Messreihe

(P:\Publik_Studenten\FBB\to_student\Statistik\Messreihe.doc)

Gegeben: Drei Gruppen aus verschiedenen Labors, Nummer der Messung und Messwert

1	23.8	1	23.8	1	22.6
2	21.	2	25.4	2	19.2
3	23.8	3	19.8	3	24.
4	22.6	4	23.2	4	17.2
5	20.6	5	19.4	5	20.
6	20.2	6	25.8	6	20.8
7	18.	7	23.2	7	20.6
8	23.4	8	22.8	8	18.8
9	20.4	9	28.	9	19.4
10	20.2	10	22.6	10	17.8
11	19.8	11	22.2	11	17.2
12	22.2	12	19.8	12	18.2
13	18.8	13	27.	13	21.4
14	18.6	14	20.4	14	22.8
15	20.	15	22.4	15	17.8
16	23.6	16	25.8	16	22.8
17	19.	17	23.4	17	17.2
18	19.	18	26.2	18	17.
19	22.4	19	19.6	19	18.6
20	23.4	20	23.	20	18.6
21	23.6	21	23.4	21	23.
22	21.4	22	19.6	22	21.2
23	21.6	23	25.4	23	19.4
24	20.	24	21.6	24	17.4
25	23.8	25	27.4	25	17.4
26	17.4	26	22.2	26	19.
27	21.6	27	24.6	27	19.4
28	21.6	28	26.4	28	17.
29	20.	29	27.	29	21.6
30	21.2	30	24.2	30	22.2
31	20.6	31	20.4	31	22.8
32	22.	32	22.6	32	22.4
33	23.6	33	27.	33	19.2
34	17.8	34	20.8	34	21.4

Eindimensionale Darstellung der Messreihen (Paare von Nummern und Werten, Messreihen MR1, MR2, MR3):

MR1 =
{{1,23.8},{2,21.},{3,23.8},{4,22.6},{5,20.6},{6,20.2},{7,18.},{8,23.4},{9,20.4},{10,20.2},
{11,19.8},{12,22.2},{13,18.8},{14,18.6},{15,20.},{16,23.6},{17,19.},{18,19.},{19,22.4},
{20,23.4},{21,23.6},{22,21.4},{23,21.6},{24,20.},{25,23.8},{26,17.4},{27,21.6},{28,21.6},
{29,20.},{30,21.2},{31,20.6},{32,22.},{33,23.6},{34,17.8}}

MR1ohmeNr =
{23.8,21.,23.8,22.6,20.6,20.2,18.,23.4,20.4,20.2,19.8,22.2,18.8,18.6,20.,23.6,19.,19.,22.4,23.4,23.6,21.4,21.6,20.,23.8,17.4,21.6,21.6,20.,21.2,20.6,22.,23.6,17.8}

MR2=
{{1,23.8},{2,25.4},{3,19.8},{4,23.2},{5,19.4},{6,25.8},{7,23.2},{8,22.8},{9,28.},{10,22.6},{11,22.2},{12,19.8},{13,27.},{14,20.4},{15,22.4},{16,25.8},{17,23.4},{18,26.2},{19,19.6},{20,23.},{21,23.4},{22,19.6},{23,25.4},{24,21.6},{25,27.4},{26,22.2},{27,24.6},{28,26.4},{29,27.},{30,24.2},{31,20.4},{32,22.6},{33,27.},{34,20.8}}
MR2ohmeNr =
{23.8,25.4,19.8,23.2,19.4,25.8,23.2,22.8,28.,22.6,22.2,19.8,27.,20.4,22.4,25.8,23.4,26.2,19.6,23.,23.4,19.6,25.4,21.6,27.4,22.2,24.6,26.4,27.,24.2,20.4,22.6,27.,20.8}

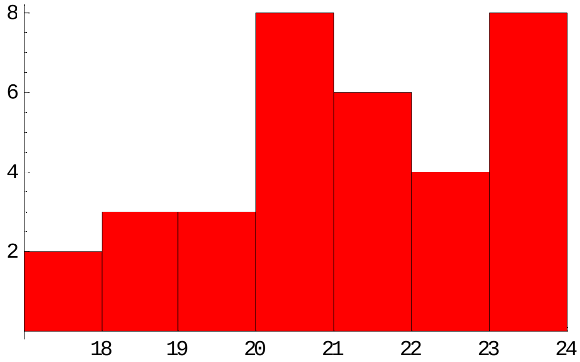
MR3=
{{1,22.6},{2,19.2},{3,24.},{4,17.2},{5,20.},{6,20.8},{7,20.6},{8,18.8},{9,19.4},{10,17.8},{11,17.2},{12,18.2},{13,21.4},{14,22.8},{15,17.8},{16,22.8},{17,17.2},{18,17.},{19,18.6},{20,18.6},{21,23.},{22,21.2},{23,19.4},{24,17.4},{25,17.4},{26,19.},{27,19.4},{28,17.},{29,21.6},{30,22.2},{31,22.8},{32,22.4},{33,19.2},{34,21.4}}
MR3ohmeNr =
{22.6,19.2,24.,17.2,20.,20.8,20.6,18.8,19.4,17.8,17.2,18.2,21.4,22.8,17.8,22.8,17.2,17.,18.6,18.6,23.,21.2,19.4,17.4,17.4,19.,19.4,17.,21.6,22.2,22.8,22.4,19.2,21.4}

Gesucht: Umfang und Grösse, Lagemasse, Streumasse, Ausreisser, Extremwerte, Diagramm.
Problem: Sind die drei Labors vergleichbar?

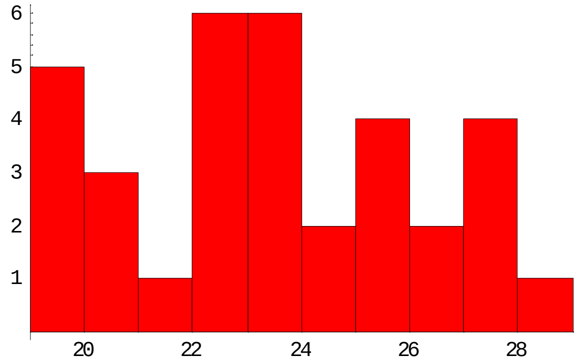
Bei der nachstehenden Auswertung wurde der Bequemlichkeit halber das Softwarepaket *„Mathematica“* verwendet.

Auswertung:

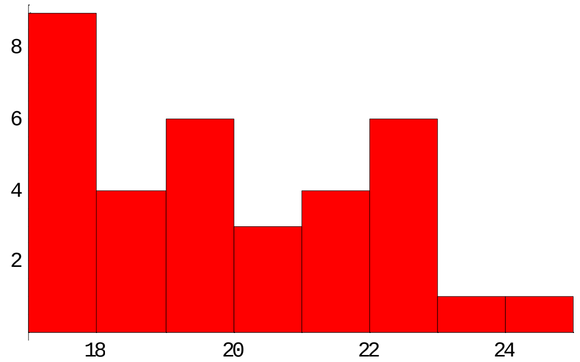
Histogramm MR1:



Histogramm MR2:



Histogramm MR3:



MinMaxLength[MR1]: Min. -> 17.4 , Max. -> 23.8 , Length -> 34

MinMaxLength[MR2]: Min. -> 19.4 , Max. -> 28.0 , Length -> 34

MinMaxLength[MR3]: Min. -> 17.0 , Max. -> 24.0 , Length -> 34

LocationReport[MR1]: {Mean→21.0882, HarmonicMean→20.9169, Median→21.1}

LocationReport[MR2]: {Mean→23.4235, HarmonicMean→23.147, Median→23.2}

LocationReport[MR3]: {Mean→19.8647, HarmonicMean→19.6455, Median→19.4}

DispersionReport[MR1]:
{Variance→3.65137, StandardDeviation→1.91086, SampleRange→6.4, MeanDeviation→1.59412, MedianDeviation→1.3, QuartileDeviation→1.3}

DispersionReport[MR2]:
{Variance→6.64185, StandardDeviation→2.57718, SampleRange→8.6, MeanDeviation→2.1218, MedianDeviation→2.3, QuartileDeviation→2.1}

DispersionReport[MR3]:
{Variance→4.57144, StandardDeviation→2.13809, SampleRange→7., MeanDeviation→1.86055, MedianDeviation→2., QuartileDeviation→1.9}

ShapeReport[MR1]:
{Skewness→-0.125161, QuartileSkewness→0.153846, KurtosisExcess→-0.998713}

ShapeReport[MR2]:
{Skewness→0.0547995, QuartileSkewness→0.238095, KurtosisExcess→-1.10282}

ShapeReport[MR3]:
{Skewness→0.252494, QuartileSkewness→0.157895, KurtosisExcess→-1.24533}

Erläuterungen siehe nächste Seiten

Location statistics describe where the data are located. The most common functions include measures of central tendency like the mean, median, and mode. `Quantile[`*data*`, `*q*`]` gives the location before which (100*q*) percent of the data lie. In other words, `Quantile` gives a value *z* such that the probability that $(x_i \quad z)$ is less than or equal to *q* and the probability that $(x_i \quad z)$ is greater than or equal to *q*. The interpolated quantile values at *q* = 0.25, 0.5 and 0.75 are called the quartiles, and you can obtain them using `Quartiles`.

`Mean[`*data*`]`	average value $\frac{1}{n}\sum x_i$
`Median[`*data*`]`	median (central value)
`Mode[`*data*`]`	mode
`GeometricMean[`*data*`]`	geometric mean $(\prod_i x_i)^{\frac{1}{n}}$
`HarmonicMean[`*data*`]`	harmonic mean $n / \sum \frac{1}{x_i}$
`RootMeanSquare[`*data*`]`	root mean square $\sqrt{\frac{1}{n}\sum x_i^2}$
`TrimmedMean[`*data*`, `*f*`]`	mean of remaining entries, when a fraction *f* is removed from each end of the sorted list of data
`TrimmedMean[`*data*`, {`f_1`, `f_2`}]`	mean of remaining entries, when fractions f_1 and f_2 are dropped from each end of the sorted data
`Quantile[`*data*`, `*q*`]`	q^{th} quantile
`InterpolatedQuantile[`*data*`, `*q*`]`	q^{th} quantile of the distribution infered by linear interpolation of the entries in the list of data
`Quartiles[`*data*`]`	list of quartiles
`LocationReport[`*data*`]`	list of location statistics including Mean, HarmonicMean, and Median

SampleRange[*data*]	range
Variance[*data*]	unbiased estimate of variance, $\frac{1}{n-1}\sum (x_i-\bar{x})^2$
VarianceMLE[*data*]	maximum likelihood estimate of variance, $\frac{1}{n}\sum (x_i-\bar{x})^2$
VarianceOfSampleMean[*data*]	unbiased estimate of variance of sample mean, $\frac{1}{n}$ Variance[*data*]
StandardDeviation[*data*]	unbiased estimate of standard deviation
StandardDeviationMLE[*data*]	maximum likelihood estimate of standard deviation
StandardErrorOfSampleMean[*data*]	unbiased estimate of standard error (standard deviation) of sample mean
CoefficientOfVariation[*data*]	coefficient of variation (ratio of standard deviation to mean)
MeanDeviation[*data*]	mean absolute deviation, $\frac{1}{n}\sum \lvert x_i-\bar{x}\rvert$
MedianDeviation[*data*]	median absolute deviation, median of $\lvert x_i - median\rvert$ values
InterquartileRange[*data*]	interquartile range
QuartileDeviation[*data*]	quartile deviation
DispersionReport[*data*]	list of dispersion statistics including Variance, StandardDeviation, SampleRange, MeanDeviation, MedianDeviation, and QuartileDeviation

Dispersion statistics summarize the scatter or spread of the data. Most of these functions describe deviation from a particular location. For instance, variance is a measure of deviation from the mean, and standard deviation is just the square root of the variance.

The range is a value describing the total spread of the data. `SampleRange` gives the difference between the largest and smallest value in `data`, while `InterquartileRange` gives the difference between the 0.75^{th} and the 0.25^{th} quartiles.

CentralMoment[*data*, *r*]	r^{th} central moment $\frac{1}{n}\sum_i (x_i - \bar{x})^r$
Skewness[*data*]	coefficient of skewness
PearsonSkewness1[*data*]	Pearson's first coefficient of skewness
PearsonSkewness2[*data*]	Pearson's second coefficient of skewness
QuartileSkewness[*data*]	quartile coefficient of skewness
Kurtosis[*data*]	kurtosis coefficient
KurtosisExcess[*data*]	kurtosis excess
ShapeReport[*data*]	list of shape statistics including Skewness, QuartileSkewness, and KurtosisExcess

You can get some information about the shape of a distribution using shape statistics. Skewness describes the amount of asymmetry. Kurtosis measures the concentration of data around the peak and in the tails versus the concentration in the flanks.

`Skewness` is calculated by dividing the third central moment by the cube of the standard deviation. Pearson's two coefficients provide two other well-known measures of skewness. `PearsonSkewness1` and `PearsonSkewness2` are found by multiplying three times the difference between the mean and either the mode or the median, respectively, and dividing this quantity by the standard deviation of the sample. `QuartileSkewness` gives a measure of asymmetry within the first and third quartiles.

`Kurtosis` is calculated by dividing the fourth central moment by the square of the sample variance (`VarianceMLE`) of the data. `KurtosisExcess` is shifted so that it is zero for the normal distribution, positive for distributions with a prominent peak and heavy tails, and negative for distributions with prominent flanks.