Grubbs test

This test detects outliers from normal distributions. The tested data are the minimum and maximum values. The result is a probality that indicates that the data belongs to the core population. If the investigated sample has some other, especially assymmetric distribution (e.g. lognormal) then these tests give false results!

The test is based on the difference of the mean of the sample and the most extreme data considering the standard deviation (Grubbs, 1950, 1969; DIN 32645; DIN 38402).

The test can detect one outlier at a time with different probablities (see table below) from a data set with assumed normal distribution. If n>25 then the result is just a coarse approximation.

$$T_{\max} = \frac{x_n - X_{mean}}{s} \qquad T_{\min} = \frac{X_{mean} - X_1}{s}$$

where

X_i or X_n = the suspected single outlier (max or min)
s = standard deviation of the whole data set
X_{aver} = mean

Grubbs' critical value table:

N	0.1	0.075	0.05	0.025	0.01		N	0.1	0.075	0.05	0.025	0.01
3	1.15	1.15	1.15	1.15	1.15		53	0	0	2.981	3.151	999
4	1.42	1.44	1.46	1.48	1.49		54	0	0	2.988	3.158	999
5	1.6	1.64	1.67	1.71	1.75		55	0	0	2.995	3.165	999
6	1.73	1.77	1.82	1.89	1.94		56	0	0	3.002	3.172	999
7	1.83	1.88	1.94	2.02	2.1		57	0	0	3.009	3.179	999
8	1.91	1.96	2.03	2.13	2.22		58	0	0	3.016	3.186	999
9	1.98	2.04	2.11	2.21	2.32		59	0	0	3.023	3.193	999
10	2.03	2.1	2.18	2.29	2.41		60	0	0	3.03	3.2	999
11	2.09	2.14	2.23	2.36	2.48		61	0	0	3.036	3.206	999
12	2.13	2.2	2.29	2.41	2.55		62	0	0	3.042	3.212	999
13	2.17	2.24	2.33	2.46	2.61		63	0	0	3.048	3.218	999
14	2.21	2.28	2.37	2.51	2.66		64	0	0	3.054	3.224	999
15	2.25	2.32	2.41	2.55	2.71		65	0	0	3.06	3.23	999
16	2.28	2.35	2.44	2.59	2.75		66	0	0	3.066	3.236	999
17	2.31	2.38	2.47	2.62	2.79		67	0	0	3.072	3.242	999
18	2.34	2.41	2.5	2.65	2.82		68	0	0	3.078	3.248	999
19	2.36	2.44	2.53	2.68	2.85		69	0	0	3.084	3.254	999
20	2.38	2.46	2.56	2.71	2.88		70	0	0	3.09	3.26	999
21	0	0	2.58	2.73	2.91		71	0	0	3.095	3.265	999
22	0	0	2.6	2.76	2.94		72	0	0	3.1	3.27	999
23	0	0	2.62	2.78	2.96		73	0	0	3.105	3.275	999
24	0	0	2.64	2.8	2.99		74	0	0	3.11	3.28	999
25	0	0	2.66	2.82	3.01		75	0	0	3.115	3.285	999
26	0	0	2.68	2.84	999		76	0	0	3.12	3.29	999
27	0	0	2.7	2.86	999		77	0	0	3.125	3.295	999
28	0	0	2.72	2.88	999		78	0	0	3.13	3.3	999
29	0	0	2.73	2.9	999		79	0	0	3.135	3.305	999
30	0	0	2.75	2.91	999		80	0	0	3.14	3.31	999
31	0	0	2.76	2.93	999		81	0	0	3.144	3.314	999
32	0	0	2.78	2.95	999		82	0	0	3.148	3.318	999
33	0	0	2.79	2.96	999		83	0	0	3.152	3.322	999
34	0	0	2.81	2.97	999		84	0	0	3.156	3.326	999
35	0	0	2.82	2.98	999		85	0	0	3.16	3.33	999
36	0	0	2.83	2.992	999		86	0	0	3.164	3.334	999
37	0	0	2.84	3.004	999		87	0	0	3.168	3.338	999
38	0	0	2.85	3.016	999		88	0	0	3.172	3.342	999
39	0	0	2.86	3.028	999		89	0	0	3.176	3.346	999
40	0	0	2.87	3.04	999		90	0	0	3.18	3.35	999
41	0	0	2.88	3.05	999		91	0	0	3.183	3.353	999
42	0	0	2.89	3.06	999		92	0	0	3.186	3.356	999
43	0	0	2.9	3.07	999		93	0	0	3.189	3.359	999
44	0	0	2.91	3.08	999		94	0	0	3.192	3.362	999
45	0	0	2.92	3.09	999		95	0	0	3.195	3.365	999
46	0	0	2.928	3.098	999		96	0	0	3.198	3.368	999
47	0	0	2.936	3.106	999		97	0	0	3.201	3.371	999
48	0	0	2.944	3.114	999		98	0	0	3.204	3.374	999
49	0	0	2.952	3.122	999		99	0	0	3.207	3.377	999
51	0	0	2.967	3.137	999		100	0	0	3.21	3.38	999
52	0	0	2.974	3.144	999							