LAMPIRAN 1

UJI KENORMALAN, KESERAGAMAN DAN KECUKUPAN DATA

Stasiun 2

- **Operasi Cat Adhesive Abu**

Stasiun : 2			
Nama Operasi : Cat Adhesive Abu			
No	Waktu (detik)	No	Waktu (detik)
1	25.15	19	35
2	34.7	20	43.8
3	38.4	21	40.3
4	29.5	22	36.2
5	47.96	23	40.1
6	33.28	24	49.2
7	35.4	25	35.3
8	35.7	26	40.07
9	30	27	30.35
10	33.15	28	34.08
11	37	29	47.46
12	28.6	30	41.2
13	34.6	31	33.25
14	36.3	32	34.94
15	46.6	33	32.16
16	36.8	34	44.85
17	48.77	35	27.63
18	31.6	36	25.24

- Jumlah Kelas (Aturan Sturgess)

  K= 3.3 log n + 1

  = 3.3 log 36 +1

  = 6.135 ≈ 7 kelas

- Lebar Sel

  C = $\frac{Data\ max - Data\ min}{k}$

  = $\frac{49.2-25.15}{6.135}$ = 3.9

Uji Kenormalan Operasi Cat Adhesive Abu

Kelas	Interval Kelas			Batas kelas			Oi	Z1	Z2	P(Z1)	P(Z2)	P(Z2)-P(Z1)	ei	ei gab	oi gab	$(oi-ei)^2/ei$
1	<22.15			<22.149			0	∞	-2.190	0	0.014	0.014	0.513			
2	22.15	-	26.04	22.145	-	26.045	2	-2.213	-1.613	0.013	0.053	0.040	1.439	5.636	5	0.072
3	26.05	-	29.94	26.045	-	29.945	3	-1.613	-1.012	0.053	0.156	0.102	3.684			
4	29.95	-	33.84	29.945	-	33.845	7	-1.012	-0.412	0.156	0.340	0.185	6.645	6.645	7	0.019
5	33.85	-	37.74	33.845	-	37.745	12	-0.412	0.189	0.340	0.575	0.235	8.446	8.446	12	1.495
6	37.75	-	41.64	37.745	-	41.645	5	0.189	0.790	0.575	0.785	0.210	7.565	7.565	5	0.870
7	41.65	-	45.54	41.645	-	45.545	2	0.790	1.390	0.785	0.918	0.133	4.775			
8	45.55	-	49.44	45.545	-	49.445	5	1.390	1.991	0.918	0.977	0.059	2.124	6.899	7	0.001
9	>49.44			>49.445			0	4.276	∞	1.000	1	0.000	0.000			
							36								36	2.457

σ = .49

π = 36.52

Z1 = -2.213 Z2= -1.613

P(Z1) = Normdist (-2.213) = 0.013

P(Z2) = Normdist (-1.613) = 0.053

P(Z2)-P(Z1) = 0.053 – 0.013 = 0.040

ei = (P(Z1)-P(Z2))*36 = 0.040 *36 = 1.439

$X^2 = \sum_{i=1}^{k} \frac{(oi-ei)^2}{ei} = \frac{(5-5.636)^2}{5.636} = 0.072$

v = k-r-1

= 4 – 2 -1

= 1

α = 1 – tingkat kepercayaan

= 1 – 0.95

= 0.05

$X^2(\alpha, v) = X^2(0.05, 1) = 3.841$

$\chi^2(\alpha; v) > \chi^2 hitung \rightarrow 3.841 > 2.457 \rightarrow$ Data Berdistribusi Normal

- **Operasi Cat Adhesive Hitam**

Stasiun : 2			
Nama Operasi : Cat Adhesive Hitam			
No	Waktu (detik)	No	Waktu (detik)
1	23	19	44.04
2	39.91	20	40.77
3	32.78	21	21.94
4	42.93	22	26.74
5	23.77	23	29.97
6	18.08	24	35.06
7	18.47	25	28.3
8	26.71	26	36.98
9	33.14	27	14.74
10	15.09	28	37.46
11	21.55	29	26.31
12	27.28	30	25.02
13	20.71	31	29.18
14	23.25	32	20.53
15	26.17	33	33.6
16	35.47	34	35.4
17	46.65	35	31.2
18	31.73	36	27

- Jumlah Kelas (Aturan Sturgess)

  K= 3.3 log n + 1

  = 3.3 log 36 +1

  = 6.135 ≈ 7 kelas

- Lebar Sel

  C = $\frac{Data\ max - Data\ min}{k}$

  = $\frac{46.65-14.74}{6.135}$ = 5.2

Uji Kenormalan Operasi Cat Adhesive Hitam

Kelas	Interval Kelas			Batas kelas			Oi	Z1	Z2	P(Z1)	P(Z2)	P(Z2)-P(Z1)	ei	ei gab	oi gab	$(oi-ei)^2/ei$
1	<14.74			<14.735			0	∞	-1.773	0	0.038	0.038	1.372	11.137	12	0.067
2	14.74	-	19.93	14.735	-	19.935	4	-1.773	-1.135	0.038	0.128	0.090	3.240			
3	19.94	-	25.13	19.935	-	25.135	8	-1.135	-0.498	0.128	0.309	0.181	6.526			
4	25.14	-	30.33	25.135	-	30.335	9	-0.498	0.140	0.309	0.556	0.246	8.869	8.869	9	0.002
5	30.34	-	35.53	30.335	-	35.535	8	0.140	0.778	0.556	0.782	0.226	8.135	8.135	8	0.002
6	35.54	-	40.73	35.535	-	40.735	3	0.778	1.416	0.782	0.922	0.140	5.036	7.859	7	0.094
7	40.74	-	45.93	40.735	-	45.935	3	1.416	2.053	0.922	0.980	0.058	2.103			
8	45.94	-	51.13	45.935	-	51.135	1	2.053	2.691	0.980	0.996	0.016	0.592			
9	>51.13			>51.135			0	2.691	∞	0.996	1	0.004	0.128			
							36								36	0.165

σ = 8.15

π = 29.19

Z1 = -1.773 Z2= -1.135

P(Z1) = Normdist (-1.773) = 0.038

P(Z2) = Normdist (-1.135) = 0.128

P(Z2)-P(Z1) = 0.128 – 0.038 = 0.090

ei = (P(Z1)-P(Z2))*36 = 0.090 *36 = 3.240

$X^2 = \sum_{i=1}^{k} \frac{(oi-ei)^2}{ei} = \frac{(12-11.137)^2}{11.137} = 0.067$

v = k-r-1

= 4 – 2 -1

= 1

α = 1 – tingkat kepercayaan

= 1 – 0.95

= 0.05

$X^2(\alpha, v) = X^2(0.05, 1) = 3.841$

$\chi^2(\alpha;\nu) > \chi^2 hitung$ →3.841> 0.165→ Data Berdistribusi Normal

➢ **Stasiun 3**

- **Operasi Ukur Kompon**

Stasiun : 3			
Nama Operasi : Ukur Kompon			
No	Waktu	No	Waktu
1	8.16	19	5.53
2	4.26	20	5.81
3	5.75	21	6.75
4	6.41	22	6.6
5	5.44	23	6.06
6	4.49	24	6.6
7	4.36	25	5.56
8	5.4	26	8.72
9	5.62	27	7.81
10	7.72	28	5.78
11	6.53	29	7.71
12	6.18	30	7.59
13	7.75	31	7.35
14	5.62	32	4.97
15	6.35	33	6.41
16	5.69	34	5.35
17	8.03	35	6.76
18	5.69	36	5.42

- Jumlah Kelas (Aturan Sturgess)

  K= 3.3 log n + 1

  = 3.3 log 36 +1

  = 6.135 ≈ 7 kelas

- Lebar Sel

  C = $\frac{Data\ max - Data\ min}{k}$

  = $\frac{8.72-4.26}{6.135}$ = 0.7

Uji Kenormalan Operasi Ukur Kompon

Kelas	Interval Kelas			Batas kelas			Oi	Z1	Z2	P(Z1)	P(Z2)	P(Z2)-P(Z1)	ei	ei gab	oi gab	$(oi-ei)^2/ei$
1	<4.26			<4.255			0	∞	-1.613	0	0.053	0.053	1.921			
2	4.26	-	4.95	4.255	-	4.955	3	-1.809	-1.185	0.035	0.118	0.083	2.980	11.000	12	0.091
3	4.96	-	5.65	4.955	-	5.655	9	-1.185	-0.561	0.118	0.287	0.169	6.099			
4	5.66	-	6.35	5.655	-	6.355	8	-0.561	0.063	0.287	0.525	0.238	8.560	8.560	8	0.037
5	6.36	-	7.05	6.355	-	7.055	7	0.063	0.687	0.525	0.754	0.229	8.240	8.240	7	0.187
6	7.06	-	7.75	7.055	-	7.755	5	0.687	1.312	0.754	0.905	0.151	5.439			
7	7.76	-	8.45	7.755	-	8.455	3	1.312	1.936	0.905	0.974	0.068	2.462	8.666	9	0.013
8	8.46	-	9.15	8.455	-	9.155	1	1.936	2.560	0.974	0.995	0.021	0.764			
9	>9.15			>9.155			0	4.004	∞	1.000	1	0.000	0.00			
							36								36	0.327

σ = 1.12

π = 6.28

Z1 = -1.809 Z2= -1.185

P(Z1) = Normdist (-1.809) = 0.035

P(Z2) = Normdist (-1.185) = 0.118

P(Z2)-P(Z1) = 0.118 – 0.035 = 0.083

ei = (P(Z1)-P(Z2))*36 = 0.083 *36 = 2.980

$X^2 = \sum_{i=1}^{k} \frac{(oi-ei)^2}{ei} = \frac{(12-11)^2}{11} = 0.091$

v = k-r-1

= 4 – 2 -1

= 1

α = 1 – tingkat kepercayaan

= 1 – 0.95

= 0.05

$X^2(\alpha, v) = X^2(0.05, 1) = 3.841$

$\chi^2(\alpha; v) > \chi^2 hitung \rightarrow 3.841 > 0.327 \rightarrow$ Data Berdistribusi Normal

- **Operasi Potong Kompon**

Stasiun : 3			
Nama Operasi : Potong Kompon			
No	Waktu	No	Waktu
1	13.62	19	17.47
2	13.75	20	14.22
3	13.47	21	12.93
4	16.44	22	14.34
5	13.13	23	16.21
6	10.75	24	17.93
7	12.34	25	15.27
8	17.97	26	16.38
9	19.25	27	16.94
10	15.87	28	13.78
11	12.59	29	14.15
12	17.25	30	16.69
13	14.59	31	15.34
14	12.69	32	15.78
15	18.41	33	16.38
16	12.97	34	16.3
17	16.28	35	17.16
18	17.53	36	14.21

- Jumlah Kelas (Aturan Sturgess)

  K= 3.3 log n + 1

  = 3.3 log 36 +1

  = 6.135 ≈ 7 kelas

- Lebar Sel

  C = $\frac{Data\ max - Data\ min}{k}$

  = $\frac{19.25-10.75}{6.135}$ = 1.4

Uji Kenormalan Operasi Potong Kompon

Kelas	Interval Kelas			Batas kelas			Oi	Z1	Z2	P(Z1)	P(Z2)	P(Z2)-P(Z1)	ei	ei gab	oi gab	$(oi-ei)^2/ei$
1	<10.75			<10.745			0	∞	-2.246	0	0.012	0.012	0.445			
2	10.75	-	12.14	10.745	-	12.145	1	-2.246	-1.554	0.012	0.060	0.048	1.719	6.998	8	0.143
3	12.15	-	13.54	12.145	-	13.545	7	-1.554	-0.862	0.060	0.194	0.134	4.834			
4	13.55	-	14.94	13.545	-	14.945	8	-0.862	-0.170	0.194	0.433	0.238	8.576	8.576	8	0.039
5	14.95	-	16.34	14.945	-	16.345	7	-0.170	0.522	0.433	0.699	0.267	9.600	9.600	7	0.704
6	16.35	-	17.74	16.345	-	17.745	9	0.522	1.214	0.699	0.888	0.188	6.783			
7	17.75	-	19.14	17.745	-	19.145	3	1.214	1.907	0.888	0.972	0.084	3.024	10.826	13	0.437
8	19.15	-	20.54	19.145	-	20.545	1	1.907	2.599	0.972	0.995	0.024	0.850			
9	>20.54			>20.545			0	2.599	∞	0.995	1	0.005	0.168			
							36								36	1.323

$\sigma = 2.02$

$\pi = 15.29$

Z1 = -2.246 Z2= -1.554

P(Z1) = Normdist (-2.246) = 0.012

P(Z2) = Normdist (-1.554) = 0.060

P(Z2)-P(Z1) = 0.060 – 0.012 = 0.048

ei = (P(Z1)-P(Z2))*36 = 0.048 *36 = 1.719

$X^2 = \sum_{i=1}^{k} \frac{(oi-ei)^2}{ei} = \frac{(8-6.998)^2}{6.998} = 0.143$

v = k-r-1

= 4 – 2 -1

= 1

α = 1 – tingkat kepercayaan

= 1 – 0.95

= 0.05

$X^2(\alpha, v) = X^2(0.05, 1) = 3.841$

$\chi^2(\alpha; v) > \chi^2 hitung \rightarrow 3.841 > 1.323 \rightarrow$ Data Berdistribusi Normal

➢ **Stasiun 4**

- **Operasi Injection**

Stasiun : 4			
Nama Operasi : Injection			
No	Waktu	No	Waktu
1	772.1	19	776.72
2	787.69	20	756.46
3	797.75	21	775.02
4	763.14	22	791.52
5	747.67	23	784.79
6	750.32	24	746.27
7	755.72	25	745.59
8	739.56	26	752.49
9	751.58	27	760.52
10	747.9	28	767.97
11	744.92	29	764.44
12	771.89	30	775.12
13	777.5	31	769.51
14	754.34	32	752.58
15	779.53	33	787.17
16	781.97	34	752.95
17	766.89	35	751.44
18	763.02	36	738.69

- Jumlah Kelas (Aturan Sturgess)

  K= 3.3 log n + 1

  = 3.3 log 36 +1

  = 6.135 ≈ 7 kelas

- Lebar Sel

  $C = \frac{\text{Data max} - \text{Data min}}{k}$

  $= \frac{797.75 - 738.69}{6.135} = 9.6$

Uji Kenormalan Operasi Injection

Kelas	Interval Kelas			Batas kelas			Oi	Z1	Z2	P(Z1)	P(Z2)	P(Z2)-P(Z1)	ei	ei gab	oi gab	$(oi-ei)^2/ei$
1	<738.69			<738.69			0	∞	-1.211	0	0.113	0.113	4.068	7.863	7	0.095
2	738.69	-	748.28	738.685	-	748.285	7	-1.607	-0.997	0.054	0.159	0.105	3.795			
3	748.29	-	757.88	748.285	-	757.885	9	-0.997	-0.387	0.159	0.350	0.190	6.845	6.845	9	0.679
4	757.89	-	767.48	757.885	-	767.485	5	-0.387	0.224	0.350	0.589	0.239	8.603	8.603	5	1.509
5	767.49	-	777.08	767.485	-	777.085	7	0.224	0.834	0.589	0.798	0.209	7.536	7.536	7	0.038
6	777.09	-	786.68	777.085	-	786.685	4	0.834	1.444	0.798	0.926	0.128	4.601	7.138	8	0.104
7	786.69	-	796.28	786.685	-	796.285	3	1.444	2.055	0.926	0.980	0.054	1.957			
8	796.29	-	805.88	796.285	-	805.885	1	2.055	2.665	0.980	0.996	0.016	0.580			
9	>805.88			>805.88			0	8.802	∞	1.000	1	0.000	0.000			
							36								36	2.425

σ = 15.73

π = 763.97

Z1 = -1.607 Z2= -0.997

P(Z1) = Normdist (-1. 607) = 0.054

P(Z2) = Normdist (-0.997) = 0.159

P(Z2)-P(Z1) = 0.159 – 0.054= 0.105

ei = (P(Z1)-P(Z2))*36 = 0.105 *36 = 7.863

$X^2 = \sum_{i=1}^{k} \frac{(oi-ei)^2}{ei} = \frac{(7-7.863)^2}{7.863} = 0.095$

v = k-r-1

= 5 – 2 -1

= 2

α = 1 – tingkat kepercayaan

= 1 – 0.95

= 0.05

$X^2(\alpha, v) = X^2(0.05, 2) = 5.991$

$\chi^2(\alpha;v) > \chi^2 hitung$ →5.991> 2.425 `→ Data Berdistribusi Normal

➢ **Stasiun 5**

- **Operasi Finishing**

Stasiun	: 5		
Nama Operasi	: Finishing		
No	Waktu	No	Waktu
1	122.3	19	81.7
2	147	20	75.5
3	127.5	21	112.6
4	104.4	22	71.3
5	54.6	23	84.9
6	65	24	83
7	105.9	25	89.6
8	63.1	26	157.3
9	60.01	27	94.21
10	62.7	28	81.61
11	72.2	29	89.6
12	66.9	30	81.74
13	71.9	31	95.29
14	75.1	32	106.96
15	61.1	33	82.25
16	74.8	34	80.51
17	89.5	35	104.86
18	84.1	36	97.52

- Jumlah Kelas (Aturan Sturgess)

  K= 3.3 log n + 1

  = 3.3 log 36 +1

  = 6.135 ≈ 7 kelas

- Lebar Sel

  $C = \frac{\text{Data max} - \text{Data min}}{k}$

  $= \frac{157.3 - 54.6}{6.135} = 16.7$

Uji Kenormalan Operasi Finishing

Kelas	Interval Kelas			Batas kelas			Oi	Z1	Z2	P(Z1)	P(Z2)	P(Z2)-P(Z1)	ei	ei gab	oi gab	$(oi-ei)^2/ei$
1	<54.60			<54.595			0	∞	-1.430	0	0.076	0.076	2.751	8.475	7	0.257
2	54.60	-	71.29	54.595	-	71.295	7	-1.430	-0.721	0.076	0.235	0.159	5.724			
3	71.30	-	87.99	71.295	-	87.995	14	-0.721	-0.013	0.235	0.495	0.260	9.344	9.344	14	2.320
4	88.00	-	104.69	87.995	-	104.695	8	-0.013	0.696	0.495	0.757	0.262	9.424	9.424	8	0.215
5	104.70	-	121.39	104.695	-	121.395	3	0.696	1.404	0.757	0.920	0.163	5.874	8.757	7	0.353
6	121.40	-	138.09	121.395	-	138.095	2	1.404	2.113	0.920	0.983	0.063	2.261			
7	138.10	-	154.79	138.095	-	154.795	1	2.113	2.821	0.983	0.998	0.015	0.537			
8	154.80	-	171.49	154.795	-	171.495	1	2.821	3.530	0.998	1.000	0.002	0.079			
9	>171.49			>171.495			0	3.530	∞	1.000	1	0.000	0.007			
							36								36	3.145

σ = 23.57

π = 88.29

Z1 = -1.430 Z2= -0.721

P(Z1) = Normdist (-1.430) = 0.076

P(Z2) = Normdist (-0.721) = 0.235

P(Z2)-P(Z1) = 0.235 – 0.076= 0.159

ei = (P(Z1)-P(Z2))*36 = 0.159 *36 = 8.475

$X^2 = \sum_{i=1}^{k} \frac{(oi-ei)^2}{ei} = \frac{(7-8.475)^2}{8.475} = 0.257$

v = k-r-1

= 4 – 2 -1

= 1

α = 1 – tingkat kepercayaan

= 1 – 0.95

= 0.05

$X^2(\alpha, v) = X^2(0.05,1) = 3.841$

$\chi^2(\alpha; v) > \chi^2 hitung \rightarrow 3.841 > 3.145 \rightarrow$ Data Berdistribusi Normal

➢ **Stasiun 6**

- **Operasi Slab Ampal**

Stasiun : 6			
Nama Operasi : Slab Ampal			
No	Waktu (detik)	No	Waktu (detik)
1	104.67	19	138.6
2	120.48	20	172.74
3	142.77	21	122.52
4	125.2	22	117.92
5	156.2	23	122.65
6	137.9	24	105.26
7	123.6	25	137.22
8	130.4	26	110.87
9	122.9	27	119.59
10	152.7	28	114.67
11	147.7	29	112.03
12	186.8	30	154.42
13	156.7	31	118.49
14	147.7	32	146.49
15	154.4	33	137.59
16	115.9	34	97.42
17	150.7	35	90.65
18	145.3	36	114.56

- Jumlah Kelas (Aturan Sturgess)

  K= 3.3 log n + 1

  = 3.3 log 36 +1

  = 6.135 ≈ 7 kelas

- Lebar Sel

  $C = \frac{\text{Data max} - \text{Data min}}{k}$

  $= \frac{186.8 - 90.65}{6.135} = 15.7$

Uji Kenormalan Operasi Slab Ampal

Kelas	Interval Kelas			Batas kelas			Oi	Z1	Z2	P(Z1)	P(Z2)	P(Z2)-P(Z1)	ei	ei gab	oi gab	$(oi-ei)^2/ei$
1	<90.65			<90.645			0	∞	-1.945	0	0.026	0.026	0.931			
2	90.65	-	106.34	90.645	-	106.345	4	-1.945	-1.209	0.026	0.113	0.088	3.151	11.465	13	0.205
3	106.35	-	122.04	106.345	-	122.045	9	-1.209	-0.472	0.113	0.318	0.205	7.383			
4	122.05	-	137.74	122.045	-	137.745	8	-0.472	0.265	0.318	0.604	0.286	10.293	10.293	8	0.511
5	137.75	-	153.44	137.745	-	153.445	9	0.265	1.001	0.604	0.842	0.237	8.543	8.543	9	0.024
6	153.45	-	169.14	153.445	-	169.145	4	1.001	1.738	0.842	0.959	0.117	4.220			
7	169.15	-	184.84	169.145	-	184.845	1	1.738	2.475	0.959	0.993	0.034	1.240	5.699	6	0.016
8	184.85		200.54	184.845	-	200.545	1	2.475	3.211	0.993	0.999	0.006	0.216			
9	>200.54			>200.545			0	3.211	∞	0.999	1	0.001	0.024			
							36								36	0.756

σ = 21.31

π = 132.10

Z1 = -1.945 Z2= -1.209

P(Z1) = Normdist (-1.945) = 0.026

P(Z2) = Normdist (-1.209) = 0.113

P(Z2)-P(Z1) = 0.113 – 0.026= 0.088

ei = (P(Z1)-P(Z2))*36 = 0.088 *36 = 11.465

$X^2 = \sum_{i=1}^{k} \frac{(oi-ei)^2}{ei} = \frac{(13-11.465)^2}{11.465} = 0.205$

v = k-r-1

= 4 – 2 -1

= 1

α = 1 – tingkat kepercayaan

= 1 – 0.95

= 0.05

$X^2(\alpha, v) = X^2(0.05, 1) = 3.841$

$\chi^2(\alpha; v) > \chi^2 hitung \rightarrow 3.841 > 0.756 \rightarrow$ Data Berdistribusi Normal

➢ **Stasiun 7**

- **Operasi Slab Lekukan**

Stasiun : 7			
Nama Operasi : Slab Lekukan			
No	Waktu	No	Waktu
1	45.22	19	84.28
2	62.68	20	70.32
3	51.81	21	69.22
4	58.1	22	86.28
5	51.88	23	75.88
6	60.6	24	69.22
7	71.19	25	46.66
8	54.37	26	47.81
9	60.03	27	66.02
10	52.87	28	79.63
11	58.29	29	97.59
12	47	30	63.69
13	56.93	31	64.41
14	50.82	32	46.06
15	51.22	33	87.15
16	60.87	34	94.02
17	68.5	35	58.57
18	64.34	36	92.16

- Jumlah Kelas (Aturan Sturgess)

  K= 3.3 log n + 1

  = 3.3 log 36 +1

  = 6.135 ≈ 7 kelas

- Lebar Sel

  $C = \frac{\text{Data max} - \text{Data min}}{k}$

  $= \frac{92.16 - 45.22}{6.135} = 7.7$

Uji Kenormalan Operasi Slab Lekukan

Kelas	Interval Kelas			Batas kelas			Oi	Z1	Z2	P(Z1)	P(Z2)	P(Z2)-P(Z1)	ei	ei gab	oi gab	$(oi-ei)^2/ei$
1	<45.22			<45.215			0	∞	-1.336	0	0.091	0.091	3.268	7.571	10	0.780
2	45.22	-	52.91	45.215	-	52.915	10	-1.336	-0.805	0.091	0.210	0.120	4.303			
3	52.92	-	60.61	52.915	-	60.615	7	-0.805	-0.275	0.210	0.392	0.181	6.532	6.532	7	0.034
4	60.62	-	68.31	60.615	-	68.315	6	-0.275	0.256	0.392	0.601	0.209	7.532	7.532	6	0.312
5	68.32	-	76.01	68.315	-	76.015	6	0.256	0.786	0.601	0.784	0.183	6.597	6.597	6	0.054
6	76.02	-	83.71	76.015	-	83.715	1	0.786	1.317	0.784	0.906	0.122	4.388	7.769	7	0.076
7	83.72	-	91.41	83.715	-	91.415	3	1.317	1.848	0.906	0.968	0.062	2.217			
8	91.42	-	99.11	91.415	-	99.115	3	1.848	2.378	0.968	0.991	0.024	0.851			
9	>99.11			>99.115			0	2.378	∞	0.991	1	0.009	0.313			
							36								36	1.255

$\sigma = 14.51$

$\pi = 64.60$

Z1 = -1.336 Z2= -0.805

P(Z1) = Normdist (-1.336) = 0.091

P(Z2) = Normdist (-1.805) = 0.210

P(Z2)-P(Z1) = 0.210 – 0.091= 0.120

ei = (P(Z1)-P(Z2))*36 = 0.120 *36 = 7.571

$X^2 = \sum_{i=1}^{k} \frac{(oi-ei)^2}{ei} = \frac{(10-7.571)^2}{7.571} = 0.780$

v = k-r-1

= 5 – 2 -1

= 2

α = 1 – tingkat kepercayaan

= 1 – 0.95

= 0.05

$X^2(\alpha, v) = X^2(0.05, 2) = 5.991$

$\chi^2(\alpha; v) > \chi^2 hitung \rightarrow 5.991 > 1.255 \rightarrow$ Data Berdistribusi Normal

➢ **Stasiun 8**

- **Operasi Cuci Thinner**

Stasiun : 8			
Nama Operasi : Cuci Thinner			
No	Waktu	No	Waktu
1	16	19	14.83
2	15.1	20	13.94
3	18.21	21	14.88
4	15.27	22	14.97
5	14.28	23	15.34
6	16.79	24	16.49
7	15.42	25	19.38
8	16.88	26	14.61
9	13.72	27	12.79
10	16.58	28	14.33
11	15.43	29	15.41
12	15.76	30	16.43
13	13.69	31	16.64
14	15.84	32	13.87
15	18.71	33	14.59
16	19.78	34	15.84
17	18.43	35	16.79
18	13.94	36	17.34

- Jumlah Kelas (Aturan Sturgess)

  K= 3.3 log n + 1

  = 3.3 log 36 +1

  = 6.135 ≈ 7 kelas

- Lebar Sel

  C = $\frac{Data\ max - Data\ min}{k}$

  = $\frac{19.78-12.79}{6.135}$ = 1.1

Uji Kenormalan Operasi Cuci Thiner

Kelas	Interval Kelas			Batas kelas			Oi	Z1	Z2	P(Z1)	P(Z2)	P(Z2)-P(Z1)	ei	ei gab	oi gab	$(oi-ei)^2/ei$
1	<12.79			<12.785			0	∞	-1.800	0	0.036	0.036	1.294			
2	12.79	-	13.88	12.785	-	13.885	3	-1.800	-1.140	0.036	0.127	0.091	3.282	11.356	13	0.238
3	13.89	-	14.98	13.885	-	14.985	10	-1.140	-0.480	0.127	0.315	0.188	6.780			
4	14.99	-	16.08	14.985	-	16.085	10	-0.480	0.179	0.315	0.571	0.256	9.205	9.205	10	0.069
5	16.09	-	17.18	16.085	-	17.185	7	0.179	0.839	0.571	0.799	0.228	8.213	8.213	7	0.179
6	17.19	-	18.28	17.185	-	18.285	2	0.839	1.499	0.799	0.933	0.134	4.815			
7	18.29	-	19.38	18.285	-	19.385	3	1.499	2.158	0.933	0.985	0.052	1.855	7.226	6	0.208
8	19.39	-	20.48	19.385	-	20.485	1	2.158	2.818	0.985	0.998	0.013	0.469			
9	>20.48			>20.485			0	2.818	∞	0.998	1	0.002	0.087			
							36								36	0.694

σ = 1.67

π = 15.79

Z1 = -1.800 Z2= -1.140

P(Z1) = Normdist (-1.800) = 0.036

P(Z2) = Normdist (-1.140) = 0.127

P(Z2)-P(Z1) = 0.127 – 0.036 = 0.091

ei = (P(Z1)-P(Z2))*36 = 0.091 *36 = 3.282

$X^2 = \sum_{i=1}^{k} \frac{(oi-ei)^2}{ei} = \frac{(13-11.356)^2}{11.356} = 0.258$

v = k-r-1

= 4 – 2-1

= 1

α = 1 – tingkat kepercayaan

= 1 – 0.95

= 0.05

$X^2(\alpha, v) = X^2(0.05, 1) = 3.841$

$\chi^2(\alpha; v) > \chi^2 hitung \rightarrow 3.841 > 0.694 \rightarrow$ Data Berdistribusi Normal

➢ **Stasiun 9**

- **Operasi Semprot Angin**

Stasiun : 9			
Nama Operasi : Semprot Angin			
No	Waktu	No	Waktu
1	12.3	19	11.9
2	10.9	20	9.3
3	7.8	21	8.7
4	10.3	22	9.1
5	12.3	23	7.4
6	12.1	24	10.5
7	11.1	25	6.4
8	13.6	26	9.8
9	7.2	27	11.3
10	9.6	28	5.7
11	9.5	29	7.4
12	7.8	30	7.6
13	11.4	31	7.7
14	10.15	32	8.1
15	8.9	33	14.2
16	8.3	34	12.8
17	11	35	12.3
18	12.3	36	7.2

- Jumlah Kelas (Aturan Sturgess)

  K= 3.3 log n + 1

  = 3.3 log 36 +1

  = 6.135 ≈ 7 kelas

- Lebar Sel

  C = $\frac{Data\ max - Data\ min}{k}$

  = $\frac{14.7-5.2}{6.135}$ = 1.4

Uji Kenormalan Operasi Semprot Angin

Kelas	Interval Kelas			Batas kelas			Oi	Z1	Z2	P(Z1)	P(Z2)	P(Z2)-P(Z1)	ei	ei gab	oi gab	$(oi-ei)^2/ei$
1	<5.7			<5.695			0	∞	-3.519	0	0.000	0.000	0.008	8.682	12	1.268
2	5.70	-	7.09	5.695	-	7.095	2	-1.899	-1.256	0.029	0.105	0.076	2.726			
3	7.10	-	8.49	7.095	-	8.495	10	-1.256	-0.614	0.105	0.270	0.165	5.947			
4	8.50	-	9.89	8.495	-	9.895	7	-0.614	0.029	0.270	0.512	0.242	8.705	8.705	7	0.334
5	9.90	-	11.29	9.895	-	11.295	6	0.029	0.671	0.512	0.749	0.237	8.550	8.550	6	0.760
6	11.30	-	12.69	11.295	-	12.695	8	0.671	1.314	0.749	0.906	0.157	5.635	9.035	11	0.428
7	12.70	-	14.09	12.695	-	14.095	2	1.314	1.957	0.906	0.975	0.069	2.492			
8	14.10	-	15.49	14.095	-	15.495	1	1.957	2.599	0.975	0.995	0.021	0.739			
9	>15.49			>15.495			0	2.599	∞	0.995	1	0.005	0.168			
							36								36	2.790

σ = 2.18

π = 9.83

Z1 = -1.899 Z2= -1.256

P(Z1) = Normdist (-1.899) = 0.029

P(Z2) = Normdist (-1.256) = 0.105

P(Z2)-P(Z1) = 0.105 – 0.029 = 0.076

ei = (P(Z1)-P(Z2))*36 = 0.076 *36 = 2.726

$X^2 = \sum_{i=1}^{k} \frac{(oi-ei)^2}{ei} = \frac{(12-8.682)^2}{8.682} = 1.268$

v = k-r-1

= 4 – 2 -1

= 1

α = 1 – tingkat kepercayaan

= 1 – 0.95

= 0.05

$X^2(\alpha, v) = X^2(0.05, 1) = 3.841$

$\chi^2(\alpha; v) > \chi^2 hitung \rightarrow 3.841 > 2.790 \rightarrow$ Data Berdistribusi Normal

- **Operasi Cat Hitam**

Stasiun : 9			
Nama Operasi : Cat Hitam			
No	Waktu	No	Waktu
1	35.84	19	38.45
2	34	20	34.56
3	36.94	21	39.43
4	36.93	22	35.46
5	39.13	23	37.29
6	34.35	24	34.35
7	37.65	25	36.78
8	31.43	26	37.24
9	39.39	27	38.39
10	40.6	28	39.4
11	41.72	29	34.23
12	45.35	30	35.27
13	45.67	31	37.89
14	38.27	32	41.23
15	37.2	33	36.31
16	39.48	34	38.79
17	40.21	35	35.43
18	43.45	36	34.47

- Jumlah Kelas (Aturan Sturgess)

  K= 3.3 log n + 1

  = 3.3 log 36 +1

  = 6.135 ≈ 7 kelas

- Lebar Sel

  C = $\frac{Data\ max - Data\ min}{k}$

  = $\frac{45.35-31.43}{6.135}$ = 2.3

Uji Kenormalan Operasi Cat Hitam

Kelas	Interval Kelas			Batas kelas			Oi	Z1	Z2	P(Z1)	P(Z2)	P(Z2)-P(Z1)	ei	ei gab	oi gab	$(oi-ei)^2/ei$
1	<31.43			<31.425			0	∞	-3.856	0	0.000	0.000	0.002			
2	31.43	-	33.72	31.425	-	33.725	1	-2.145	-1.366	0.016	0.086	0.070	2.519	9.458	11	0.251
3	33.73	-	36.02	33.725	-	36.025	10	-1.366	-0.587	0.086	0.279	0.193	6.936			
4	36.03	-	38.32	36.025	-	38.325	10	-0.587	0.192	0.279	0.576	0.298	10.714	10.714	10	0.048
5	38.33	-	40.62	38.325	-	40.625	10	0.192	0.971	0.576	0.834	0.258	9.292	9.292	10	0.054
6	40.63	-	42.92	40.625	-	42.925	2	0.971	1.751	0.834	0.960	0.126	4.524			
7	42.93	-	45.22	42.925	-	45.225	1	1.751	2.530	0.960	0.994	0.034	1.235	5.947	5	0.151
8	45.23	-	47.52	45.225	-	47.525	2	2.530	3.309	0.994	1.000	0.005	0.189			
9	>47.52			>47.525			0	4.441	∞	1.000	1	0.000	0.000			
							36								36	0.504

σ = 2.95

π = 37.76

Z1 = -2.145 Z2= -1.366

P(Z1) = Normdist (-2.145) = 0.016

P(Z2) = Normdist (-1.366) = 0.086

P(Z2)-P(Z1) = 0.086 – 0.016 = 0.070

ei = (P(Z1)-P(Z2))*36 = 0.070*36 = 2.519

$X^2 = \sum_{i=1}^{k} \frac{(oi-ei)^2}{ei} = \frac{(11-9.458)^2}{9.458} = 0.251$

v = k-r-1

= 4 – 2 -1

= 1

α = 1 – tingkat kepercayaan

= 1 – 0.95

= 0.05

$X^2(\alpha, v) = X^2(0.05, 1) = 3.841$

$\chi^2(\alpha; v) > \chi^2 hitung \rightarrow 3.841 > 0.504 \rightarrow$ Data Berdistribusi Normal

➢ **Stasiun 10**

- **Operasi Pasang Tutup Baut**

Stasiun : 10			
Nama Operasi : Pasang tutup baut			
No	Waktu	No	Waktu
1	3.7	19	5.28
2	3.5	20	3.95
3	3.7	21	2.97
4	4.7	22	3.29
5	5.3	23	3.83
6	4.24	24	2.85
7	3.97	25	2.72
8	4.18	26	2.85
9	3.37	27	2.72
10	2.98	28	2.85
11	3.97	29	2.72
12	2.98	30	2.85
13	3.97	31	2.59
14	3.52	32	3.22
15	2.17	33	3.23
16	2.66	34	3.25
17	2.71	35	3.25
18	2.25	36	5.23

- Jumlah Kelas (Aturan Sturgess)

  K= 3.3 log n + 1

  = 3.3 log 36 +1

  = 6.135 ≈ 7 kelas

- Lebar Sel

  C = $\frac{Data\ max - Data\ min}{k}$

  = $\frac{5.3-2.17}{6.135}$ = 0.5

Uji Kenormalan Operasi Pasang Tutup Baut

Kelas	Interval Kelas			Batas kelas			Oi	Z1	Z2	P(Z1)	P(Z2)	P(Z2)-P(Z1)	ei	ei gab	oi gab	$(oi-ei)^2/ei$
1	<2.17			<2.165			0	∞	-1.565	0	0.059	0.059	2.115	6.184	4	0.771
2	2.17	-	2.66	2.165	-	2.665	4	-1.565	-0.947	0.059	0.172	0.113	4.069			
3	2.67	-	3.16	2.665	-	3.165	11	-0.947	-0.329	0.172	0.371	0.199	7.175	7.175	11	2.039
4	3.17	-	3.66	3.165	-	3.665	8	-0.329	0.289	0.371	0.614	0.243	8.737	8.737	8	0.062
5	3.67	-	4.16	3.665	-	4.165	7	0.289	0.907	0.614	0.818	0.204	7.348	7.348	7	0.016
6	4.17	-	4.66	4.165	-	4.665	2	0.907	1.525	0.818	0.936	0.119	4.268	6.556	6	0.047
7	4.67	-	5.16	4.665	-	5.165	1	1.525	2.144	0.936	0.984	0.048	1.711			
8	5.17	-	5.66	5.165	-	5.665	3	2.144	2.762	0.984	0.997	0.013	0.474			
9	>5.66			>5.665			0	2.762	∞	0.997	1	0.003	0.103			
							36								36	2.937

$\sigma = 0.81$

$\pi = 3.43$

Z1 = -1.565 Z2= -0.947

P(Z1) = Normdist (-1.565) = 0.059

P(Z2) = Normdist (-0.172) = 0.172

P(Z2)-P(Z1) = 0.172 – 0.059 = 0.113

ei = (P(Z1)-P(Z2))*36 = 0.113 *36 = 6.184

$X^2 = \sum_{i=1}^{k} \frac{(oi-ei)^2}{ei} = \frac{(4-6.184)^2}{6.184} = 0.771$

v = k-r-1

= 5 – 2 -1

= 2

α = 1 – tingkat kepercayaan

= 1 – 0.95

= 0.05

$X^2(\alpha, v) = X^2(0.05, 2) = 5.991$

$\chi^2(\alpha; v) > \chi^2 hitung \rightarrow 5.991 > 2.937 \rightarrow$ Data Berdistribusi Normal

- **Stasiun 11**

  Operasi QC

Stasiun : 11			
Nama Operasi : QC			
No	Waktu	No	Waktu
1	8.36	19	7.33
2	7.38	20	7.26
3	9.45	21	6.75
4	8.7	22	7.44
5	9.74	23	8.34
6	8.59	24	7.84
7	8.45	25	8.54
8	7.69	26	7.21
9	8.87	27	9.84
10	7.19	28	9.26
11	7.41	29	8.47
12	6.18	30	7.65
13	7.52	31	8.29
14	9.12	32	6.54
15	8.78	33	7.88
16	8.25	34	7.16
17	9.45	35	8.33
18	8.32	36	8.47

- Jumlah Kelas (Aturan Sturgess)

  K= 3.3 log n + 1

  = 3.3 log 36 +1

  = 6.135 ≈ 7 kelas

- Lebar Sel

  C = $\frac{Data\ max - Data\ min}{k}$

  = $\frac{9.84-6.18}{6.135}$ = 0.6

Uji Kenormalan Operasi QC

Kelas	Interval Kelas			Batas kelas			Oi	Z1	Z2	P(Z1)	P(Z2)	P(Z2)-P(Z1)	ei	ei gab	oi gab	$(oi-ei)^2/ei$
1	<6.18			<6.175			0	∞	-2.156	0	0.016	0.016	0.560			
2	6.18	-	6.77	6.175	-	6.775	3	-2.156	-1.488	0.016	0.068	0.053	1.901	7.414	8	0.046
3	6.78	-	7.37	6.775	-	7.375	5	-1.488	-0.821	0.068	0.206	0.138	4.953			
4	7.38	-	7.97	7.375	-	7.975	8	-0.821	-0.153	0.206	0.439	0.233	8.397	8.397	8	0.019
5	7.98	-	8.57	7.975	-	8.575	10	-0.153	0.515	0.439	0.697	0.257	9.266	9.266	10	0.058
6	8.58	-	9.17	8.575	-	9.175	5	0.515	1.182	0.697	0.881	0.185	6.655			
7	9.18	-	9.77	9.175	-	9.775	4	1.182	1.850	0.881	0.968	0.086	3.110	10.728	10	0.049
8	9.78	-	10.37	9.775	-	10.375	1	1.850	2.517	0.968	0.994	0.026	0.945			
9	>11.07			>11.075			0	3.296	∞	1.000	1	0.000	0.018			
							36								36	0.173

$\sigma = 0.90$

$\pi = 8.11$

Z1 = -2.156 Z2= -1.488

P(Z1) = Normdist (-2.156) = 0.016

P(Z2) = Normdist (-1.488) = 0.068

P(Z2)-P(Z1) = 0.068 – 0.016 = 0.053

ei = (P(Z1)-P(Z2))*36 = 0.053 *36 = 1.901

$X^2 = \sum_{i=1}^{k} \frac{(oi-ei)^2}{ei} = \frac{(8-7.414)^2}{7.414} = 0.046$

v = k-r-1

= 4 – 2 -1

= 1

α = 1 – tingkat kepercayaan

= 1 – 0.95

= 0.05

$X^2(\alpha, v) = X^2(0.05, 1) = 3.841$

$\chi^2(\alpha; v) > \chi^2 hitung \rightarrow 3.841 > 0.173 \rightarrow$ Data Berdistribusi Normal

Stasiun 2

- **Uji Keseragaman Operasi Cat Adhesive Abu**

Sub Group ke-	Waktu ke-						Waktu
	1	2	3	4	5	6	Rata2
1	25.15	34.7	38.4	29.5	47.96	33.28	34.832
2	35.4	35.7	30	33.15	37	28.6	33.308
3	34.6	36.9	46.6	36.8	48.77	31.6	39.112
4	35	43.8	40.3	36.2	40.1	49.2	40.767
5	35.3	40.07	30.35	34.08	47.46	41.2	38.077
6	33.25	34.94	32.16	44.85	27.63	25.24	33.012
						$\sum$	219.107
						$\bar{\bar{x}}$	36.52
						σ	6.49
						$\sigma_{\bar{x}}$	2.65

Contoh Perhitungan:

$\bar{x} = \frac{\sum xi}{k} = \frac{219.107}{6} = 36.52$

$\sigma = \sqrt{\frac{\sum(xi-x)^2}{n-1}} = \sqrt{\frac{\sum(25.15-36.52)^2+(34.7-36.52)^2+\cdots(25.24-36.52)^2}{36-1}} = 6.49$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{6.49}{\sqrt{6}} = 2.65$

BKB = $\bar{x}$-c((σ_x)

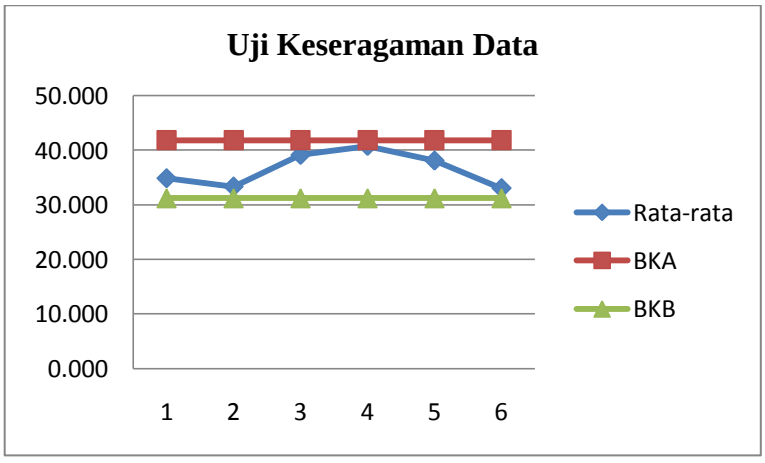
= 36.52 – 2(2.65)

= 31.22

BKA = $\bar{x}$+c((σ_x)

= 36.52 + 2(2.65)

= 41.82



- **Uji Keseragaman Operasi Cat Adhesive Hitam**

Sub Grup ke-	Waktu ke-						Waktu
	1	2	3	4	5	6	Rata2
1	23	39.9	32.78	42.93	23.77	18.08	30.078
2	18.47	26.7	33.14	15.09	21.55	27.28	23.707
3	20.71	23.3	26.17	35.47	46.65	31.73	30.663
4	44.04	40.8	21.94	26.74	29.97	35.06	33.087
5	28.3	37	14.74	37.46	26.31	25.02	28.135
6	29.18	20.5	33.6	35.4	31.20	27	29.485
						$\sum$	175.155
						$\bar{\bar{x}}$	29.19
						σ	8.15
						$\sigma_{\bar{x}}$	3.33

Contoh Perhitungan:

$\bar{x} = \frac{\sum xi}{k} = \frac{222.405}{6} = 37.07$

$\sigma = \sqrt{\frac{\sum(xi-x)^2}{n-1}} = \sqrt{\frac{\sum(22.3-37.07)^2+(34.7-37.07)^2+\cdots(25.24-37.07)^2}{36-1}} = 8.15$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{8.05}{\sqrt{6}} = 3.29$

BKB = $\bar{x}$-c((σ_x)

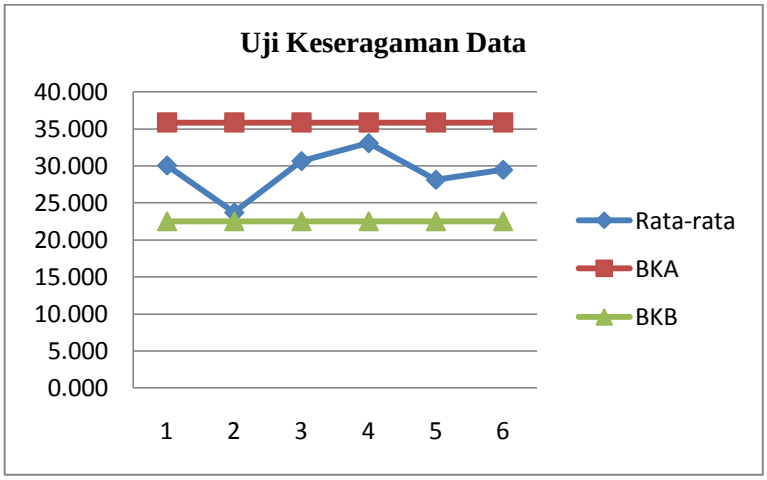
= 37.07 – 2(3.29)

= 30.49

BKA = $\bar{x}$+c((σ_x)

= 37.07 + 2(3.29)

= 43.64



Stasiun 3

- **Uji Keseragaman Operasi Ukur Kompon**

Sub Grup ke-	Waktu ke-						Waktu
	1	2	3	4	5	6	Rata2
1	8.16	4.26	5.75	6.41	5.44	4.49	5.752
2	4.36	5.4	5.62	7.72	6.53	6.18	5.968
3	7.75	5.62	6.35	5.69	8.03	5.69	6.522
4	5.53	5.81	6.75	6.6	6.06	6.6	6.225
5	5.56	8.72	7.81	5.78	7.71	7.59	7.195
6	7.35	4.97	6.41	5.35	6.76	5.42	6.043
						$\sum$	37.705
						$\bar{\bar{x}}$	6.28
						σ	1.12
						$\sigma_{\bar{x}}$	0.46

Contoh Perhitungan:

$\bar{x} = \frac{\sum xi}{k} = \frac{37.705}{6} = 6.28$

$\sigma = \sqrt{\frac{\sum(xi-x)^2}{n-1}} = \sqrt{\frac{\sum(8.16-6.28)^2+(4.26-6.28)^2+\cdots(5.42-6.28)^2}{36-1}} = 1.12$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{1.12}{\sqrt{6}} = 0.46$

BKB = $\bar{x}$-c((σ_x)

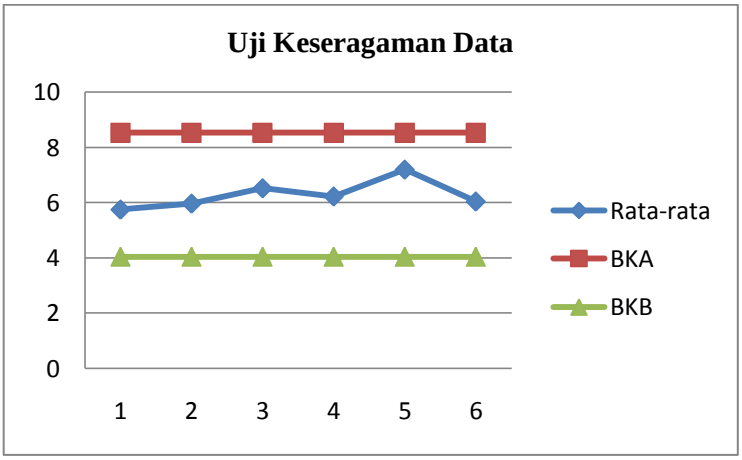
= 6.28 – 2(0.46)

= 4.041

BKA = $\bar{x}$+c((σ_x)

= 6.28+ 2(0.46)

= 8.527



- **Uji Keseragaman Operasi Potong Kompon**

Sub Grup ke-	Waktu ke-						Waktu
	1	2	3	4	5	6	Rata2
1	13.62	13.8	13.47	16.44	13.13	10.75	13.527
2	12.34	18	19.25	15.87	12.59	17.25	15.878
3	17.47	14.2	12.93	14.34	16.21	17.93	15.517
4	14.59	12.7	18.41	12.97	16.28	17.53	15.412
5	15.27	16.4	16.94	13.78	14.15	16.69	15.535
6	15.34	15.8	16.38	16.3	17.16	14.21	15.862
						$\sum$	91.73
						$\bar{\bar{x}}$	15.29
						σ	2.02
						$\sigma_{\bar{x}}$	0.83

Contoh Perhitungan:

$\bar{x} = \frac{\sum xi}{k} = \frac{91.73}{6} = 15.29$

$\sigma = \sqrt{\frac{\sum(xi-x)^2}{n-1}} = \sqrt{\frac{\sum(13.62-15.29)^2+(13.8-15.29)^2+\cdots(14.21-15.29)^2}{36-1}} = 2.02$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{2.02}{\sqrt{6}} = 0.83$

BKB = $\bar{x}$-c((σ_x)

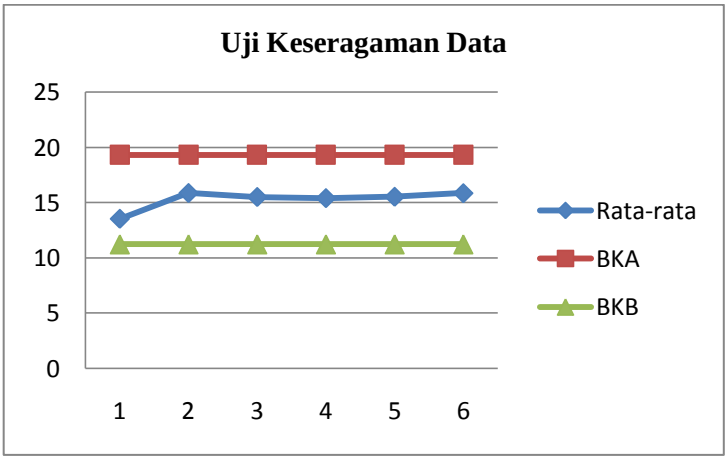
= 15.29 – 2(0.83)

= 11.243

BKA = $\bar{x}$+c((σ_x)

= 15.29 + 2(0.83)

= 19.334



Stasiun 4

- **Uji Keseragaman Operas1 Injection**

Sub Grup ke-	Waktu ke-						Waktu
	1	2	3	4	5	6	Rata2
1	772.1	787.69	797.75	763.14	747.67	750.32	769.778
2	755.72	739.56	751.58	747.9	744.92	771.89	751.928
3	777.5	754.34	779.53	781.97	766.89	763.02	770.542
4	776.72	756.46	775.02	791.52	784.79	746.27	771.797
5	745.59	752.49	760.52	767.97	764.44	775.12	761.022
6	769.51	752.58	787.17	752.95	751.44	738.69	758.723
						$\sum$	4583.79
						$\bar{\bar{x}}$	763.97
						σ	15.73
						$\sigma_{\bar{x}}$	6.42

Contoh Perhitungan:

$\bar{x} = \frac{\sum xi}{k} = \frac{4583.79}{6} = 763.97$

$\sigma = \sqrt{\frac{\sum(xi-x)^2}{n-1}} = \sqrt{\frac{\sum(772.1-763.97)^2+(787.69-763.97)^2+\cdots(738.69-763.97)^2}{36-1}} = 15.73$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{15.73}{\sqrt{6}} = 6.42$

BKB = $\bar{x}$-c((σ_x)

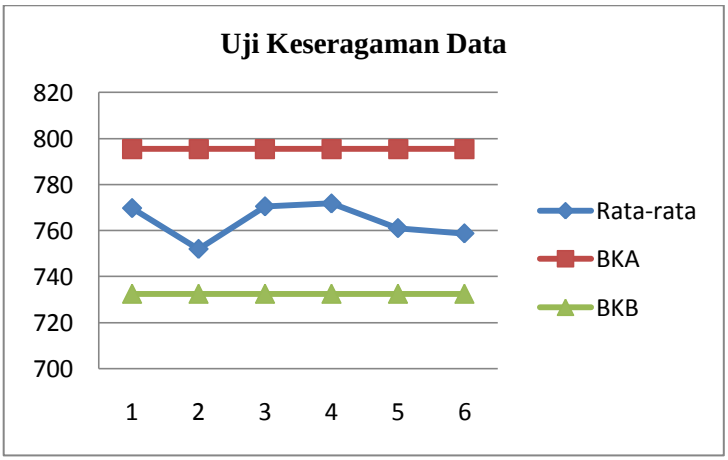
= 763.97 – 2(6.42)

= 732.5

BKA = $\bar{x}$+c((σ_x)

= 763.97 + 2(6.42)

= 795.4



Stasiun 5

- **Uji Keseragaman Operasi Finishing**

Sub Grup ke-	Waktu ke-						Waktu
	1	2	3	4	5	6	Rata2
1	122.3	147	127.5	104.4	54.6	65	103.467
2	105.9	63.1	60.01	62.7	72.2	66.9	71.802
3	71.9	75.1	61.1	74.8	89.5	84.1	76.083
4	81.7	75.5	112.6	71.3	84.9	83	84.833
5	89.6	157	94.21	81.61	89.6	81.74	99.010
6	95.29	107	82.25	80.51	104.86	97.52	94.565
						$\sum$	529.76
						$\bar{x}$	88.29
						σ	23.57
						$\sigma_{\bar{x}}$	9.62

Contoh Perhitungan:

$\bar{x} = \frac{\sum xi}{k} = \frac{529.76}{6} = 88.29$

$\sigma = \sqrt{\frac{\sum(xi-x)^2}{n-1}} = \sqrt{\frac{\sum(122.3-88.29)^2+(147-88.29)^2+\cdots(97.52-88.29)^2}{36-1}} = 23.57$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{23.57}{\sqrt{6}} = 9.62$

BKB = $\bar{x}$-c((σ_x)

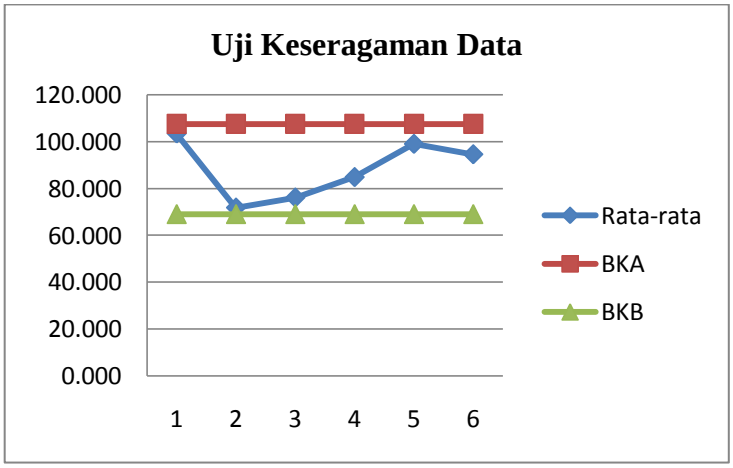
= 88.29 – 2(9.62)

= 69.05

BKA = $\bar{x}$+c((σ_x)

= 88.29+ 2(9.62)

= 107.54



Stasiun 6

- **Uji Keseragaman Operasi Slab Ampal**

Sub Grup ke-	Waktu ke-						Waktu
	1	2	3	4	5	6	Rata2
1	104.67	120	142.77	125.2	156.2	137.9	131.203
2	123.6	130	122.9	152.7	147.7	186.8	144.017
3	156.7	148	154.4	115.9	150.7	145.3	145.117
4	138.6	173	122.52	117.92	122.65	105.26	129.948
5	137.22	111	119.59	114.67	112.03	154.42	124.8
6	118.49	146	137.59	97.42	90.65	114.56	117.533
						$\sum$	792.618
						$\bar{\bar{x}}$	132.10
						σ	21.31
						$\sigma_{\bar{x}}$	8.70

Contoh Perhitungan:

$\bar{x} = \frac{\sum xi}{k} = \frac{792.618}{6} = 132.10$

$\sigma = \sqrt{\frac{\sum(xi-x)^2}{n-1}} = \sqrt{\frac{\sum(104.67-132.10)^2+(120-132.10)^2+\cdots(114.56-132.10)^2}{36-1}} = 21.31$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{21.31}{\sqrt{6}} = 8.70$

BKB = $\bar{x}$-c((σ_x)

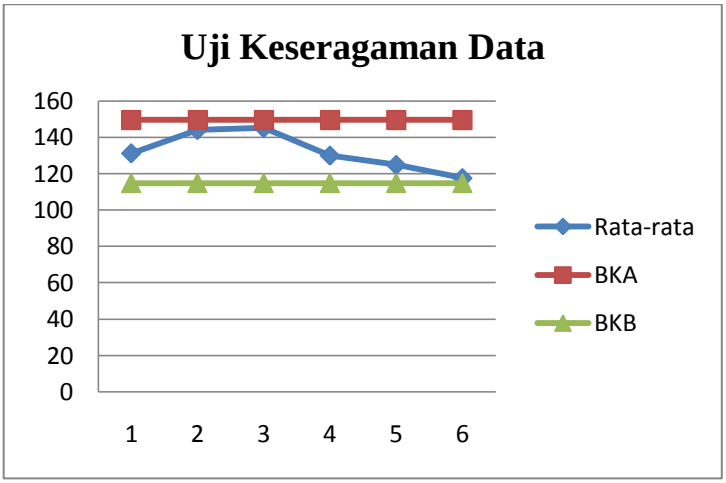
= 132.10 – 2(8.70)

= 114.70

BKA = $\bar{x}$+c((σ_x)

= 132.10 + 2(8.70)

= 149.50



Stasiun 7

- **Uji Keseragaman Operasi Slab Lekukan**

Sub Grup ke-	Waktu ke-						Waktu
	1	2	3	4	5	6	Rata2
1	45.22	62.7	51.81	58.1	51.88	60.6	55.048
2	71.19	54.4	60.03	52.87	58.29	47	57.292
3	56.93	50.8	51.22	60.87	68.5	64.34	58.780
4	84.28	70.3	69.22	86.28	75.88	69.22	75.867
5	46.66	47.8	66.02	79.63	97.59	63.69	66.900
6	64.41	46.1	87.15	94.02	58.57	92.16	73.728
						$\sum$	387.615
						$\bar{x}$	64.60
						σ	14.51
						$\sigma_{\bar{x}}$	5.92

Contoh Perhitungan:

$\bar{x} = \frac{\sum xi}{k} = \frac{387.615}{6} = 64.60$

$\sigma = \sqrt{\frac{\sum(xi-x)^2}{n-1}} = \sqrt{\frac{\sum(92.16-64.60)^2+(62.7-64.60)^2+\cdots(92.16-64.60)^2}{36-1}} = 14.51$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{14.51}{\sqrt{6}} = 5.92$

BKB = $\bar{x}$-c((σ_x)

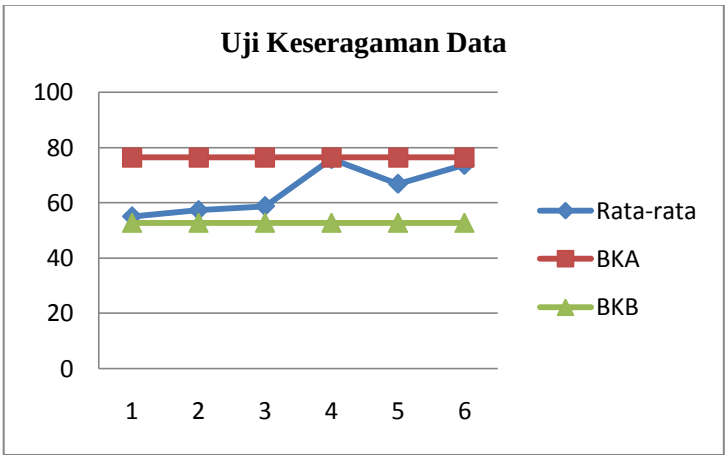
= 64.60 – 2(5.92)

= 52.75

BKA = $\bar{x}$+c((σ_x)

= 64.60 + 2(5.92)

= 76.45



Stasiun 8

- **Uji Keseragaman Operasi Cuci Thiner**

Sub Grup ke-	Waktu ke-						Waktu
	1	2	3	4	5	6	Rata2
1	16	15.1	18.21	15.27	14.28	16.79	15.942
2	15.42	16.9	13.72	16.58	15.43	15.76	15.632
3	13.69	15.8	18.71	19.78	18.43	13.94	16.732
4	14.83	13.9	14.88	14.97	15.34	16.49	15.075
5	19.38	14.6	12.79	14.33	15.41	16.43	15.492
6	16.64	13.9	14.59	15.84	16.79	17.34	15.845
						$\sum$	94.717
						$\bar{x}$	15.79
						σ	1.67
						$\sigma_{\bar{x}}$	0.68

Contoh Perhitungan:

$\bar{x} = \frac{\sum xi}{k} = \frac{94.717}{6} = 15.79$

$\sigma = \sqrt{\frac{\sum(xi-x)^2}{n-1}} = \sqrt{\frac{\sum(16-15.79)^2+(15.1-15.79)^2+\cdots(17.34-15.79)^2}{36-1}} = 1.67$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{1.67}{\sqrt{6}} = 0.68$

BKB = $\bar{x}$-c((σ_x)

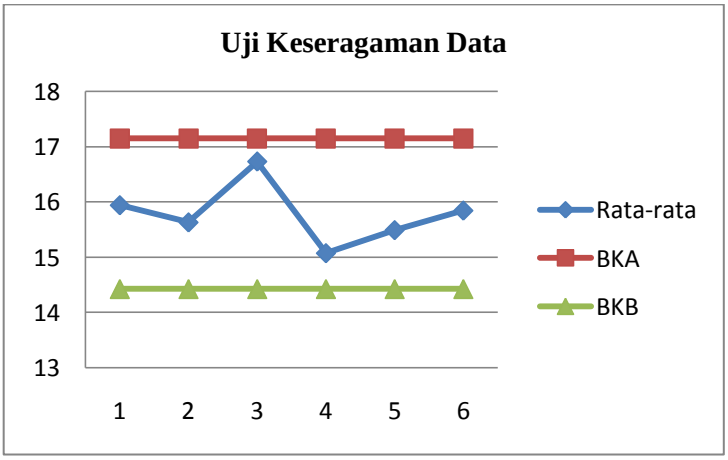
= 15.79 – 2(0.68)

= 14.425

BKA = $\bar{x}$+c((σ_x)

= 15.79 + 2(0.68)

= 17.147



Stasiun 9

- **Uji Keseragaman Operasi Semprot Angin**

Sub Grup ke-	Waktu ke-						Waktu
	1	2	3	4	5	6	Rata2
1	12.3	10.9	7.8	10.3	12.3	12.1	10.950
2	11.1	13.6	7.2	9.6	9.5	7.8	9.800
3	11.4	10.2	8.9	8.3	11	12.3	10.342
4	11.9	9.3	8.7	9.1	7.4	10.5	9.483
5	6.4	9.8	11.3	5.7	7.4	7.6	8.033
6	7.7	8.1	14.2	12.8	12.3	7.2	10.383
						$\sum$	58.992
						$\bar{x}$	9.83
						σ	2.18
						$\sigma_{\bar{x}}$	0.89

Contoh Perhitungan:

$\bar{x} = \frac{\sum xi}{k} = \frac{58.992}{6} = 9.83$

$\sigma = \sqrt{\frac{\sum(xi-x)^2}{n-1}} = \sqrt{\frac{\sum(12.3-9.83)^2+(10.9-9.83)^2+\cdots(7.8-9.83)^2}{36-1}} = 2.18$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{2.18}{\sqrt{6}} = 0.89$

BKB = $\bar{x}$-c((σ_x)

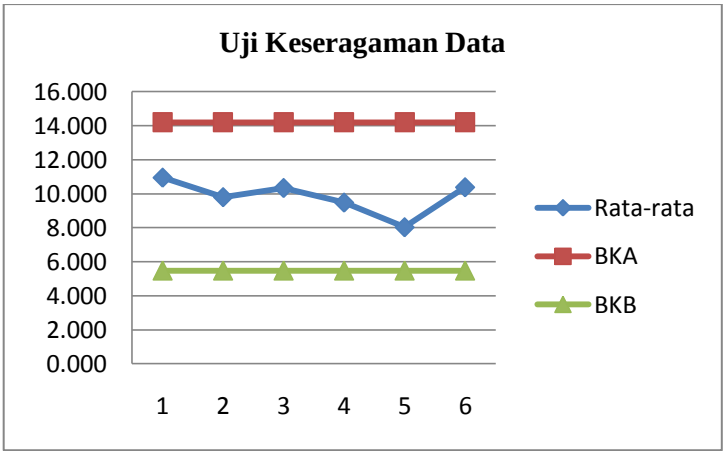
= 9.83 – 2(0.89)

= 5.47

BKA = $\bar{x}$+c((σ_x)

= 9.83 + 2(0.89)

= 14.19



- **Uji Keseragaman Operasi Cat Hitam**

Sub Group ke-	Waktu ke-						Waktu
	1	2	3	4	5	6	Rata2
1	35.84	34	36.94	36.93	39.13	34.35	36.198
2	37.65	31.43	39.39	40.6	41.72	45.35	39.357
3	42.36	38.27	37.2	39.48	40.21	43.45	40.162
4	38.45	34.56	39.43	35.46	37.29	34.35	36.590
5	36.78	37.24	38.39	39.4	34.23	35.27	36.885
6	37.89	41.23	36.31	38.79	35.43	34.47	37.353
						$\sum$	226.545
						$\bar{x}$	37.76
						σ	2.95
						$\sigma_{\bar{x}}$	1.21

Contoh Perhitungan:

$$\bar{x} = \frac{\sum xi}{k} = \frac{226.545}{6} = 37.76$$

$$\sigma = \sqrt{\frac{\sum(xi-x)^2}{n-1}} = \sqrt{\frac{\sum(35.84-37.76)^2+(34-37.76)^2+\cdots(34.47-37.76)^2}{36-1}} = 2.95$$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{2.95}{\sqrt{6}} = 1.21$$

BKB = $\bar{x}$-c((σ_x)

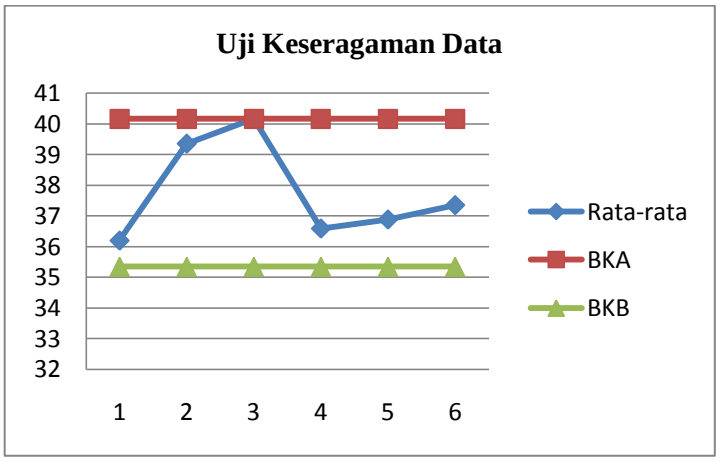
= 37.76 – 2(1.21)

= 35.347

BKA = $\bar{x}$+c((σ_x)

= 37.76 + 2(1.21)

= 40.168



Stasiun 10

- **Uji Keseragaman Operasi Pasang Tutup Baut**

Sub Grup ke-	Waktu ke-						Waktu
	1	2	3	4	5	6	Rata2
1	3.7	3.5	3.7	4.7	5.3	4.24	4.190
2	3.97	4.18	3.37	2.98	3.97	2.98	3.575
3	3.97	3.52	2.17	2.66	2.71	2.25	2.880
4	5.28	3.95	2.97	3.29	3.83	2.85	3.695
5	2.72	2.85	2.72	2.85	2.72	2.85	2.785
6	2.59	3.22	3.23	3.25	3.25	5.23	3.462
						$\sum$	20.587
						$\bar{x}$	3.43
						σ	0.81
						$\sigma_{\bar{x}}$	0.33

Contoh Perhitungan:

$\bar{x} = \frac{\sum xi}{k} = \frac{20.587}{6} = 9.83$

$\sigma = \sqrt{\frac{\sum(xi-x)^2}{n-1}} = \sqrt{\frac{\sum(3.7-3.43)^2+(3.5-3.43)^2+\cdots(5.23-3.43)^2}{36-1}} = 0.81$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{0.81}{\sqrt{6}} = 0.33$

BKB = $\bar{x}$-c((σ_x)

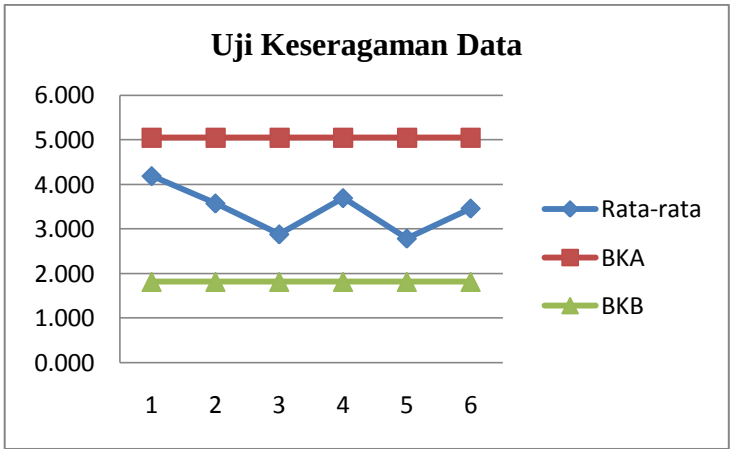
= 3.43 – 2(0.81)

= 1.81

BKA = $\bar{x}$+c((σ_x)

= 3.43 + 2(0.81)

= 5.05



Stasiun 11

- **Uji Keseragaman Operasi QC**

Sub Group ke:-	Waktu ke:-						Waktu
	1	2	3	4	5	6	Rata2
1	8.36	7.38	9.45	8.7	9.74	8.59	8.703
2	8.45	7.69	8.87	7.19	7.41	6.18	7.632
3	7.52	9.12	8.78	8.25	9.45	8.32	8.573
4	7.33	7.26	6.75	7.44	8.34	7.84	7.493
5	8.54	7.21	9.84	9.26	8.47	7.65	8.495
6	8.29	6.54	7.88	7.16	8.33	8.47	7.778
						$\sum$	48.675
						$\bar{x}$	8.11
						σ	0.90
						$\sigma_{\bar{x}}$	0.37

Contoh Perhitungan:

$\bar{x} = \frac{\sum xi}{k} = \frac{48.675}{6} = 8.11$

$\sigma = \sqrt{\frac{\sum(xi-x)^2}{n-1}} = \sqrt{\frac{\sum(8.36-8.11)^2+(7.38-8.11)^2+\cdots(8.47-8.11)^2}{36-1}} = 0.90$

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{0.90}{\sqrt{6}} = 0.37$

BKB = $\bar{x}$-c((σ_x)

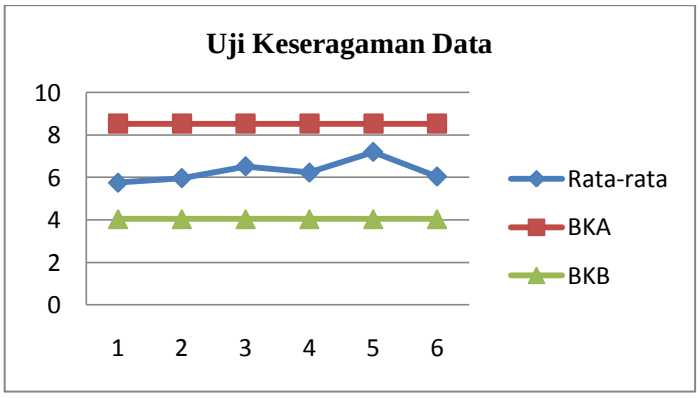
= 8.11 – 2(0.37)

= 7.379

BKA = $\bar{x}$+c((σ_x)

= 8.11 + 2(0.37)

= 8.846



❖ **Uji Kecukupan Data**

- **Uji Kecukupan Data Waktu St.2**

  - **Operasi Cat Adhesive Abu**

$$N^1 = \left[\frac{\frac{c}{\alpha}\sqrt{N\sum Xi^2 - (\sum Xi)^2}}{\sum Xi}\right]^2$$

$$N^1 = \left[\frac{\frac{2}{0.1}\sqrt{36\sum(25.15^2 + 34.7^2 + \cdots + 25.24^2) - (22.3 \quad + 34.7 \quad + \cdots + 25.24 \quad)^2}}{(25.15 \quad + 34.7 \quad + \cdots + 25.24)}\right]^2$$

$= 12.29$

N^1<N → Data Cukup

  - **Operasi Cat Adhesive Hitam**

$$N^1 = \left[\frac{\frac{c}{\alpha}\sqrt{N\sum Xi^2 - (\sum Xi)^2}}{\sum Xi}\right]^2$$

$$N^1 = \left[\frac{\frac{2}{0.1}\sqrt{36\sum(23^2 + 39.9^2 + \cdots + 27^2) - (23 \quad + 39.9 \quad + \cdots + 27)^2}}{(23 \quad + 39.9 \quad + \cdots + 27)}\right]^2$$

$= 30.336$

N^1<N → Data Cukup

- **Uji Kecukupan Data Waktu St.3**

  - **Operasi Ukur Kompon**

$$N^1 = \left[\frac{\frac{c}{\alpha}\sqrt{N\sum Xi^2 - (\sum Xi)^2}}{\sum Xi}\right]^2$$

$$N^1 = \left[\frac{\frac{2}{0.1}\sqrt{36\sum(8.16^2 + 4.26^2 + \cdots + 5.42^2) - (8.16 + 4.26 + \cdots + 5.42)^2}}{(8.16 + 4.26 + \cdots + 5.42)}\right]^2$$

$= 12.38$

N^1<N → Data Cukup

  - **Operasi Potong Kompon**

$$N^1 = \left[\frac{\frac{c}{\alpha}\sqrt{N\sum Xi^2 - (\sum Xi)^2}}{\sum Xi}\right]^2$$

$$N^1 = \left[\frac{\frac{2}{0.1}\sqrt{36\sum(13.62^2 + 13.8^2 + \cdots + 14.21^2) - (13.62 + 13.8 + \cdots + 14.21)^2}}{(13.62 + 13.8 + \cdots + 14.21)}\right]^2$$

= 6.808

N^1<N → Data Cukup

- **Uji Kecukupan Data Waktu St.4**

Operasi Injection

$$N^1 = \left[\frac{\frac{c}{\alpha}\sqrt{N\sum Xi^2 - (\sum Xi)^2}}{\sum Xi}\right]^2$$

N^1

$$= \left[\frac{\frac{2}{0.1}\sqrt{36\sum(772.1^2 + 787.69^2 + \cdots + 738.69^2) - (772.1 + 787.69 + \cdots + 738.69)^2}}{(772.1 + 787.69 + \cdots + 738.69)}\right]^2$$

= 0.165

N^1<N → Data Cukup

- **Uji Kecukupan Data Waktu St.5**

- **Operasi Finishing**

$$N^1 = \left[\frac{\frac{c}{\alpha}\sqrt{N\sum Xi^2 - (\sum Xi)^2}}{\sum Xi}\right]^2$$

$$N^1 = \left[\frac{\frac{2}{0.1}\sqrt{36\sum(122.3^2 + 147^2 + \cdots + 97.52^2) - (122.3 + 147 + \cdots + 97.52)^2}}{(122.3 + 147 + \cdots + 97.52)}\right]^2$$

= 27.715

N^1<N → Data Cukup

- **Uji Kecukupan Data Waktu St.6**

- **Operasi Slab Ampal**

$$N^1 = \left[\frac{\frac{c}{\alpha}\sqrt{N\sum Xi^2 - (\sum Xi)^2}}{\sum Xi}\right]^2$$

N^1

$$= \left[\frac{\frac{2}{0.1}\sqrt{36\sum(104.67^2 + 120.48^2 + \cdots + 114.56^2) - (104.67 \quad + 120.48 \quad + \cdots + 114.56 \quad)^2}}{(104.67 \quad + 120.48 \quad + \cdots + 114.56}\right]^2$$

= 10.121

N^1<N → Data Cukup

- **Uji Kecukupan Data Waktu St.7**

- **Operasi Slab Lekukan**

$$N^1 = \left[\frac{\frac{c}{\alpha}\sqrt{N\sum Xi^2 - (\sum Xi)^2}}{\sum Xi}\right]^2$$

$$N^1 = \left[\frac{\frac{2}{0.1}\sqrt{36\sum(45.22^2 + 62.7^2 + \cdots + 92.16^2) - (45.22 + 62.7 + \cdots + 92.16)^2}}{(45.22 + 62.7 + \cdots + 92.16)}\right]^2$$

= 19.623

N^1<N → Data Cukup

- **Uji Kecukupan Data Waktu St.8**

- **Operasi Cuci Thiner**

$$N^1 = \left[\frac{\frac{c}{\alpha}\sqrt{N\sum Xi^2 - (\sum Xi)^2}}{\sum Xi}\right]^2$$

$$N^1 = \left[\frac{\frac{2}{0.1}\sqrt{36\sum(16^2 + 15.1^2 + \cdots + 17.34^2) - (16 + 15.1 + \cdots + 17.34)^2}}{(16 + 15.1 + \cdots + 17.34)}\right]^2$$

= 4.338

N^1<N → Data Cukup

- **Uji Kecukupan Data Waktu St.9**

- **Operasi Semprot Angin**

$$N^1 = \left[\frac{\frac{c}{\alpha}\sqrt{N\sum Xi^2 - (\sum Xi)^2}}{\sum Xi}\right]^2$$

$$N^1 = \left[\frac{\frac{2}{0.1}\sqrt{36\sum(12.3^2 + 10.9^2 + \cdots + 7.2^2) - (12.3 + 10.9 + \cdots + 7.2)^2}}{(12.3 + 10.9 + \cdots + 7.2)}\right]^2$$

= 19.099

N^1<N → Data Cukup

- **Operasi Cat Hitam**

$$N^1 = \left[\frac{\frac{c}{\alpha}\sqrt{N\sum Xi^2 - (\sum Xi)^2}}{\sum Xi}\right]^2$$

$$N^1 = \left[\frac{\frac{2}{0.1}\sqrt{36\sum(35.84^2 + 34^2 + \cdots + 34.47^2) - (35.84 + 34 + \cdots + 34.47)^2}}{(35.84 + 34 + \cdots + 34.47)}\right]^2$$

$= 2.376$

N^1<N → Data Cukup

- **Uji Kecukupan Data Waktu St.10**

- **Operasi Pasang Tutup Baut**

$$N^1 = \left[\frac{\frac{c}{\alpha}\sqrt{N\sum Xi^2 - (\sum Xi)^2}}{\sum Xi}\right]^2$$

$$N^1 = \left[\frac{\frac{2}{0.1}\sqrt{36\sum(3.7^2 + 3.5^2 + \cdots + 5.23^2) - (3.7 + 3.5 + \cdots + 5.23)^2}}{(3.7 + 3.5 + \cdots + 5.23)}\right]^2$$

$= 21.612$

N^1<N → Data Cukup

- **Uji Kecukupan Data Waktu St.11**

- **Operasi QC**

$$N^1 = \left[\frac{\frac{c}{\alpha}\sqrt{N\sum Xi^2 - (\sum Xi)^2}}{\sum Xi}\right]^2$$

$$N^1 = \left[\frac{\frac{2}{0.1}\sqrt{36\sum(8.36^2 + 7.38^2 + \cdots + 8.47^2) - (8.36 + 7.38 + \cdots + 8.47)^2}}{(8.36 + 7.38 + \cdots + 8.47)}\right]^2$$

$= 4.77$

N^1<N → Data Cukup

LAMPIRAN 2

PERHITUNGAN FAKTOR KELONGGARAN

❖ Faktor Kelonggaran

➢ Faktor Kelonggaran St. 2

Faktor	Kelas	Kelonggaran (%)
Tenaga yang dikeluarkan	Dapat Diabaikan	1
Sikap Kerja	Duduk	1
Gerakan Kerja	Normal	0
Kelelahan Mata	Pandangan yang hampir terus menerus	6
Keadaan temperatur tempat kerja	Tinggi	5
Keadaan atmosfer	Cukup	1
Keadaan lingkungan yang baik	Siklus kerja berulang-ulang antara 0-5 detik	1
Kelonggaran yang tak terhindarkan	Cat adhesive habis	0.007
Kelonggaran kebutuhan pribadi	ke kamar mandi, minum air	0.021
	Total	15.03

Faktor Kelonggaran St. 3

Faktor	Kelas	Kelonggaran (%)
Tenaga yang dikeluarkan	Sangat ringan	6
Sikap Kerja	Duduk	1
Gerakan Kerja	Normal	0
Kelelahan Mata	Pandangan yang hampir terus menerus	6
Keadaan temperatur tempat kerja	Tinggi	5
Keadaan atmosfer	Cukup	1
Keadaan lingkungan yang baik	Siklus kerja berulang-ulang antara 0-5 detik	1
Kelonggaran yang tak terhindarkan	Mengganti Pisau/Cutter	0.007
Kelonggaran kebutuhan pribadi	ke kamar mandi, minum air	0.021
	Total	20.03

➢ Faktor Kelonggaran St. 4

Faktor	Kelas	Kelonggaran (%)
Tenaga yang dikeluarkan	Sangat Ringan	6
Sikap Kerja	Berdiri	1
Gerakan Kerja	Normal	0
Kelelahan Mata	Pandangan terputus-putus	1
Keadaan temperatur tempat kerja	Tinggi	5
Keadaan atmosfer	Cukup	1
Keadaan lingkungan yang baik	Sangat Bising	1
Kelonggaran yang tak terhindarkan	Mati Listrik	0.002
Kelonggaran kebutuhan pribadi	ke kamar mandi, minum air	0.021
	Total	15.02

- **Faktor Kelonggaran St. 5**

Faktor	Kelas	Kelonggaran (%)
Tenaga yang dikeluarkan	Sangat Ringan	6
Sikap Kerja	Duduk	1
Gerakan Kerja	Normal	0
Kelelahan Mata	Pandangan yang hampir terus-menerus	6
Keadaan temperatur tempat kerja	Tinggi	5
Keadaan atmosfer	Cukup	1
Keadaan lingkungan yang baik	Sangat Bising	1
Kelonggaran yang tak terhindarkan	Mengasah alat	0.005
Kelonggaran kebutuhan pribadi	ke kamar mandi, minum air	0.021
	Total	20.03

- **Faktor Kelonggaran St. 6**

Faktor	Kelas	Kelonggaran (%)
Tenaga yang dikeluarkan	Sangat Ringan	6
Sikap Kerja	Duduk	1
Gerakan Kerja	Normal	0
Kelelahan Mata	Pandangan yang hampir terus menerus	6
Keadaan temperatur tempat kerja	Tinggi	5
Keadaan atmosfer	Cukup	1
Keadaan lingkungan yang baik	Siklus kerja berulang-ulang antara 0-5 detik	1
Kelonggaran yang tak terhindarkan	Mengganti Ampelas, Mati Listrik	0.009
Kelonggaran kebutuhan pribadi	ke kamar mandi, minum air	0.021
	Total	20.03

- **Faktor Kelonggaran St. 7**

Faktor	Kelas	Kelonggaran (%)
Tenaga yang dikeluarkan	Sangat Ringan	6
Sikap Kerja	Duduk	1
Gerakan Kerja	Normal	0
Kelelahan Mata	Pandangan yang hampir terus menerus	6
Keadaan temperatur tempat kerja	Tinggi	5
Keadaan atmosfer	Cukup	1
Keadaan lingkungan yang baik	Siklus kerja berulang-ulang antara 0-5 detik	1
Kelonggaran yang tak terhindarkan	Mengasah Alat, Mati Listrik	0.007
Kelonggaran kebutuhan pribadi	ke kamar mandi, minum air	0.021
	Total	20.03

- **Faktor Kelonggaran St. 8**

Faktor	Kelas	Kelonggaran (%)
Tenaga yang dikeluarkan	Dapat Diabaikan	1
Sikap Kerja	Duduk	1
Gerakan Kerja	Normal	0
Kelelahan Mata	Pandangan yang hampir terus menerus	6
Keadaan temperatur tempat kerja	Tinggi	5
Keadaan atmosfer	Cukup	5
Keadaan lingkungan yang baik	Siklus kerja berulang-ulang antara 0-5 detik	1
Kelonggaran yang tak terhindarkan	Cairan Thiner Habis	0.007
Kelonggaran kebutuhan pribadi	ke kamar mandi, minum air	0.021
	Total	19.03

- **Faktor Kelonggaran St. 9**

Faktor	Kelas	Kelonggaran (%)
Tenaga yang dikeluarkan	Sangat Ringan	6
Sikap Kerja	Duduk	1
Gerakan Kerja	Normal	0
Kelelahan Mata	Pandangan yang hampir terus menerus	6
Keadaan temperatur tempat kerja	Tinggi	5
Keadaan atmosfer	Cukup	1
Keadaan lingkungan yang baik	Siklus kerja berulang-ulang antara 0-5 detik	1
Kelonggaran yang tak terhindarkan	Cat Habis, Mati Listrik	0.009
Kelonggaran kebutuhan pribadi	ke kamar mandi, minum air	0.021
	Total	20.03

- **Faktor Kelonggaran St. 10**

Faktor	Kelas	Kelonggaran (%)
Tenaga yang dikeluarkan	Dapat Diabaikan	1
Sikap Kerja	Duduk	1
Gerakan Kerja	Normal	0
Kelelahan Mata	Pandangan yang hampir terus-menerus	6
Keadaan temperatur tempat kerja	Tinggi	5
Keadaan atmosfer	Cukup	1
Keadaan lingkungan yang baik	Siklus kerja berulang-ulang antara 5-10 detik	1
Kelonggaran yang tak terhindarkan	Tutup Baut habis	0.007
Kelonggaran kebutuhan pribadi	ke kamar mandi, minum air	0.021
	Total	15.03

- **Faktor Kelonggaran St. 11**

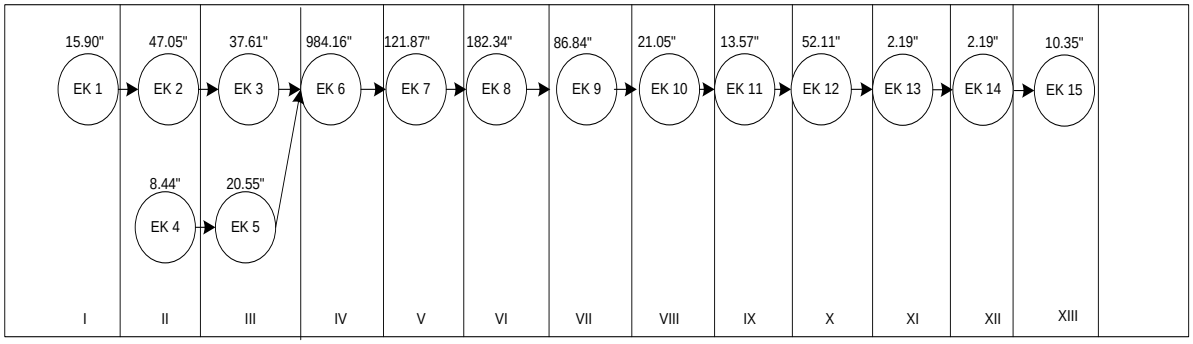
Faktor	Kelas	Kelonggaran (%)
Tenaga yang dikeluarkan	Dapat Diabaikan	1
Sikap Kerja	Duduk	1
Gerakan Kerja	Normal	0
Kelelahan Mata	Pandangan yang hampir terus menerus	6
Keadaan temperatur tempat kerja	Tinggi	5
Keadaan atmosfer	Cukup	1
Keadaan lingkungan yang baik	Siklus kerja berulang-ulang antara 0-5 detik	1
Kelonggaran yang tak terhindarkan	Mati Listrik	0.002
Kelonggaran kebutuhan pribadi	ke kamar mandi, minum air	0.021
	Total	15.02

LAMPIRAN 3

PERHITUNGAN *LINE BALANCING* DENGAN PARALEL MESIN

✓ ***Region Approach*** **(Pembagian Wilayah)**

Step 1: Membagi region atau daerah dari kiri ke kanan. Jika memungkinkan letakkan task (EK) pada region paling kanan



Pembagian Wilayah

Step 2: Menentukan ranking dari setiap task (EK) pada setiap region atau daerah berdasarkan dari waktu maksimum ke waktu minimum

Pembagian Wilayah Elemen Kerja

Region	Task (EK)	Task Time (ti)
I	1	15.9
II	2,4	47.05/8.44
III	3,5	37.61/20.55
IV	6	984.16
V	7	121.87
VI	8	182.34
VII	9	86.84
VIII	10	21.05
IX	11	13.57
X	12	52.11
XI	13	2.19
XII	14	2.19
XIII	15	10.35

Step 3: Lakukan pembebanan task (EK) ke dalam stasiun kerja (SK)

Pembebanan Elemen Kerja

Stasiun Kerja (SK)	Task (EK)	Task Time (ti)	Cum Stasiun Time (ST)	Jumlah Operator
1	1	15.90	15.90	1
	2	47.05	62.95	
	3	37.61	100.55	
2	4	8.44	8.44	1
	5	20.55	29.00	
3-A	6	984.16	984.16	1
3-B			984.16	1
3-C			984.16	1
4	7	121.87	121.87	1
5	8	182.34	182.34	1
	9	86.84	269.19	
6	10	21.05	21.05	1
	11	13.57	34.62	
	12	52.12	86.74	
	13-14	4.38	91.12	
	15	10.35	101.47	

Step 4: Perhitungan efisiensi stasiun kerja & efisiensi lintasan metode Region

Perhitungan Efisiensi Stasiun Kerja

Stasiun Kerja (SK)	Elemen Kerja	Stasiun Time (ST)	Idle Time	Efisiensi Stasiun Kerja (%)
1	1,2,3	100.55	883.61	10.22
2	4,5	29.00	955.16	2.95
3-A	6	984.16	0	100
3-B		984.16	0	100
3-C		984.16	0	100
4	7	121.87	862.29	12.38
5	8,9	269.19	714.97	27.35
6	10,11,12,13-14,15	101.47	882.69	10.31
		3574.56		45.40

Contoh Perhitungan:

Idle Time = Stasiun Time max - Stasiun Time

= 984.16 – 100.55 = 883.61 detik

EL= $\frac{\sum_{i=1}^{k} Sti}{(k)(ws)} = \frac{3574.56}{8*984.16}$= 45.40%

SI = $\sqrt{\sum_{i-1}^{k}(St\ maks - STi)^2}$= $\sqrt{883.61^2 + 955.16^2 + \cdots + 882.69)}$ = 1930.53

BD= $\frac{(K)(Ws)-\sum_{i=1}^{k} Sti}{(k)(ws)} = \frac{(8)(984.16)-3574.56}{(8)(984.16)}$ = 54.59%

✓ **Metode Pembebanan Berurut (*Moodie Young*)**

Step 1: Urutkan task (EK) dari waktu maksimum sampai minimum

Step 2: Untuk tiap task (EK) buatlah daftar task (EK) yang mendahului dalam matriks P (matriks *predecessors*/pendahulu) dan daftar task (EK) yang mengikuti dalam matriks F (matriks *follower*/pengikut)

Step 3: carilah task (EK) dalam matriks P yang berisi semuanya 0, Bila ada 2 task (EK) atau lebih maka pilih task yang memiliki waktu maksimum

Step 4: Untuk task (EK) yang terpilih di step 3, bebankan ke stasiun kerja. Coret task (EK) tersebut dari matriks P

Step 5: Ubah nomor task (EK) tersebut menjadi 0 di matriks P untuk task (EK) yang mengikuti task (EK) tersebut

Step 6: Ulangi step 3-5 sampai semua task (EK) terbebankan ke stasiun kerja

Matrik *Predecessors-Followers* Metode *Moodie Young*

Task (EK)	Task Time	P			F		
6	984.16	3	5	0	7	0	0
8	182.34	8	0	0	9	0	0
7	121.87	7	0	0	8	0	0
9	86.84	8	0	0	10	0	0
2	47.05	1	0	0	3	0	0
12	52.12	11	0	0	14	0	0
3	37.61	2	0	0	6	0	0
11	13.57	10	0	0	12	0	0
5	20.55	4	0	0	6	0	0
1	15.9	0	0	0	2	0	0
10	21.05	9	0	0	11	0	0
15	10.35	14	0	0	0	0	0
4	8.44	0	0	0	5	0	0
13-14	4.38	13	0	0	15	0	0

Pembebanan Elemen Kerja

Stasiun Kerja (SK)	Task (EK)	Task Time (ti)	Cum Stasiun Time (ST)	Jumlah Operator
1	1	15.90	15.90	1
	2	47.05	62.95	
	3	37.61	100.55	
2	4	8.44	8.44	1
	5	20.55	29.00	
3-A	6	984.16	984.16	1
3-B			984.16	1
3-C			984.16	1
4	7	121.87	121.87	1
5	8	182.34	182.34	1
	9	86.84	269.19	
6	10	21.05	21.05	1
	11	13.57	34.62	
	12	52.12	86.74	
	13-14	4.38	91.12	
	15	10.35	101.47	

Perhitungan Efisiensi Stasiun Kerja

Stasiun Kerja (SK)	Elemen Kerja	Stasiun Time (ST)	Idle Time	Efisiensi Stasiun Kerja (%)
1	1,2,3	100.55	883.61	10.22
2	4,5	29.00	955.16	2.95
3-A	6	984.16	0	100
3-B		984.16	0	100
3-C		984.16	0	100
4	7	121.87	862.29	12.38
5	8,9	269.19	714.97	27.35
6	10,11,12,13-14,15	101.47	882.69	10.31
		3574.56		45.40

Contoh Perhitungan:

Idle Time = Stasiun Time max - Stasiun Time

= 984.16 – 100.55 = 883.61 detik

EL= $\frac{\sum_{i=1}^{k} Sti}{(k)(ws)} = \frac{3574.56}{8*984.16}$= 45.40%

SI = $\sqrt{\sum_{i-1}^{k}(St\ maks - STi)^2}$= $\sqrt{883.61^2 + 955.16^2 + \cdots + 882.69)}$ = 1930.53

BD= $\frac{(K)(Ws)-\sum_{i=1}^{k} Sti}{(k)(ws)} = \frac{(8)(984.16)-3574.56}{(8)(984.16)}$ = 54.59%

KOMENTAR DOSEN PENGUJI

Nama Mahasiswa : Rio
NRP : 0723106
Tanggal USTA : 2 Agustus 2011
Judul Tugas Akhir : Usulan Penyeimbangan Lintasan Produksi & Peningkatan Kapasitas Produksi Yang Ekonomis (Studi Kasus Di PT. Agronesia Divisi Karet "PT. INKABA Bandung)

Komentar dan Saran Dosen Penguji I (Victor Suhandi, ST.,MT)

1. Perhitungan kapasitas kurang pas
2. Pengurangan tenaga kerja agak diragukan

KOMENTAR DOSEN PENGUJI

Nama Mahasiswa : Rio
NRP : 0723106
Tanggal USTA : 2 Agustus 2011
Judul Tugas Akhir : Usulan Penyeimbangan Lintasan Produksi & Peningkatan Kapasitas Produksi Yang Ekonomis (Studi Kasus Di PT. Agronesia Divisi Karet "PT. INKABA Bandung)

Komentar dan Saran Dosen Penguji II (Santoso, ST.,MT)

1. Lengkapi daftar literature di bab 2
2. Penjelasan detail hasil line balancing tanpa penambahan mesin (kelebihan & kekurangan) → tambahkan
   → kapasitas tetap
3. Penjelasan mengenai proses forecasting (predicting) demand, karena dari job order → mass production
4. Tanpa forecasting → penambahan 3 mesin menimbulkan tanda Tanya
5. Jika alasan penambahan 3 mesin → memberdayakan fasilitas? Harus diberikan usulan misal subkontrak (menerima subkontrak) atau dijual jika kesuitan menjual produk yang sampai 2x lebih banyak.

KOMENTAR DOSEN PENGUJI

Nama Mahasiswa : Rio
NRP : 0723106
Tanggal USTA : 2 Agustus 2011
Judul Tugas Akhir : Usulan Penyeimbangan Lintasan Produksi & Peningkatan Kapasitas Produksi Yang Ekonomis (Studi Kasus Di PT. Agronesia Divisi Karet "PT. INKABA Bandung)

Komentar dan Saran Dosen Penguji II (Vivi Arisandhy, ST.,MT)

1. Presentasi: - Suara cukup jelas
   - Slide cukup baik, hanya ada tabel yang tidak jelas (terlalu kecil/tipis) & kalimat agak panjang
2. Seharusnya berangkat dari trend data permintaan meningkat → jadi target produksi
3. Jika kapasitas kurang, alternatifnya:
   I. Subkontrak → jika kurangnya sedikit
   II. Tambah 1 mesin saja → hitung juga rasio keuntungan
   III. Tambah 2 mesin
4. Perbaiki salah ketik & tata kalimat
5. Cek format penulisan → kutipan, referensi, justified, dll
6. Cek format daftar pustaka

DATA PENULIS

Nama	: Rio
Tempat/Tanggal Lahir	: Jakarta 22-11-1989
Alamat	: Jln Kenanga No. 18, Kota Batu-Ciomas, Bogor
No Handphone	: 08179003026
Email	: rio89_com@yahoo.com
Pendidikan	: SMA Tunas Harapan-Bogor
	Teknik Industri Universitas Kristen Maranatha
Nilai Tugas Akhir	: A
Tanggal USTA	: 2 Agustus 2011