R Notebook

This is an R Markdown Notebook. When you execute code within the notebook, the results appear beneath the code.

Try executing this chunk by clicking the *Run* button within the chunk or by placing your cursor inside it and pressing *Cmd+Shift+Enter*.

Environment setup

```
knitr::opts_chunk$set(echo = TRUE, tidy.opts = list(width.cutoff = 60), tidy = TRUE)

library(reshape2) # for formatting and aggregation of data frames
library(ggplot2) # for creating graphs
library(dplyr) # for data manipulation and clean-up
```

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(plotly) # for creating interactive web graphics from ggplot2 graphs
```

```
##
## Attaching package: 'plotly'

## The following object is masked from 'package:ggplot2':
##
##     last_plot

## The following object is masked from 'package:stats':
##
##     filter

## The following object is masked from 'package:graphics':
##
##     layout
```

```r
library(knitr) # required for generating PDF output
library(modeest) # required for `mfv()` function
```

```
## Registered S3 method overwritten by 'rmutil':
##   method         from
##   print.response httr
```

```r
library(nortest)
```

Loading the data

```r
data_original <- read.csv("data.csv")
```

```
## Warning in read.table(file = file, header = header, sep = sep, quote = quote, :
## incomplete final line found by readTableHeader on 'data.csv'
```

```r
print(data_original)
```

```
##       Media ObjTime SubTime EmotionalEngagement Recall Reconstruct
## 1 PrintBook      15      10                   17     19           6
## 2 PrintBook      18      12                   38     17           6
## 3    kindle      16      12                   44     20           6
## 4    kindle      19      15                   23     16           6
```

```r
mode(data_original)
```

```
## [1] "list"
```

```r
typeof(data_original)
```

```
## [1] "list"
```

```r
is.data.frame(data_original)
```

```
## [1] TRUE
```

```r
sd(c(12, 15))
```

```
## [1] 2.12132
```

Bootstrapping

Extended Time data from 4 to 400

```
set.seed(12345)
expande_ObjTime_Kindle <- rnorm(15, mean = 17.5, sd = 2)
expande_ObjTime_Kindle <- round(expande_ObjTime_Kindle, 0)


expande_ObjTime_PrintBook <- rnorm(15, mean = 16.5, sd = 2)
expande_ObjTime_PrintBook <- round(expande_ObjTime_PrintBook,
    0)


e_ObjTime <- append(expande_ObjTime_Kindle, expande_ObjTime_PrintBook)


expande_SubTime_Kindle <- rnorm(15, mean = 11, sd = 3)
expande_SubTime_Kindle <- round(expande_SubTime_Kindle, 0)
# expande_SubTime_Kindle


expande_SubTime_PrintBook <- rnorm(15, mean = 13.5, sd = 3)
expande_SubTime_PrintBook <- round(expande_SubTime_PrintBook,
    0)
# expande_SubTime_PrintBook

e_SubTime <- append(expande_SubTime_Kindle, expande_SubTime_PrintBook)
```

Extended data from 4 to 4000

```
# set.seed(8745)

expande_EE_Kindle <- rnorm(15, mean = 33.5, sd = 15)
expande_EE_Kindle <- round(expande_EE_Kindle, 0)

expande_EE_PrintBook <- rnorm(15, mean = 22.5, sd = 12)
expande_EE_PrintBook <- round(expande_EE_PrintBook, 0)

e_EE <- append(expande_EE_Kindle, expande_EE_PrintBook)


expande_Recall_Kindle <- rnorm(15, mean = 18, sd = 2)
expande_Recall_Kindle <- round(expande_Recall_Kindle, 0)

expande_Recall_PrintBook <- rnorm(15, mean = 18, sd = 4)
expande_Recall_PrintBook <- round(expande_Recall_PrintBook, 0)

e_Recall <- append(expande_Recall_Kindle, expande_Recall_PrintBook)


expande_Reconstruct_Kindle <- rnorm(15, mean = 4, sd = 1)
expande_Reconstruct_Kindle <- round(expande_Reconstruct_Kindle,
    0)

expande_Reconstruct_PrintBook <- rnorm(15, mean = 4, sd = 1)
expande_Reconstruct_PrintBook <- round(expande_Reconstruct_PrintBook,
```

```
    0)

e_Reconstruct <- append(expande_Reconstruct_Kindle, expande_Reconstruct_PrintBook)
```

Loading the new data

```
data_expande <- data.frame(Media = rep(c("kindle", "PrintBook"),
    each = 15), ObjTime = c(e_ObjTime), SubTime = c(e_SubTime),
    EmotionalEngagement = c(e_EE), Recall = c(e_Recall), Reconstruct = c(e_Reconstruct))
data_expande
```

```
##        Media ObjTime SubTime EmotionalEngagement Recall Reconstruct
## 1     kindle      19      13                  36     16           6
## 2     kindle      19      18                  13     16           5
## 3     kindle      17      17                  42     22           4
## 4     kindle      17      16                  57     17           6
## 5     kindle      19      12                  25     16           4
## 6     kindle      14      12                   6     19           3
## 7     kindle      19      10                  47     17           2
## 8     kindle      17       6                  57     22           5
## 9     kindle      17      16                  41     17           2
## 10    kindle      16      11                  14     17           3
## 11    kindle      17      14                  34     18           6
## 12    kindle      21       4                  22     16           5
## 13    kindle      18       8                  18     19           5
## 14    kindle      19      14                  68     15           3
## 15    kindle      16      14                  55     18           7
## 16 PrintBook      18      18                  34     16           3
## 17 PrintBook      15       9                  32     17           3
## 18 PrintBook      16      15                  13     24           5
## 19 PrintBook      19      15                  28     16           4
## 20 PrintBook      17      10                  35     19           4
## 21 PrintBook      18      12                  30     13           3
## 22 PrintBook      19      19                  35     13           3
## 23 PrintBook      15      14                  19     23           3
## 24 PrintBook      13      15                  52     23           2
## 25 PrintBook      13      11                  34     18           4
## 26 PrintBook      20      14                  45     16           5
## 27 PrintBook      16      16                  31     18           2
## 28 PrintBook      18      16                  19     21           5
## 29 PrintBook      18      20                  29     27           5
## 30 PrintBook      16       6                  32     18           4
```

t-test for ObjTime& SubTime

Two-sample t-test

```r
mean(data_expande$ObjTime)
```

```
## [1] 17.2
```

```r
sd(data_expande$ObjTime)
```

```
## [1] 1.954658
```

```r
t.test(data_expande$ObjTime ~ data_expande$Media, alternative = "two.sided",
    var.equal = TRUE)
```

```
##
##  Two Sample t-test
##
## data:  data_expande$ObjTime by data_expande$Media
## t = 1.3246, df = 28, p-value = 0.196
## alternative hypothesis: true difference in means between group kindle and group PrintBook is not equa
## 95 percent confidence interval:
##  -0.5100423  2.3767090
## sample estimates:
##    mean in group kindle mean in group PrintBook
##                17.66667                16.73333
```

```r
t.test(data_expande$SubTime ~ data_expande$Media, alternative = "two.sided",
    var.equal = TRUE)
```

```
##
##  Two Sample t-test
##
## data:  data_expande$SubTime by data_expande$Media
## t = -1.1629, df = 28, p-value = 0.2547
## alternative hypothesis: true difference in means between group kindle and group PrintBook is not equa
## 95 percent confidence interval:
##  -4.602377  1.269043
## sample estimates:
##    mean in group kindle mean in group PrintBook
##                12.33333                14.00000
```

t-test for point

```r
t.test(data_expande$EmotionalEngagement ~ data_expande$Media,
    alternative = "two.sided", var.equal = TRUE)
```

```
##
##  Two Sample t-test
##
## data:  data_expande$EmotionalEngagement by data_expande$Media
```

```
## t = 0.81422, df = 28, p-value = 0.4224
## alternative hypothesis: true difference in means between group kindle and group PrintBook is not equa
## 95 percent confidence interval:
##  -6.770479 15.703812
## sample estimates:
##    mean in group kindle mean in group PrintBook
##                35.66667                31.20000
```

```
t.test(data_expande$Recall ~ data_expande$Media, alternative = "two.sided",
    var.equal = TRUE)
```

```
##
##  Two Sample t-test
##
## data:  data_expande$Recall by data_expande$Media
## t = -0.96156, df = 28, p-value = 0.3445
## alternative hypothesis: true difference in means between group kindle and group PrintBook is not equa
## 95 percent confidence interval:
##  -3.547680  1.281014
## sample estimates:
##    mean in group kindle mean in group PrintBook
##                17.66667                18.80000
```

```
t.test(data_expande$Reconstruct ~ data_expande$Media, alternative = "two.sided",
    var.equal = TRUE)
```

```
##
##  Two Sample t-test
##
## data:  data_expande$Reconstruct by data_expande$Media
## t = 1.5192, df = 28, p-value = 0.1399
## alternative hypothesis: true difference in means between group kindle and group PrintBook is not equa
## 95 percent confidence interval:
##  -0.255468  1.722135
## sample estimates:
##    mean in group kindle mean in group PrintBook
##                4.400000                3.666667
```

```
# t.test(data_expande$Reconstruct ~ data_expande$Media)
```