Lösungen / Statistik 2/09

```
Remove["Global`*"]
```

1.

■ Idee/ Idée:

```
α = 0.001; n = 100;  μ0 = 200; σ = 4;

fR[α_] := FindRoot[1 / (Sqrt[2 Pi]) Integrate[E^(-x^2 / 2), {x, -c, c}] == 1 - α, {c, 1}];

c1[c_] := c /. fR[α]; c1[c]

3.29053

g1[c_] := (-c1[c] == Sqrt[n] (cU - μ0) / σ);
g2[c_] := (c1[c] == Sqrt[n] (cO - μ0) / σ);

solv1 = Solve[g1[c], {cU}] // Flatten;
cU1[n_, μ_, σ_] := cU /. solv1;
cU1[n, μ, σ]

198.684

solv2 = Solve[g2[c], {cO}] // Flatten;
cO1[n_, μ_, σ_] := cO /. solv2;
cO1[n, μ, σ]

201.316
```

■ Programm

```
α = 0.001; n = 10;  μ0 = 200; σ = 4;
fR[α_] := FindRoot[1 / (Sqrt[2 Pi]) Integrate[E^(-x^2 / 2), {x, -c, c}] == 1 - α, {c, 1}];
c1[c_] := c /. fR[α];
g1[c_] := (-c1[c] == Sqrt[n] (cU - μ0) / σ);
g2[c_] := (c1[c] == Sqrt[n] (cO - μ0) / σ);
solv1 = Solve[g1[c], {cU}] // Flatten;
cU1[n_, μ_, σ_] := cU /. solv1;
solv2 = Solve[g2[c], {cO}] // Flatten;
cO1[n_, μ_, σ_] := cO /. solv2;
{cU1[n, μ, σ], cO1[n, μ, σ]}

{195.838, 204.162}
```

```
α = 0.001; n = 100;  μ0 = 200; σ = 4;
fR[α_] := FindRoot[1 / (Sqrt[2 Pi]) Integrate[E^(-x^2 / 2), {x, -c, c}] == 1 - α, {c, 1}];
c1[c_] := c /. fR[α];
g1[c_] := (-c1[c] == Sqrt[n] (cU - μ0) / σ);
g2[c_] := (c1[c] == Sqrt[n] (cO - μ0) / σ);
solv1 = Solve[g1[c], {cU}] // Flatten;
cU1[n_, μ_, σ_] := cU /. solv1;
solv2 = Solve[g2[c], {cO}] // Flatten;
cO1[n_, μ_, σ_] := cO /. solv2;
{cU1[n, μ, σ], cO1[n, μ, σ]}
```

```
{198.684, 201.316}
```

```
α = 0.001; n = 1000;  μ0 = 200; σ = 4;
fR[α_] := FindRoot[1 / (Sqrt[2 Pi]) Integrate[E^(-x^2 / 2), {x, -c, c}] == 1 - α, {c, 1}];
c1[c_] := c /. fR[α];
g1[c_] := (-c1[c] == Sqrt[n] (cU - μ0) / σ);
g2[c_] := (c1[c] == Sqrt[n] (cO - μ0) / σ);
solv1 = Solve[g1[c], {cU}] // Flatten;
cU1[n_, μ_, σ_] := cU /. solv1;
solv2 = Solve[g2[c], {cO}] // Flatten;
cO1[n_, μ_, σ_] := cO /. solv2;
{cU1[n, μ, σ], cO1[n, μ, σ]}
```

```
{199.584, 200.416}
```

```
α = 0.001; n = 100;  μ0 = 200; σ = 0.1;
fR[α_] := FindRoot[1 / (Sqrt[2 Pi]) Integrate[E^(-x^2 / 2), {x, -c, c}] == 1 - α, {c, 1}];
c1[c_] := c /. fR[α];
g1[c_] := (-c1[c] == Sqrt[n] (cU - μ0) / σ);
g2[c_] := (c1[c] == Sqrt[n] (cO - μ0) / σ);
solv1 = Solve[g1[c], {cU}] // Flatten;
cU1[n_, μ_, σ_] := cU /. solv1;
solv2 = Solve[g2[c], {cO}] // Flatten;
cO1[n_, μ_, σ_] := cO /. solv2;
{cU1[n, μ, σ], cO1[n, μ, σ]}
```

```
{199.967, 200.033}
```

2.

```
β = 0.01; α = β;  n = 100;  μ0 = 200; σ = 4;
fR[α_] := FindRoot[1 / (Sqrt[2 Pi]) Integrate[E^(-x^2 / 2), {x, -c, c}] == 1 - α, {c, 1}];
c1[c_] := c /. fR[α];
g1[c_] := (-c1[c] == Sqrt[n] (cU - μ0) / σ);
g2[c_] := (c1[c] == Sqrt[n] (cO - μ0) / σ);
solv1 = Solve[g1[c], {cU}] // Flatten;
cU1[n_, μ_, σ_] := cU /. solv1;
solv2 = Solve[g2[c], {cO}] // Flatten;
cO1[n_, μ_, σ_] := cO /. solv2;
{cU1[n, μ, σ], cO1[n, μ, σ]}
```

```
{198.97, 201.03}
```

```
α = 0.001; n = 100; μ0 = 200; σ = 4;
fR[α_] := FindRoot[1 / (Sqrt[2 Pi]) Integrate[E^(-x^2 / 2), {x, -c, c}] == 1 - α, {c, 1}];
c1[c_] := c /. fR[α];
g1[c_] := (-c1[c] == Sqrt[n] (cU - μ0) / σ);
g2[c_] := (c1[c] == Sqrt[n] (cO - μ0) / σ);
solv1 = Solve[g1[c], {cU}] // Flatten;
cU1[n_, μ_, σ_] := cU /. solv1;
solv2 = Solve[g2[c], {cO}] // Flatten;
cO1[n_, μ_, σ_] := cO /. solv2;
{cU1[n, μ, σ], cO1[n, μ, σ]}
```

```
{198.684, 201.316}
```

3.

Selbststudium

4.

```
Remove["Global`*"]
```

▪ a

```
Sqrt[8000] // N
```

```
89.4427
```

90 Einsätzt zufällig herausgreifen erfüllt die gegebene Bedingung.

▪ b

```
<< Statistics`DescriptiveStatistics`
```

```
data = {{1, 7.6}, {2, 7.7}, {6, 7.8}, {6 , 7.9}, {10 , 8.0}, {13, 8.1},
   {14, 8.2}, {13, 8.3}, {10, 8.4}, {7, 8.5}, {5 , 8.6}, {1, 8.7}, {2 , 8.8}}
```

```
{{1, 7.6}, {2, 7.7}, {6, 7.8}, {6, 7.9}, {10, 8.}, {13, 8.1},
 {14, 8.2}, {13, 8.3}, {10, 8.4}, {7, 8.5}, {5, 8.6}, {1, 8.7}, {2, 8.8}}
```

```
data[[5]][[2]]
```

```
8.
```

```
Table[data[[5]][[2]], {k, 1, data[[5]][[1]]}]
```

```
{8., 8., 8., 8., 8., 8., 8., 8., 8., 8.}
```

```
tab =
 Table[Table[data[[n]][[2]], {k, 1, data[[n]][[1]]}], {n, 1, Length[data]}] // Flatten
```

```
{7.6, 7.7, 7.7, 7.8, 7.8, 7.8, 7.8, 7.8, 7.8, 7.9, 7.9, 7.9, 7.9, 7.9,
 7.9, 8., 8., 8., 8., 8., 8., 8., 8., 8., 8., 8.1, 8.1, 8.1, 8.1, 8.1, 8.1,
 8.1, 8.1, 8.1, 8.1, 8.1, 8.1, 8.1, 8.2, 8.2, 8.2, 8.2, 8.2, 8.2, 8.2,
 8.2, 8.2, 8.2, 8.2, 8.2, 8.2, 8.2, 8.3, 8.3, 8.3, 8.3, 8.3, 8.3, 8.3, 8.3,
 8.3, 8.3, 8.3, 8.3, 8.3, 8.4, 8.4, 8.4, 8.4, 8.4, 8.4, 8.4, 8.4, 8.4, 8.4,
 8.5, 8.5, 8.5, 8.5, 8.5, 8.5, 8.5, 8.6, 8.6, 8.6, 8.6, 8.6, 8.7, 8.8, 8.8}
```

```
sum = Apply[Plus, tab]
```

```
738.
```

```
len = Length[tab]
```

```
90
```

```
locRep = LocationReport[tab]
```

```
{Mean → 8.2, HarmonicMean → 8.19211, Median → 8.2}
```

```
dispRep = DispersionReport[tab]
```

```
{Variance → 0.0653933, StandardDeviation → 0.255721, SampleRange → 1.2,
 MeanDeviation → 0.202222, MedianDeviation → 0.2, QuartileDeviation → 0.2}
```

■ c

```
Δx = 1 / len len 0.1
```

```
0.1
```

■ d

```
μ = Mean /. locRep
```

```
8.2
```

```
μMittelw = Mean /. locRep
```

```
8.2
```

■ e

```
σ = StandardDeviation /. dispRep
```

```
0.255721
```

```
σMittelw = StandardDeviation / Sqrt[len] /. dispRep
```

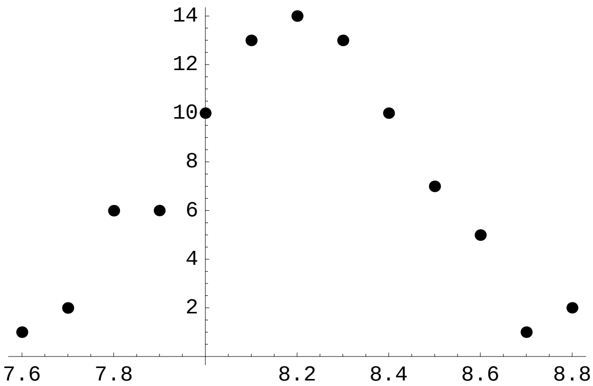
```
0.0269554
```

■ f

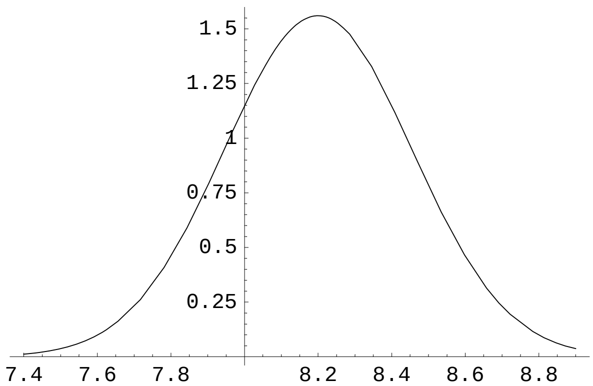
```
dataTrans = Table[{data[[k]][[2]], data[[k]][[1]]}, {k, 1, Length[data]}]
```

```
{{7.6, 1}, {7.7, 2}, {7.8, 6}, {7.9, 6}, {8., 10}, {8.1, 13},
 {8.2, 14}, {8.3, 13}, {8.4, 10}, {8.5, 7}, {8.6, 5}, {8.7, 1}, {8.8, 2}}
```

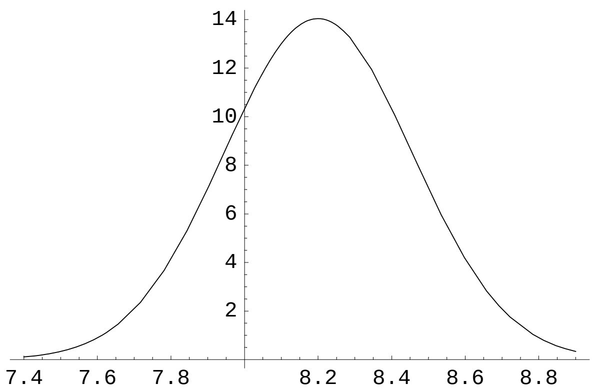
```
p1 = ListPlot[dataTrans, PlotStyle → PointSize[0.02]];
```



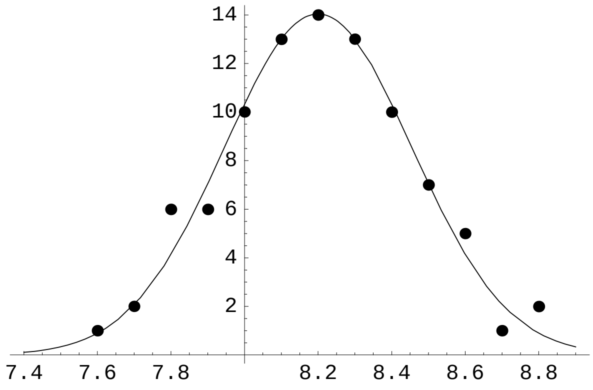

```
f[x_] := 1 / Sqrt[2 Pi σ^2] E^(-1 / 2 ((x - μ) / σ)^2);
p2 = Plot[f[x], {x, 7.4, 8.9}];
```




```
streck = 9;
p2 = Plot[streck f[x], {x, 7.4, 8.9}];
```



```
Show[p2, p1];
```



Sieht optisch anständig aus.

■ g

```
μMittelw
```

8.2

```
σ95 = 2 σMittelw
```

0.0539107

```
untereGrenze95 = μMittelw - σ95
```

8.14609

```
obereGrenze95 = μMittelw + σ95
```

8.25391

■ h

Durch 3 σMittelw ist bei einer Normalverteilung ein 99.73-% Intervall gegeben.

```
μMittelw
```

8.2

```
σ9973 = 3 σMittelw
```

0.0808661

```
untereGrenze9973 = μMittelw - σ9973
```

8.11913

```
obereGrenze9973 = μMittelw + σ9973
```

8.28087