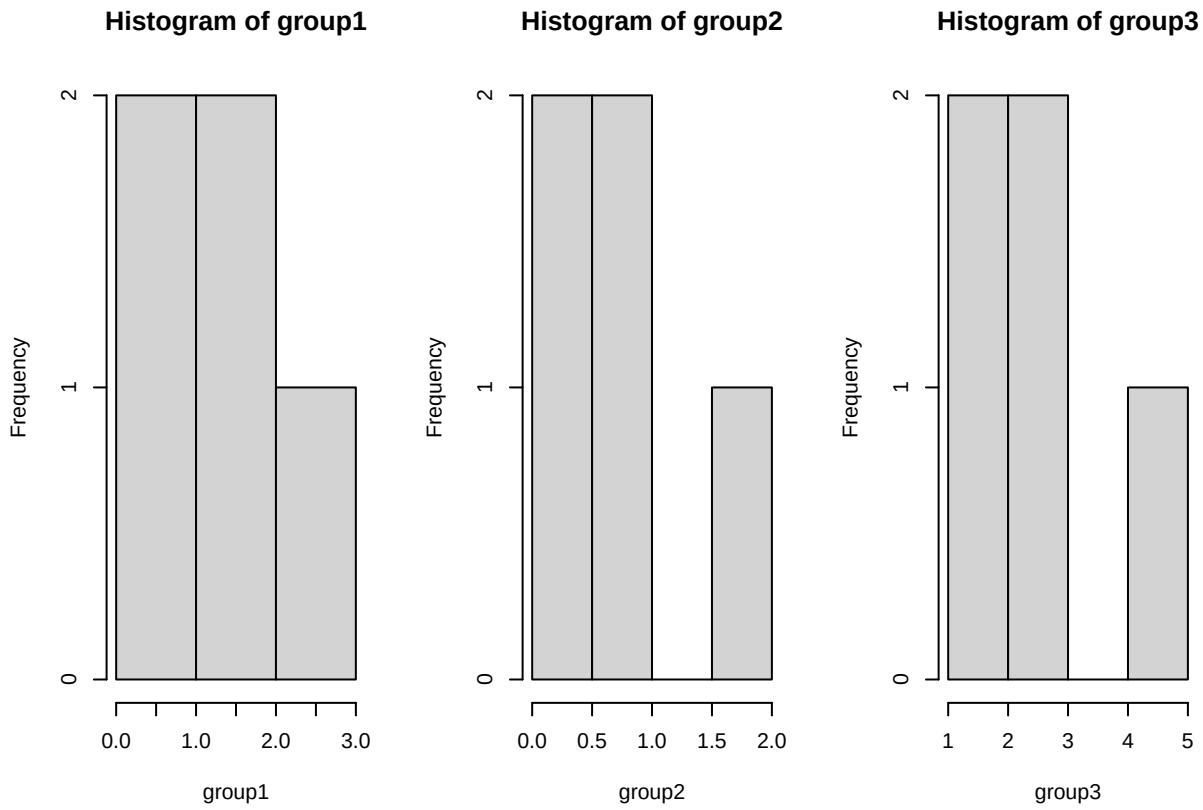
```
##
##  Kruskal-Wallis rank sum test
##
## data:  list(group1, group2, group3)
```

```
## Kruskal-Wallis chi-squared = 5.78, df = 2, p-value = 0.05558
```

```
c(var(group1),var(group2),var(group3))                                    # Problem 1d
```

```
## [1] 1.1504690 0.3226093 2.1057497
```

```
par(mfrow=c(1,3))
hist(group1)
hist(group2)
hist(group3)
```




```
cat("All three tests fail to reject the null hypothesis at a = 0.05. The p-values for the ANOVA F-test,
```

```
## All three tests fail to reject the null hypothesis at a = 0.05. The p-values for the ANOVA F-test, p
```

Problem 2

```
rm(list=ls())
data <- read.csv(file="/Users/newuser/Desktop/Notes/Undergraduate/STAT 351 - Nonparametric Statistical I
kruskal.test(list(data$score[data$group==1],data$score[data$group==2],data$score[data$group==3],data$sc
```

```
##
##  Kruskal-Wallis rank sum test
##
## data:  list(data$score[data$group == 1], data$score[data$group == 2], data$score[data$group == 3], da
## Kruskal-Wallis chi-squared = 26.033, df = 4, p-value = 3.116e-05
```

```
cat("We reject H0 at a = 0.05. There is sufficient evidence (p = ",kruskal.test(list(data$score[data$gr
```

```
## We reject H0 at a = 0.05. There is sufficient evidence (p = 3.11643e-05) that at least one of the me
```

```r
k = length(unique(data$group))
k*(k-1)/2
```

```
## [1] 10
```

```r
a = .05
a. = a/(k*(k-1)/2)
pairwise.wilcox.test(data$score,data$group,p.adjust.method="bonferroni")
```

```
##
##  Pairwise comparisons using Wilcoxon rank sum exact test
##
## data:  data$score and data$group
##
##   1      2      3      4
## 2 1.0000 -      -      -
## 3 0.0021 0.0209 -      -
## 4 0.0389 0.7526 0.0049 -
## 5 0.0209 0.1469 1.0000 0.0049
##
## P value adjustment method: bonferroni
```

```r
a.
```

```
## [1] 0.005
```

```r
cat("The differences between groups 1 and 3 (p = 0.0021), groups 3 and 4 (p = 0.0049), and groups 4 and
```

```
## The differences between groups 1 and 3 (p = 0.0021), groups 3 and 4 (p = 0.0049), and groups 4 and 5
```

Problem 3

```r
rm(list=ls())
site1 <- c(46,28,46,37,32,41,42,45,38,44)
site2 <- c(42,60,32,42,45,58,27,51,42,52)
site3 <- c(38,33,26,25,28,28,26,27,27,27)
site4 <- c(31,30,27,29,30,25,25,24,27,30)
# H0: m_1 = m_2 = m_3 = m_4
# HA: At least one m_i is different
a = .05
kruskal.test(list(site1,site2,site3,site4))
```

```
##
##  Kruskal-Wallis rank sum test
##
## data:  list(site1, site2, site3, site4)
## Kruskal-Wallis chi-squared = 22.852, df = 3, p-value = 4.335e-05
```

```r
cat("We reject H0 at a = ",a,". There is sufficient evidence (p = ",kruskal.test(list(site1,site2,site3
```

```
## We reject H0 at a = 0.05. There is sufficient evidence (p = 4.334659e-05) that at least one of the m
```