

In-class exercise 10 Solution
Topic: Correlation

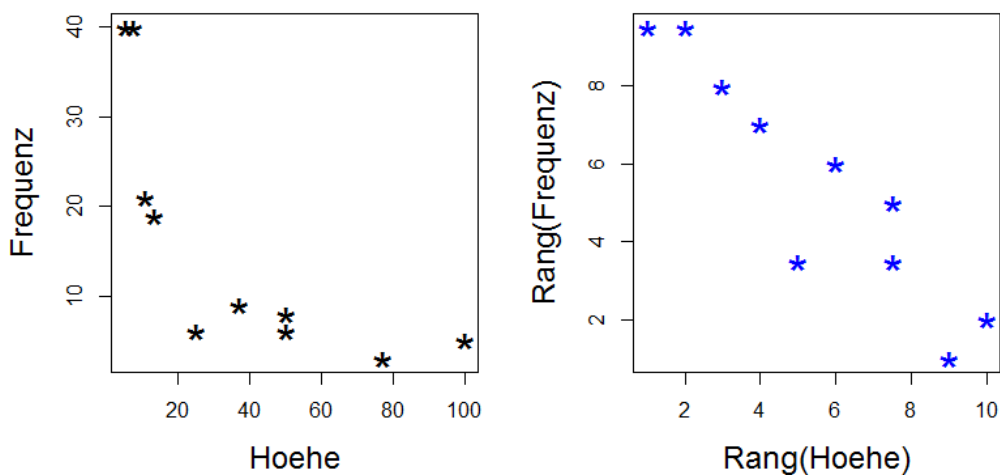
In a science article (Science, 164 (1969), p.1513) a study was presented that investigated the association between the height of a waterfall and the frequency of vibrations in the ground.

Name	h: Hoehe	f: Frequenz	Rang(f)	Rang(h)
Lower.Yellowstone	100	5	2	10
Yosemite	77	3	1	9
Canadian.Niagara	50	6	3.5	7.5
American.Niagara	50	8	5	7.5
Upper.Yellowstone	37	9	6	6
Lower.Gullfoss	25	6	3.5	5
Firehole	13.3	19	7	4
Godafoss	10.9	21	8	3
Upper.Gullfoss	7.7	40	9.5	2
Fort.Greeley	5.2	40	9.5	1

The following graph shows a scatterplot of frequency vs height.

a) Describe the form of the association.

The association is monotonically decreasing. The relationship is not linear but looks more like an exponential decay.



b) Is the Pearson correlation here appropriate? Give reasons.

No, the Pearson correlation is not appropriate, since the relationship is not linear.

c) Determine in the table the missing ranks and visualize the relationships as scatter plot.

d) Determine in R the Pearson and rank correlation.

```
h=c(100,77,50,50,37,25,13.3,10.9,7.7,5.2)
```

```
f=c(5,3,6,8,9,6,19,21,40,40)
```

```
length(h) # 10
```

```
length(f) # 10
```

```
h.rank=rank(h) # Vektor mit Raengen statt original-Werten
```

```
f.rank=rank(f)
```

```
plot(h,f) # immer zuerst Zusammenhang visualisieren
```

```
plot(h.rank,f.rank)
```

```
cor(h,f) # - 0.74
```

```
cor(h,f,method= "pearson" ) # -0.74 -> pearson ist default
```

```
cor(h,f,method= "spearman" ) # -0.93
```

```
cor(h.rank,f.rank) # -0.93 -> spearman ist pearson mit raengen
```

$$r_{s,R^sR} = \frac{\sum_{i=1}^{10} ({}^sR_i - {}^s\bar{R})({}^sR_i - {}^s\bar{R})}{\sqrt{\sum_{i=1}^{10} ({}^sR_i - {}^s\bar{R})^2} \cdot \sqrt{\sum_{i=1}^{10} ({}^sR_i - {}^s\bar{R})^2}} = -0.92$$

e) What can you learn from the absolute value and the sign of the correlation?

The absolute value quantifies the strength of the monotonic relationship (a deterministic monotone relationship yields the highest possible absolute value which is one). A negative sign indicates a decreasing relationship and a positive sign an increasing one (negative Vorzeichen) oder monoton steigende Beziehung handelt.

Problem 2)

