Control chart calculations

FORMULAS:

Chart	CL	UCL	LCL	Comments
$\bar{x}$ - R	$\bar{\bar{x}}$	$\bar{\bar{x}} + A_2\bar{R}$	$\bar{\bar{x}} - A_2\bar{R}$	$\hat{\sigma} = \dfrac{\bar{R}}{d_2}$
	$\bar{R}$	$D_4\bar{R}$	$D_3\bar{R}$	use when n < 10
individuals with moving range	$\bar{x}$	$\bar{x} + E_2\bar{R}$	$\bar{x} - E_2\bar{R}$	$\hat{\sigma} = \dfrac{\bar{R}}{d_2}$
	$\bar{R}$	$D_4\bar{R}$	$D_3\bar{R}$	use n = 2
$\bar{x}$ - s	$\bar{\bar{x}}$	$\bar{\bar{x}} + A_3\bar{s}$	$\bar{\bar{x}} - A_3\bar{s}$	$\hat{\sigma} = \bar{s}$
	$\bar{s}$	$B_4\bar{s}$	$B_3\bar{s}$	use when n ≥ 10 or when n varies
np	$n\bar{p}$	$n\bar{p} + 3\sqrt{n\bar{p}(1-\bar{p})}$	$n\bar{p} - 3\sqrt{n\bar{p}(1-\bar{p})}$	n is fixed size
p	$\bar{p}$	$\bar{p} + 3\sqrt{\dfrac{\bar{p}(1-\bar{p})}{\bar{n}}}$	$\bar{p} - 3\sqrt{\dfrac{\bar{p}(1-\bar{p})}{\bar{n}}}$	use n_i instead of $\bar{n}$ if n_i's vary widely
c	$\bar{c}$	$\bar{c} + 3\sqrt{\bar{c}}$	$\bar{c} - 3\sqrt{\bar{c}}$	fixed area of observation
u	$\bar{u}$	$\bar{u} + 3\sqrt{\dfrac{\bar{u}}{\bar{a}}}$	$\bar{u} - 3\sqrt{\dfrac{\bar{u}}{\bar{a}}}$	use a_i instead of $\bar{a}$ if a_i's vary widely

Basic Statistics - Kiemele, Schmidt & Berdine

NOTATION:

CL = center line
UCL = upper control limit
LCL = lower control limit
R = range of sample
$\bar{R}$ = average of ranges
$\bar{x}$ = average of readings
$\bar{\bar{x}}$ = average of averages
$\bar{s}$ = average of sample standard deviations

n = sample size
$\bar{n}$ = average sample size
$\bar{p}$ = average proportion of defectives
$\bar{c}$ = average count of defects
$\bar{u}$ = average count of defects per unit area of observation
$\bar{a}$ = average area of observation
$\hat{\sigma}$ = estimated overall process standard deviation

CONSTANTS:

n	A_2	A_3	B_3	B_4	d_2	D_3	D_4	E_2
2	1.88	2.66	.00	3.27	1.13	.00	3.27	2.66
3	1.02	1.95	.00	2.57	1.69	.00	2.57	1.77
4	.73	1.63	.00	2.27	2.06	.00	2.28	1.46
5	.58	1.43	.00	2.09	2.33	.00	2.11	1.29
6	.48	1.29	.03	1.97	2.53	.00	2.00	1.18
7	.42	1.18	.12	1.88	2.70	.08	1.92	1.11
8	.37	1.10	.19	1.82	2.85	.14	1.86	1.05
9	.34	1.03	.24	1.76	2.97	.18	1.82	1.01
10	.31	.98	.28	1.72	3.08	.22	1.78	.98
11	.29	.93	.32	1.68	3.17	.26	1.74	
12	.27	.89	.35	1.65	3.26	.28	1.72	
13	.25	.85	.38	1.62	3.34	.31	1.69	
14	.24	.82	.41	1.59	3.41	.33	1.67	
15	.22	.79	.43	1.57	3.47	.35	1.65	
16	.21	.76	.45	1.55	3.53	.36	1.64	
17	.20	.74	.47	1.53	3.59	.38	1.62	
18	.19	.72	.48	1.52	3.64	.39	1.61	
19	.19	.70	.50	1.50	3.69	.40	1.60	
20	.18	.68	.51	1.49	3.74	.42	1.59	