HW#5

Haichuan Du

6/29/2020

#2

```
library(clinfun)
library(jmuOutlier)
library(testforDEP) #Testing for dependency using Hoeffding's test and others.
```

```
## Loading required package: parallel
```

```
## Loading required package: minerva
```

```
## Loading required package: Hmisc
```

```
## Loading required package: lattice
```

```
## Warning: package 'lattice' was built under R version 3.6.2
```

```
## Loading required package: survival
```

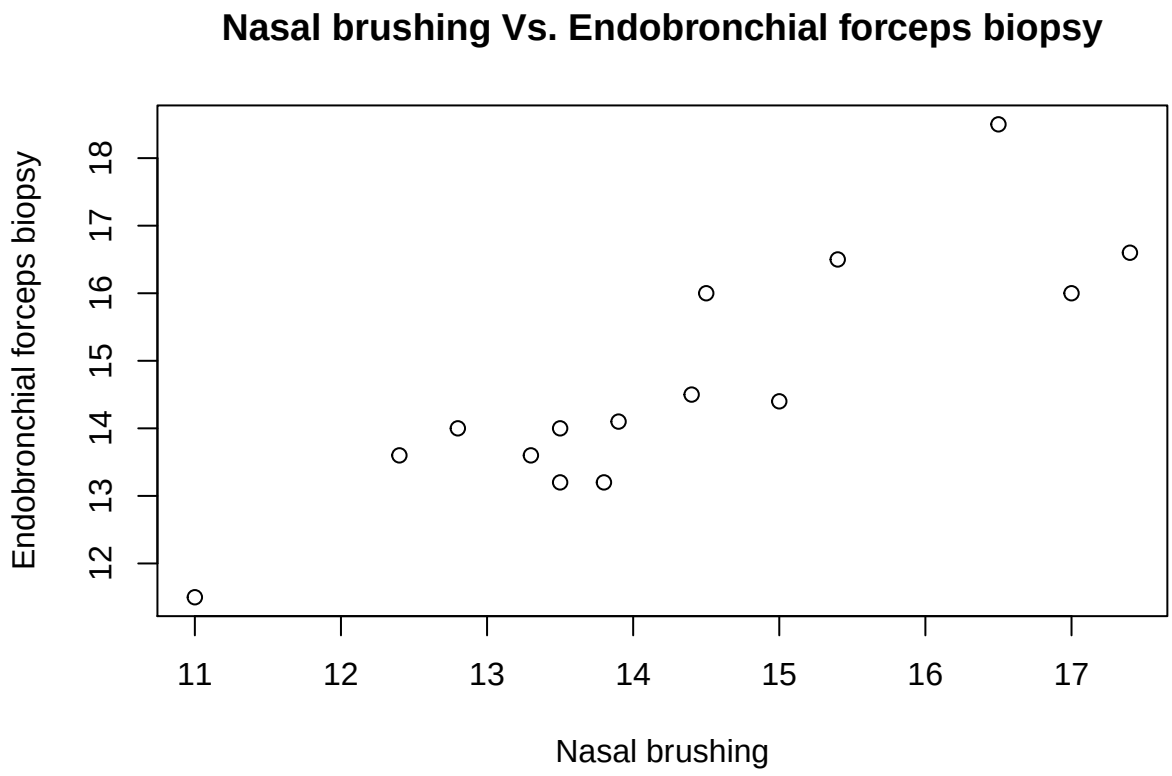
```
## Loading required package: Formula
```

```
## Loading required package: ggplot2
```

```
##
## Attaching package: 'Hmisc'
```

```
## The following objects are masked from 'package:base':
##
##     format.pval, units
```

```
x <- c(15.4, 13.5, 13.3, 12.4, 12.8, 13.5, 14.5, 13.9, 11.0, 15.0, 17.0, 13.8, 17.4, 16.5, 14.4)
y <- c(16.5, 13.2, 13.6, 13.6, 14.0, 14.0, 16.0, 14.1, 11.5, 14.4, 16.0, 13.2, 16.6, 18.5, 14.5)
plot(x,y,
     main = "Nasal brushing Vs. Endobronchial forceps biopsy",
     xlab = "Nasal brushing",
     ylab = "Endobronchial forceps biopsy")
```




```
#a)
cor.test(x,y,method='kendall')  # p-value = 0.0002291
```

```
## Warning in cor.test.default(x, y, method = "kendall"): Cannot compute exact
## p-value with ties
```

```
##
##  Kendall's rank correlation tau
##
## data:  x and y
## z = 3.6845, p-value = 0.0002291
## alternative hypothesis: true tau is not equal to 0
## sample estimates:
##       tau
## 0.7220285
```

```
#b)
perm.cor.test(x,y,method='spearman')  #p-value = 0
```

```
## [[1]]
## [1] "Permutation correlation test.  Method is spearman"
##
## [[2]]
## [1] "p-value was estimated based on 20000 simulations."
```

```
##
## $alternative
## [1] "two.sided"
##
## $p.value
## [1] 1e-04
```

```
#c)
cor.test(x,y,method='pearson')    #   p-value = 3.012e-05
```

```
##
##  Pearson's product-moment correlation
##
## data:  x and y
## t = 6.2417, df = 13, p-value = 3.012e-05
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.6355679 0.9546952
## sample estimates:
##       cor
## 0.8659097
```

```
#d)
testforDEP(x,y,test='HOEFFD')   #p-value < 0.05
```

```
## An object of class "testforDEP_result"
## Slot "TS":
## [1] 0.4279158
##
## Slot "p_value":
## [1] 9.999e-05
##
## Slot "CI":
## list()
```

A scatterplot of the Nasal brushing Vs. Endobronchial forceps biopsy is given above. In viewing this plot, there is a fairly strong, positive, linear association between Nasal brushing and Endobronchial forceps biopsy.

Ho: No association between Nasal brushing and Endobronchial forceps biopsy Ha: Some assoiation between Nasal brushing and Endobronchial forceps biopsy

By comparing four different tests. We get all p values less than 0.05. Therefore, we reject Ho and conclude Ha, that is, we have enough evidence at 0.05 level to conclude that some assoiation between Nasal brushing and Endobronchial forceps biopsy.

Kendall's test, Spearman's test, and permutation test are all designed to be sensitive to alternatives where Y increase with x or Y decreases with x, so it's not surprising to see that they have relatively small P values. Hoeffding's test is not designed for detecting Monotone, but it still has good power to detect any kind of association given suffcient data.