```r
cophenD.R <- function(){
# compares clustering results by computing
# correlations between cophenetic distances
# and distances

#read data
data("USArrests")
# Load libraries
#library("factoextra")

# standardize data
df <- scale(USArrests)
# compute matrix of distances
res.dist <- dist(df, method = "euclidean")

# ward 2 cluster
res.hc <- hclust(d = res.dist, method = "ward.D2")
res.coph <- cophenetic(res.hc)

# single linkage cluster
res.hc3 <- hclust(d = res.dist, method = "single")
res.coph3 <- cophenetic(res.hc3)

# complete linkage cluster
res.hc2 <- hclust(d = res.dist, method = "complete")
res.coph2 <- cophenetic(res.hc2)

# average linkage cluster
res.hc1 <- hclust(d = res.dist, method = "average")
res.coph1 <- cophenetic(res.hc1)

# ward  cluster
res.hc4 <- hclust(d = res.dist, method = "ward.D")
res.coph4 <- cophenetic(res.hc4)

# Median cluster
res.hc5 <- hclust(d = res.dist, method = "median")
res.coph5 <- cophenetic(res.hc5)

# Centroid cluster
res.hc6 <- hclust(d = res.dist, method = "centroid")
res.coph6 <- cophenetic(res.hc6)

# compute correlations
cat("correlation: distance vs. cophenetic distance (Method Ward2) =",cor(res.dist, res.coph),"\n")
cat("correlation: distance vs. cophenetic distance (Method Single Lkg)=",cor(res.dist, res.coph3),"\n")
cat("correlation: distance vs. cophenetic distance (Method Complete Lkg)=",cor(res.dist, res.coph2),"\n")
cat("correlation: distance vs. cophenetic distance (Method Average Lkg)=",cor(res.dist, res.coph1),"\n")
cat("correlation: distance vs. cophenetic distance (Method Ward)=",cor(res.dist, res.coph4),"\n")
cat("correlation: distance vs. cophenetic distance (Method Median)=",cor(res.dist, res.coph5),"\n")
cat("correlation: distance vs. cophenetic distance (Method Centroid)=",cor(res.dist, res.coph6),"\n")

}
```

```
R version 3.6.3 (2020-02-29) -- "Holding the Windsock"
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Platform: x86_64-apple-darwin15.6.0 (64-bit)

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'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

[R.app GUI 1.70 (7735) x86_64-apple-darwin15.6.0]

[History restored from /Users/albertocontreras/Desktop/Ciencia de Datos 2021/Multivariate Analysis/
AppMultivDataAnalysis 4thEd/NotasDeClase/Cluster Analysis/USArrests/.Rapp.history]

> source("cophenD.R")
> cophend.R()
Error in cophend.R() : could not find function "cophend.R"
> cophenD.R()
correlation: distance vs. cophenetic distance (Method Ward2) = 0.6975266
correlation: distance vs. cophenetic distance (Method Single Lkg)= 0.541272
correlation: distance vs. cophenetic distance (Method Complete Lkg)= 0.6979437
correlation: distance vs. cophenetic distance (Method Average Lkg)= 0.7180382
correlation: distance vs. cophenetic distance (Method Ward)= 0.6844016
correlation: distance vs. cophenetic distance (Method Median)= 0.436442
correlation: distance vs. cophenetic distance (Method Centroid)= 0.6074717
>
```