

### #Datasets for pre- and post-tests:

```
post=c(41,43,47,49,52,57,58,61,62,63,66,67,69,70,71,71,72,73,77,78,78,81,83,86,90,91,92,94,95,95)
```

```
pre=c(45,45,50,51,52,54,59,60,62,62,63,64,64,66,69,69,70,70,73,75,80,82,82,83,85,85,88,90,91,94)
```

### # Descriptive summaries (mean, median, range, standard deviation) for pre- and post-tests:

```
desc_sum=c(mean(pre),median(pre),max(pre)-min(pre),sd(pre))
```

```
desc_sum=c(mean(post),median(post),max(post)-min(post),sd(post))
```

### #Histograms for pre- and post-tests:

```
hist(pre, breaks=20, main ="Histogram of Pre-test Scores",xlab = "Score (percentage)", ylab="Frequency")
```

```
hist(post, breaks=20, main ="Histogram of Post-test Scores",xlab = "Score (percentage)", ylab="Frequency")
```

### #Separate boxplots for pre- and post-tests:

```
boxplot(pre, main="Boxplot of Exam Scores for Pre-test")
```

```
boxplot(post, main ="Boxplot of Exam Scores for Post-test")
```

### #Comparative horizontal boxplots for pre- and post-tests:

```
boxplot(pre, post, main="Exam Scores Comparison for Pre-test and Post- test", xlab = "Score (percentage)",  
horizontal=TRUE, names=c("Pre-test","Post- test"))
```

```
# Wilcoxon signed rank test (the non-parametric alternative to the paired t-test):
```

```
wilcox.test(pre,post,paired=TRUE,alternative="two.sided",mu=0,conf.int=TRUE,conf.level=0.95)
```

```
wilcox.test(pre,post,paired=TRUE,alternative="less",mu=0,conf.int=TRUE,conf.level=0.95)
```

```
#Chi-square Independence Test:
```

```
#Likert reponses of GroupA (70%+) in row1, Likert reponses of GroupB (<70%) in row2
```

```
row1=c(0,0,5,3,6)
```

```
row2=c(2,5,2,6,1)
```

```
data.table=rbind(row1,row2)
```

```
chisq.test(data.table)
```

```
# Pearson correlation (pre- vs. post-test score, for ratio/interval data only)
```

```
# data rearranged to ensure pre- and post-test are in the same position for each student
```

```
pre=c(45,45,50,51,52,54,59,60,62,62,63,64,64,66,69,69,70,70,73,73,80,82,82,83,85,85,88,90,91,94)
```

```
post=c(61,57,52,58,49,63,41,66,43,67,47,77,62,71,72,69,70,78,73,71,78,94,83,81,86,92,90,95,91,95)
```

```
cor(pre,post,method="pearson")
```

