

Formelsammlung zur Prüfung 336.101 VO Grundlagen der Produktion & Logistik

Sommersemester 2016

3. Managing Projects

$$ES = \text{Max}\{EF_{\text{of all immediate predecessors}}\} \quad (1)$$

$$EF = ES + \text{Activity time} \quad (2)$$

$$LF = \text{Min}\{LS_{\text{of all immediate following activities}}\} \quad (3)$$

$$LS = LF - \text{Activity time} \quad (4)$$

$$\text{Slack} = LS - ES \text{ or } LF - EF \quad (5)$$

$$\text{Crash cost per period} = \frac{\text{Crash cost} - \text{Normal cost}}{\text{Normal time} - \text{Crash time}} \quad (6)$$

S.6 Statistical Process Control

Central Limit Theorem

$$\bar{\bar{x}} = \mu \quad (7)$$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} \quad (8)$$

Setting Mean Chart Limits, σ is known

$$UCL = \bar{\bar{x}} + z\sigma_{\bar{x}} \quad (9)$$

$$LCL = \bar{\bar{x}} - z\sigma_{\bar{x}} \quad (10)$$

Setting Mean Chart Limits, σ is unknown, using table values

$$UCL_{\bar{x}} = \bar{\bar{x}} + A_2\bar{R} \quad (11)$$

$$LCL_{\bar{x}} = \bar{\bar{x}} - A_2\bar{R} \quad (12)$$

Setting Range Chart Limits (R-Charts)

$$UCL_R = D_4 \bar{R} \quad (13)$$

$$LCL_R = D_3 \bar{R} \quad (14)$$

Control Charts for Attributes: p-Charts

$$UCL_p = \bar{p} + z\sigma_{\hat{p}} \quad (15)$$

$$LCL_p = \bar{p} - z\sigma_{\hat{p}} \quad (16)$$

$$\sigma_{\hat{p}} = \sqrt{\frac{\bar{p}(1-\bar{p})}{n}} \quad (17)$$

Control Charts for Attributes: c-Charts

$$UCL_c = \bar{c} + z\sqrt{\bar{c}} \quad (18)$$

$$LCL_c = \bar{c} - z\sqrt{\bar{c}} \quad (19)$$

Factors for Computing Control Chart Limits (3-sigma)

Sample Size, n	Mean Factor, A_2	Upper Range, D_4	Lower Range, D_3
2	1.88	3.268	0
3	1.023	2.574	0
4	0.729	2.282	0
5	0.577	2.115	0
6	0.483	2.004	0
7	0.419	1.924	0.076
8	0.373	1.864	0.136
9	0.337	1.816	0.184
10	0.308	1.777	0.223
12	0.266	1.716	0.284

S.7 Capacity Planning

Multiproduct Break-Even Analysis

$$BEP_{\$} = \frac{F}{\sum[(1 - \frac{V_i}{P_i}) \times (W_i)]} \quad (20)$$

$$\text{coordinate k of the center of gravity} = \frac{\sum_i d_{ik} Q_i}{\sum_i Q_i} \quad (21)$$

where k: either x or y-coordinate

9. Layout Decisions

$$\text{Takt time} = \frac{\text{Total work time available}}{\text{Units required}} \quad (22)$$

$$\text{Workers required} = \frac{\text{Total operation time required}}{\text{Takt time}} \quad (23)$$

$$\text{Cycle time} = \frac{\text{Production time available per day}}{\text{Units required per day}} \quad (24)$$

$$\text{Minimum number of workstations} = \frac{\sum_{i=1}^n \text{Time for task i}}{\text{Cycle time}} \quad (25)$$

$$\text{Efficiency} = \frac{\sum \text{Task times}}{(\text{Actual number of workstations}) \times (\text{Largest assigned cycle time})} \quad (26)$$

12. Managing Inventory

Economic Order Quantity Model

$$Q^* = \sqrt{\frac{2DS}{H}} \quad (27)$$

$$TC = \frac{D}{Q}S + \frac{Q}{2}H \quad (28)$$

Production Order Quantity Model

$$Q_p^* = \sqrt{\frac{2DS}{H[1 - (d/p)]}} \quad (29)$$

$$\text{Max. inventory level} = pt - dt(\text{mit } t = Q/p) = Q(1 - \frac{d}{p}) \quad (30)$$

14. Material Requirements Planning

$$\begin{aligned} \text{Total requirements} &= \text{Gross requirements} + \text{Allocations} \\ \text{Available inventory} &= \text{On hand} + \text{Scheduled receipts} \\ \text{Net requirements} &= \text{Total requirements} - \text{Available inventory} \end{aligned} \quad (31)$$

15. Scheduling for the Short-Term

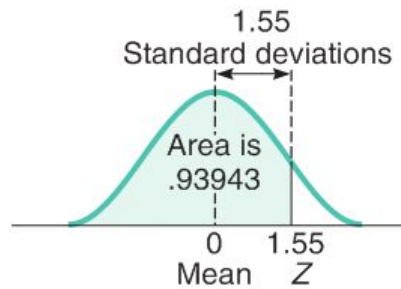
$$\text{Average completion time} = \frac{\text{Sum of total flow time}}{\text{Number of jobs}} \quad (32)$$

$$\text{Utilization metric} = \frac{\text{Total job work (processing) time}}{\text{Sum of total flow time}} \quad (33)$$

$$\text{Average number of jobs in the system} = (\text{Utilization metric})^{-1} \quad (34)$$

$$\text{Average job lateness} = \frac{\text{Total late days}}{\text{Number of jobs}} \quad (35)$$

Appendix 1. Normal Distribution Table



Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
.1	.53983	.54380	.54776	.55172	.55567	.55962	.56356	.56749	.57142	.57535
.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91309	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97778	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
2.3	.98928	.98956	.98983	.99010	.99036	.99061	.99086	.99111	.99134	.99158
2.4	.99180	.99202	.99224	.99245	.99266	.99286	.99305	.99324	.99343	.99361
2.5	.99379	.99396	.99413	.99430	.99446	.99461	.99477	.99492	.99506	.99520
2.6	.99534	.99547	.99560	.99573	.99585	.99598	.99609	.99621	.99632	.99643
2.7	.99653	.99664	.99674	.99683	.99693	.99702	.99711	.99720	.99728	.99736
2.8	.99744	.99752	.99760	.99767	.99774	.99781	.99788	.99795	.99801	.99807
2.9	.99813	.99819	.99825	.99831	.99836	.99841	.99846	.99851	.99856	.99861
3.0	.99865	.99869	.99874	.99878	.99882	.99886	.99889	.99893	.99896	.99900