Grubb's Test for Detecting Outliers

Statisticians have devised several ways to detect outliers. Grubbs' test is particularly easy to follow. This method is also called the ESD method (extreme studentized deviate).

The first step is to quantify how far the outlier is from the others. Calculate the ratio Z as the difference between the outlier and the mean divided by the SD. If Z is large, the value is far from the others. Note that you calculate the mean and SD from all values, including the outlier.

$$Z = \frac{|\text{mean} - \text{value}|}{SD}$$

Critical values for Z. Calculate Z as shown above. Look up the critical value of Z in the table below, where N is the number of values in the group. If your value of Z is higher than the tabulated value, the P value is less than 0.05.

N	Critical Z	N	Critical Z
3	1.15	27	2.86
4	1.48	28	2.88
5	1.71	29	2.89
6	1.89	30	2.91
7	2.02	31	2.92
8	2.13	32	2.94
9	2.21	33	2.95
10	2.29	34	2.97
11	2.34	35	2.98
12	2.41	36	2.99
13	2.46	37	3.00
14	2.51	38	3.01
15	2.55	39	3.03
16	2.59	40	3.04
17	2.62	50	3.13
18	2.65	60	3.20
19	2.68	70	3.26
20	2.71	80	3.31
21	2.73	90	3.35
22	2.76	100	3.38
23	2.78	110	3.42
24	2.80	120	3.44
25	2.82	130	3.47
26	2.84	140	3.49

Q-Test for Detecting Outliers

Q-test. Use to identify statistical outliers in data. This test should be applied sparingly and never more than once to a single data set.

$$Q_n = \frac{|x_a - x_b|}{R}$$

R is the range of all data points, x_a is the suspected outlier, and x_b is the data point closest to x_a. At the 90% confidence interval Q for N replicate measurements is:

Q-Test decision level at 90% confidence interval							
N	3	4	5	6	7	8	9	10
Q	0.94	0.76	0.64	0.56	0.51	0.47	0.44	0.41