Lösungen zur Übung 2

1. a)

```
> farbe <- c("braun", "rot", "gelb", "gruen", "orange", "gelbbraun")
> sch <- matrix(rep(" ", 10 * 25), ncol = 10)
> for(i in 1:10) sch[, i] <- sample(farbe, 25, prob =
+ c(0.3, 0.2, 0.2, 0.1, 0.1, 0.1), replace = T)

> table(sch)
 braun gelb gelbbraun gruen orange rot
    63   41        30    30     23  63        beobachtet = 2.3, erwartet = 2.5
                                ===
```

b)

```
> apply(sch, 2, table)
[[1]]:
 braun gelb gelbbraun gruen orange rot
     5    1         5     3      3   8
[[2]]:
 braun gelb gelbbraun gruen orange rot
     5    8         1     2      5   4
[[3]]:
 braun gelb gelbbraun gruen rot
     6    3         3     5   8                keine orangen  Smarties
[[4]]:
 braun gelb gelbbraun gruen orange rot
     7    4         4     4      2   4
[[5]]:
 braun gelb gelbbraun gruen orange rot
     8    4         4     1      1   7
[[6]]:
 braun gelb gelbbraun gruen orange rot
    10    3         3     4      2   3
[[7]]:
 braun gelb gruen orange rot
     8    2     5      3   7
[[8]]:
 braun gelb gelbbraun gruen orange rot
     5    7         2     1      2   8
[[9]]:
 braun gelb gelbbraun gruen rot                keine orangen Smarties
     2    5         6     4   8
[[10]]:
 braun gelb gelbbraun gruen orange rot
     7    4         2     1      5   6
```

Zwei Schachteln waren ohne orange Smarties. Die Wahrscheinlichkeit, dass eine Schachtel keine orangen Smarties enthält ist gleich
$P(1.\text{ ist nicht orange}) \cdot P(2.\text{ ist nicht orange}) \cdot \ldots \cdot P(25.\text{ ist nicht orange}) = (0.9)^{25} = 0.0718$.
Erwartete Anzahl Schachteln ohne orange Smarties $= 10 \cdot 0.0718 = 0.718$.

2.
```
> munz_sample(0:1,500,prob=c(0.5,0.5),replace=T)
> munz_matrix(munz,ncol=50)
> munz
      [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12]
 [1,]    0    0    0    1    1    0    0    0    1     1     0     0
 [2,]    0    0    0    0    1    0    1    0    0     0     0     1
 [3,]    0    1    0    1    1    1    1    1    0     0     0     0
 [4,]    1    0    0    0    1    1    1    1    1     1     1     0
 [5,]    1    0    1    1    0    1    1    1    1     1     0     1
 [6,]    0    1    1    0    1    0    0    1    1     0     0     0
 [7,]    1    0    1    1    1    1    1    1    0     1     0     1
 [8,]    0    0    1    1    0    1    0    0    1     1     0     0
 [9,]    0    0    0    1    1    1    1    1    0     1     0     0
[10,]    1    0    0    0    0    0    0    1    1     0     0     1
      [,13] [,14] [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22]
 [1,]     0     1     1     1     0     0     0     0     0     0
 [2,]     0     0     1     1     0     1     0     0     0     0
 [3,]     1     0     1     1     0     0     1     1     0     1
 [4,]     0     1     1     1     1     0     1     0     1     1
 [5,]     0     0     1     0     1     0     1     0     1     1
 [6,]     0     0     1     1     1     0     1     1     0     1
 [7,]     1     1     1     1     1     0     1     0     1     1
 [8,]     1     0     1     0     0     0     1     0     1     0
 [9,]     0     1     1     1     1     1     0     0     0     1
[10,]     0     1     1     1     0     1     0     1     1     1
      [,23] [,24] [,25] [,26] [,27] [,28] [,29] [,30] [,31] [,32]
 [1,]     0     0     0     1     1     1     0     1     0     0
 [2,]     1     1     0     1     1     1     1     0     1     0
 [3,]     1     1     0     0     1     0     0     0     0     1
 [4,]     1     1     1     1     1     1     0     0     1     1
 [5,]     1     0     1     1     0     1     0     1     0     0
 [6,]     0     0     1     0     1     0     0     1     0     1
 [7,]     0     0     1     1     1     0     1     1     1     0
 [8,]     0     0     0     0     1     1     1     0     1     0
 [9,]     0     1     1     1     0     0     1     1     0     1
[10,]     1     0     1     1     0     1     0     1     1     1
      [,33] [,34] [,35] [,36] [,37] [,38] [,39] [,40] [,41] [,42]
 [1,]     1     0     1     0     1     1     0     1     1     0
 [2,]     1     1     0     1     1     1     0     1     1     0
 [3,]     1     0     1     0     1     0     1     1     0     1
 [4,]     1     0     1     1     1     1     1     0     0     0
 [5,]     1     0     0     0     0     1     1     0     1     1
 [6,]     1     0     0     1     1     0     1     0     1     0
 [7,]     0     0     0     0     0     0     1     0     1     1
 [8,]     1     1     0     1     0     1     0     1     1     1
 [9,]     0     0     1     1     0     1     1     0     0     1
[10,]     1     0     1     1     1     1     0     0     1     0
      [,43] [,44] [,45] [,46] [,47] [,48] [,49] [,50]
 [1,]     0     1     1     0     0     0     0     0
 [2,]     1     0     1     1     1     1     0     0
 [3,]     1     1     1     1     0     0     0     1
 [4,]     1     0     0     1     0     1     1     1
 [5,]     0     1     1     0     0     1     0     1
 [6,]     1     1     1     0     1     1     0     1
 [7,]     1     0     1     1     0     0     1     1
 [8,]     0     0     0     1     0     0     1     0
```

```
 [9,]     1     1     1     0     1     0     0     0
[10,]     1     0     1     1     1     1     1     1
> l_c(2,1,4,3,4,3,4,5,3,3,1,1,2,2,10,4,4,2,6,1,2,5,4,3,4,2,4,2,2,3,2,2,
+ 6,1,2,3,4,3,5,3,4,3,3,2,3,3,2,3,2,5)

> table(l)
 1  2  3  4 5 6 10
 5 14 14 10 4 2  1

> crosstabs(~l)
Call:
crosstabs( ~ l)
50 cases in table
+-------+
|N      |
|N/Total|
+-------+
l      |
-------+-------+
1      | 5     |
       |0.10   |
-------+-------+
2      |14     |
       |0.28   |
-------+-------+
3      |14     |
       |0.28   |
-------+-------+
4      |10     |
       |0.20   |
-------+-------+
5      | 4     |
       |0.08   |
-------+-------+
6      | 2     |
       |0.04   |
-------+-------+
10     | 1     |
       |0.02   |
-------+-------+
```

a) 0.62

b) Verteilung ist rechtsschief

```
> ll_c(table(l)[-7],0,0,0,table(l)[7])
> ll
 1  2  3  4 5 6       10
 5 14 14 10 4 2 0 0 0  1
> names(ll)[7]_"7"
> names(ll)[8]_"8"
> names(ll)[9]_"9"
> ll
 1  2  3  4 5 6 7 8 9 10
 5 14 14 10 4 2 0 0 0  1
> barplot(ll,names=names(ll))
```

c)
```
> mean(l)
[1] 3.14
```

3. **a)** $166.5 \pm 1.96 * 6.5 = 166.5 \pm 12.74 = (153.76, 179.24)$

b)
```
> gr_rnorm(9,166.5,6.5)
> mean(gr)
[1] 166.2383          etwas kleiner
> sqrt(var(gr))
[1] 5.67311           etwas kleiner
```

c)
```
> mean(gr)- 1.96*6.5/3
[1] 161.9916
> mean(gr)+ 1.96*6.5/3
[1] 170.485
```

$\mu = 166.5$ liegt im Vertrauensintervall.

d)
```
> gr100_rnorm(9*100,166.5,6.5)
> gr100_matrix(gr100,ncol=100)
> m100_apply(gr100,2,mean)
```

e)
```
> hist(gr100,nclass=30,xlab="Koerpergroesse",probability=T,
ylim=c(0,0.2))
> hist(m100,nclass=10,xlab="Mittelwerte",xaxs="d",probability=T)
> mean(gr100)
[1] 166.364
> mean(m100)
[1] 166.364

> sqrt(var(m100))
[1] 2.0154              ca. 6.5/3=2.167
> gr_as.vector(gr100)
> sqrt(var(gr))
[1] 6.403391             ca. 6.5
```

f)
```
> mu_m100-1.96*6.5/3
> mo_m100+1.96*6.5/3
> table(165<mu)
 FALSE TRUE
    94    6
> table(mo<165)
 FALSE TRUE
    99    1
```

7 von 100 enthalten μ nicht.

Abgabe: Montag 15.11.99