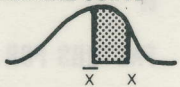
DETERMINING AREA UNDER THE NORMAL CURVE

POPULATION AVERAGE = $\overline{X}$
STANDARD DEVIATION = S
INDIVIDUAL VALUE = X

$$\frac{X-\overline{X}}{S} = Z$$



LOCATE THE Z VALUE AND READ THE CORRESPONDING TABLE VALUE. THE TABLE VALUE IS THE DECIMAL FRACTION OF THE POPULATION THAT LIES BETWEEN THE AVERAGE VALUE X, AND THE VALUE X.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3431	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

SPERRY

Formulas for Attribute Control Charts

n = size of sample

Charts for Defective Units

CONSTANT SAMPLE SIZE - NP CHART

$$\text{center line} = n\overline{p} = \frac{\text{total defective units}}{\text{number of samples}}$$

$$\overline{p} = n\overline{p}/\text{size of sample}$$

$$\text{control limits UCL} = n\overline{p} + 3\sqrt{n\overline{p}(1-\overline{p})}$$

$$\text{LCL} = n\overline{p} - 3\sqrt{n\overline{p}(1-\overline{p})}$$

VARYING SAMPLE SIZE - P CHART

$$\text{center line} = \overline{p} = \frac{\text{total defective units}}{\text{total units inspected}}$$

$$\text{control limits } *\text{UCL} = \overline{p} + 3\frac{\sqrt{\overline{p}(1-\overline{p})}}{\sqrt{n}}$$

$$*\text{LCL} = \overline{p} - 3\frac{\sqrt{\overline{p}(1-\overline{p})}}{\sqrt{n}}$$

Points Plotted

np = number of defective units

p = fraction defective

$= \frac{\text{number defective}}{\text{size of sample}}$

***Control limits can vary from sample to sample.**

SC1-4700

Charts for Defects

Points Plotted

CONSTANT SAMPLE SIZE - C CHART

center line = $\bar{c}$ = $\dfrac{\text{total defects}}{\text{number of samples}}$

c = number of defects

control limits UCL = $\bar{c} + 3\sqrt{\bar{c}}$

LCL $\bar{c} - 3\sqrt{\bar{c}}$

VARYING SAMPLE SIZE - U CHART

center line = u = $\dfrac{\text{total defects}}{\text{total units inspected}}$

u = $\dfrac{\text{number of defects}}{\text{size of sample}}$

control limits *UCL = $\bar{u} + 3\dfrac{\sqrt{\bar{u}}}{\sqrt{n}}$

*LCL = $\bar{u} - 3\dfrac{\sqrt{\bar{u}}}{\sqrt{n}}$

*Control limits can vary from sample to sample.

SPERRY

FACTORS FOR COMPUTING CONTROL LIMITS
$\bar{X}$ & R CHARTS

SAMPLE SIZE	FACTORS FOR AVERAGES	FACTORS FOR RANGE		FACTORS FOR STANDARD DEVIATION OR SIGMA	SAMPLE SIZE
n	A_2	D_3	D_4	d_2	n
2	1.880	.0	3.268	1.128	2
3	1.023	.0	2.574	1.693	3
4	.729	.0	2.282	2.059	4
5	.577	.0	2.114	2.326	5
6	.483	.0	2.004	2.534	6
7	.419	.076	1.924	2.704	7
8	.373	.136	1.864	2.846	8
9	.337	.184	1.816	2.970	9
10	.308	.223	1.777	3.078	10
11	.285	.256	1.744	3.173	11
12	.266	.284	1.717	3.258	12
13	.249	.308	1.692	3.336	13
14	.235	.329	1.671	3.407	14
15	.223	.348	1.652	3.472	15

FORMULAS FOR COMPUTING CONTROL LIMITS

FOR AVERAGES

$UCL_{\bar{X}} = \bar{\bar{X}} + A_2\bar{R}$

$LCL_{\bar{X}} = \bar{\bar{X}} - A_2\bar{R}$

FOR RANGE

$UCL_R = D_4\bar{R}$

$LCL_R = D_3\bar{R}$

STANDARD DEVIATION OR SIGMA

SIGMA = $\dfrac{\bar{R}}{d_2}$

HAVE YOU USED THE FOLLOWING TO SOLVE YOUR PROBLEM?

FLOW CHART — FISH BONE CHART

PARETO CHART — CONTROL CHART — HISTOGRAM