

Computer simulations in statistical physics

Homework 2: data analysis

Usage of statistical analysis program

Code of statistical analysis program

Analysis of data sets

set 1	set 2	set 3	set 4	set 5
set 6	set 7	set 8	set 9	set 10

Usage and functionality of program stats

Downloading, compiling, getting help

```
> wget http://komet337/Bluemer/NumMeth/stats_v1_4.c
...
12:34:20 (198.57 MB/s) - 'stats_v1_4.c' saved [9772/9772]

> gcc -lm -o stats stats_v1_4.c

> ./stats -h
*****
stats: statistics utility (average, histogram, etc.)
Version: 1.4a, 10.05.2007 by Nils Bluemer
input:  standardin, 1 column
options: -a average
         -s average, short output
         -c autocorrelation function (used for averaging)
         -i histogram
         -r average, uneven spacing
         -w weighted histogram (input here: y, delta_y)
         -h this help
```

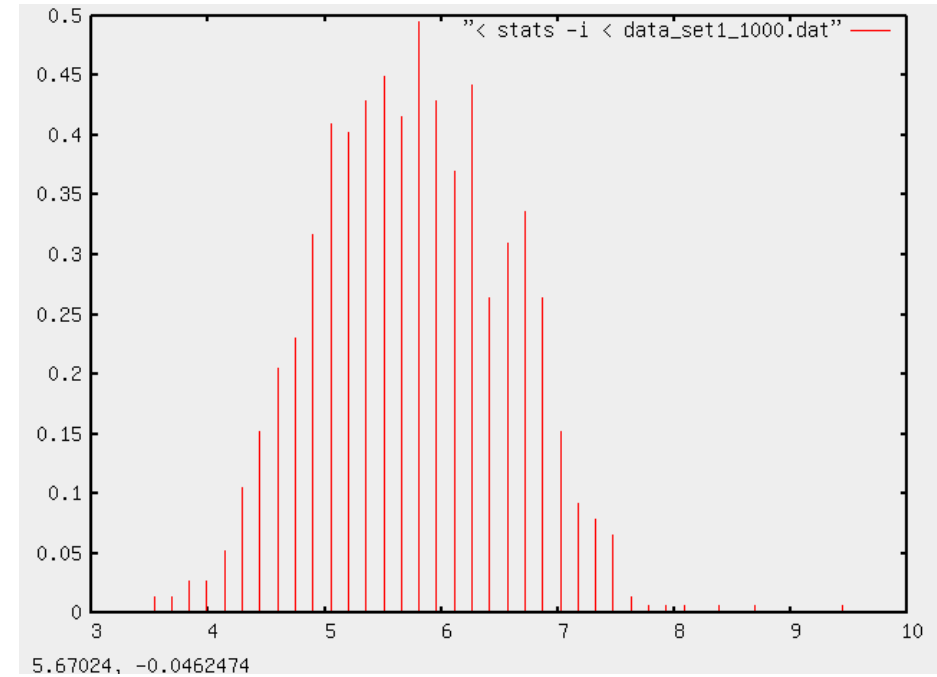
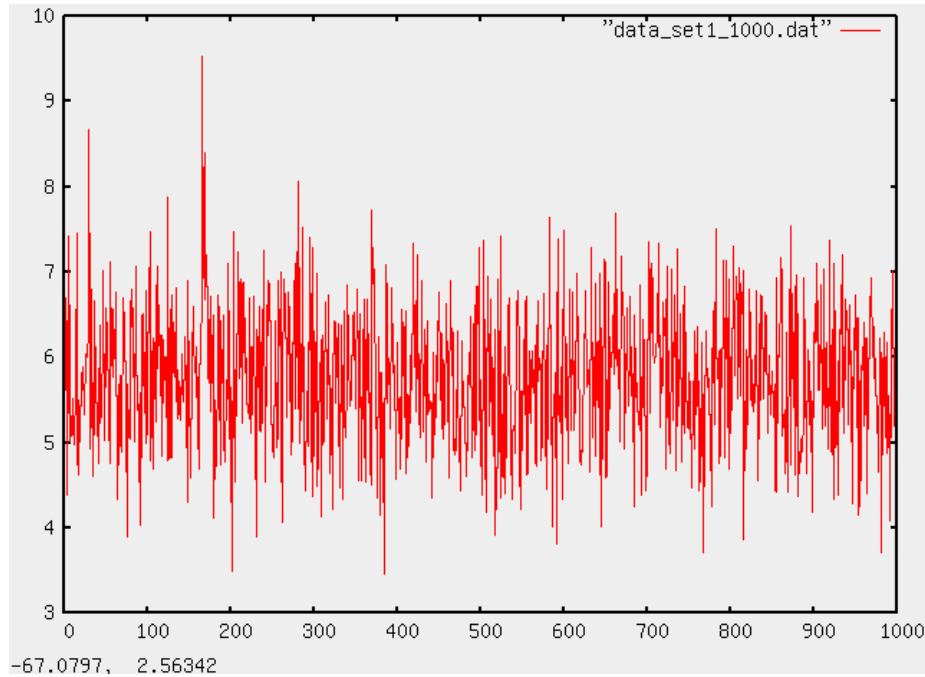
Usage: compute averages and error bars

```
> wget http://komet337/Bluemer/Comp_sim/data_set1_10.dat
> wget http://komet337/Bluemer/Comp_sim/data_set1_100.dat
> wget http://komet337/Bluemer/Comp_sim/data_set1_1000.dat
> wget http://komet337/Bluemer/Comp_sim/data_set1_10000.dat

> ./stats -a < data_set1_1000.dat
Average: 5.7610558, variance: 0.6616717, error: 0.025735851
Korrelation time: 1.105017, corrected error: 0.027053472,
    transient: -2.6028452e-05

> ./stats -s < data_set1_10.dat
5.699736 0.30664264 -0.013894061
> ./stats -s < data_set1_100.dat
5.7115932 0.08192819 -0.00085808941
> ./stats -s < data_set1_1000.dat
5.7610558 0.027053472 -2.6028452E-05
> ./stats -s < data_set1_10000.dat
5.7484945 0.0080512779 1.0067773E-06
```

Plotting input and results with gnuplot



```
> gnuplot
```

```
...
```

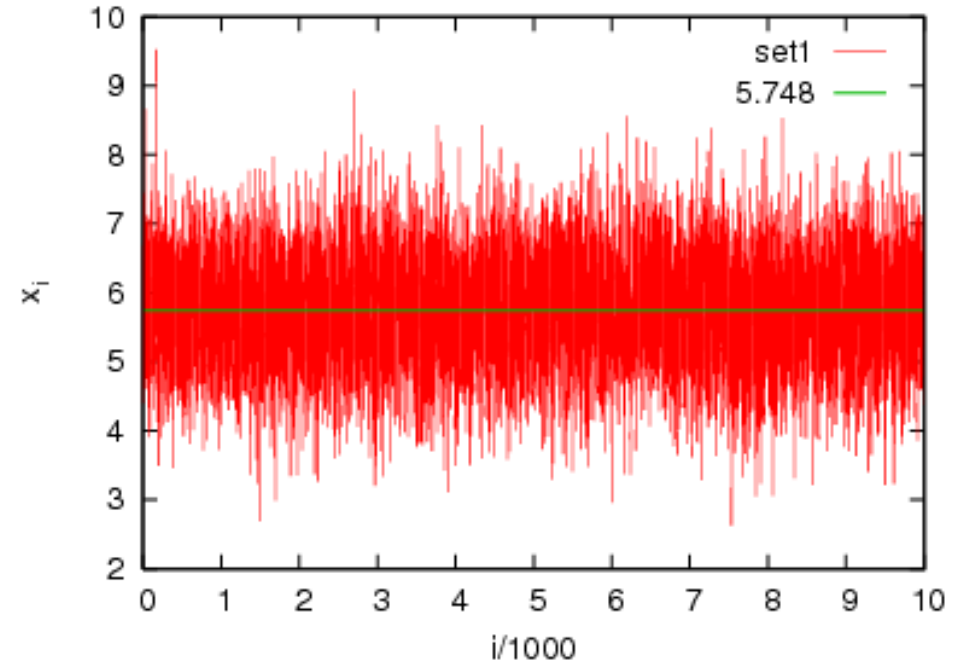
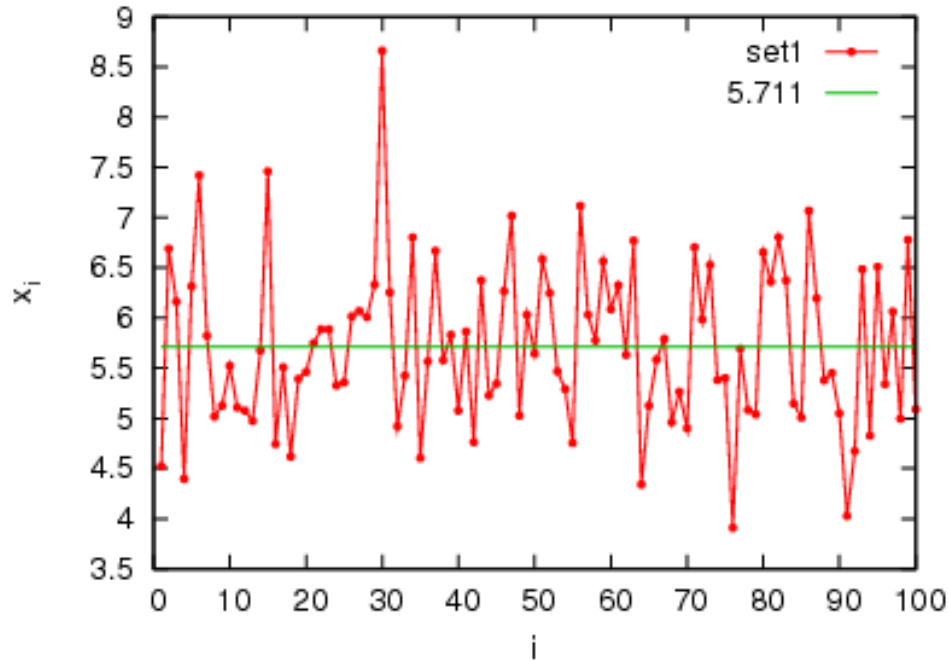
```
Terminal type set to 'x11'
```

```
gnuplot> plot "data_set1_1000.dat" w l
```

```
gnuplot> plot "< ./stats -i < data_set1_1000.dat" with impulses
```

Set 1

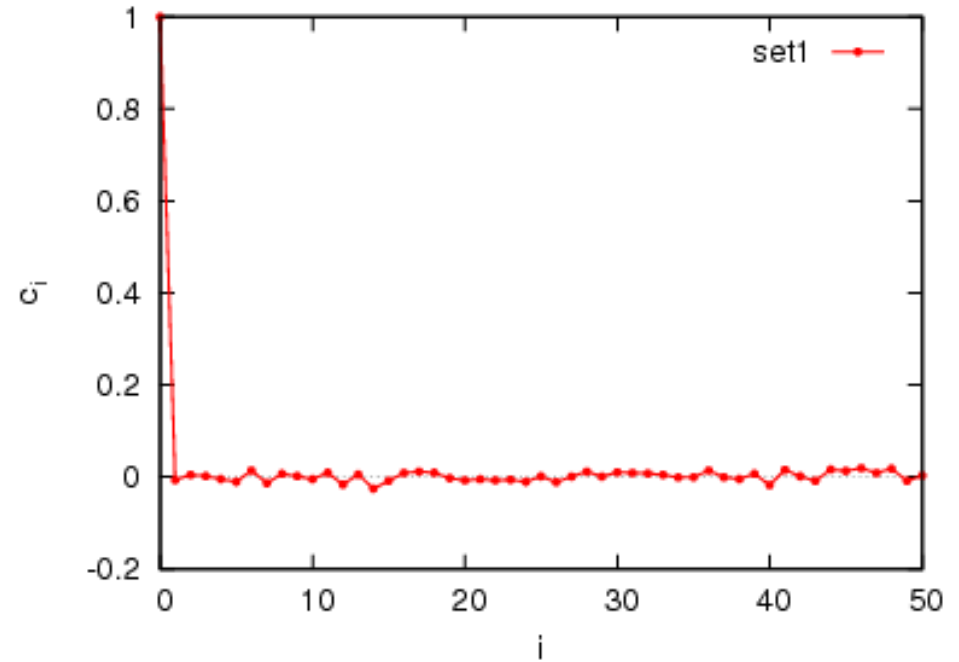
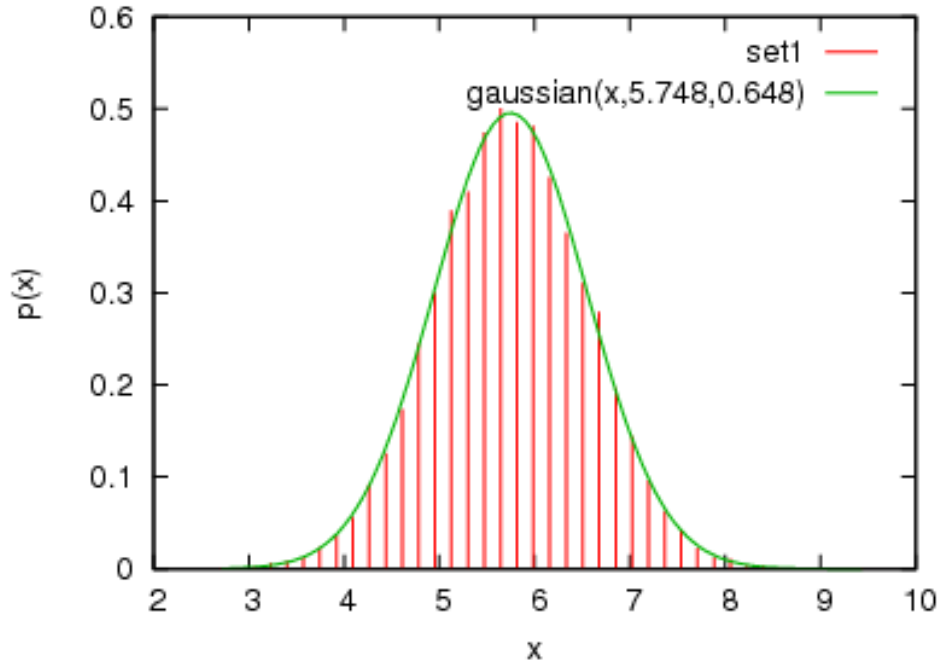
Trace and averages



Estimates of mean / initial error analysis

- $\langle x \rangle \approx 5.748 \pm 0.008$ (naive estimate)
- no transient
- autocorrelation?

Histogram, autocorrelation function, full error estimate



- gaussian distribution of “measurements” - width $\sqrt{0.648}$
- no autocorrelation ($\tau = 1.0$)
- final error estimate: $\langle x \rangle \approx 5.748 \pm 0.008$
- **true distribution:** gaussian, mean 5.740, variance 0.650