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APPENDIX 1

Code: C4

From:Peter Sun

Date: 24/2/94

This questionaire forms an important input to my Post Graduate Programme. I would be grateful if you could fill and return this questionaire and revert to me if any clarifications are needed.

A set of criteria are listed.Please assign a suitable Grade (Please see Legend for the Grade).Please note that the criteria listed are for the Hard Soaps finishing Department.

The Grades given should be in your opinion optimum for the Company and should not merely reflect the historical performance.

Thanks for your cooperation,

PETER SUN

TECHNICAL QUESTIONAIRE(PRODUCTION)

1)% Of Total Rejects(after packing) to Total Production

% of Rejects to total Prod.	Grade (Flag)
0.00%	e
0.25%	d
0.50%	c
0.75%	b
1.00%	a
1.25%	a
1.50%	a
1.75%	a
2.00%	a
2.25%	a
2.50%	a
2.75%	a
3.00%	a
3.25%	a
3.50%	a

Legend

Grade	Flag	Scores
Very Poor	a	0–20
Poor	b	20–40
Satisfactory	c	40–60
Good	d	60–80
Excellent	e	80–100

2)Quality Index

Quality index	Grade (Flag)
55	a
60	b
65	b
70	b
75	c
80	d
85	d
90	e
95	e
100	e

Legend

Grade	Flag	Scores
Very Poor	a	0–20
Poor	b	20–40
Satisfactory	c	40–60
Good	d	60–80
Excellent	e	80–100

3)Effective Asset Utilisation %

Effective Asset Utilisation %	Grade (Flag)
10%	a
15%	a
20%	a
25%	b
30%	b
35%	c
40%	c
45%	c
50%	d
55%	d
60%	e
65%	e
70%	e
75%	e
80%	e

Legend

Grade	Flag	Scores
Very Poor	a	0–20
Poor	b	20–40
Satisfactory	c	40–60
Good	d	60–80
Excellent	e	80–100

4)%Material Variance/Standard material Usage

PERFUME

% Material Var.to std usage	Grade (Flag)
−15.00%	a
−10.00%	a
−5.00%	b
0.00%	e
5.00%	a
10.00%	a
15.00%	a
20.00%	a
25.00%	a
30.00%	a
35.00%	a

Legend

Grade	Flag	Scores
Very Poor	a	0−20
Poor	b	20−40
Satisfactory	c	40−60
Good	d	60−80
Excellent	e	80−100

CHEMICALS

% Material Var.to std usage	Grade (Flag)
−10.00%	a
−7.50%	a
−5.00%	a
−2.50%	b
0.00%	e
2.50%	b
5.00%	a
7.50%	a
10.00%	a
12.50%	a
15.00%	a
17.50%	a

Legend

Grade	Flag	Scores
Very Poor	a	0−20
Poor	b	20−40
Satisfactory	c	40−60
Good	d	60−80
Excellent	e	80−100

5)%Material Variance/Standard material Usage(Cont..)

WRAPPERS

% Material Var.to std usage	Grade (Flag)
−6.00%	b
−4.00%	b
−2.00%	c
0.00%	d
2.00%	c
4.00%	a
6.00%	a
8.00%	a
10.00%	a
12.00%	a
14.00%	a

Legend

Grade	Flag	Scores
Very Poor	a	0−20
Poor	b	20−40
Satisfactory	c	40−60
Good	d	60−80
Excellent	e	80−100

CORR. BOXES

% Material Var.to std usage	Grade (Flag)
−6.00%	a
−4.50%	b
−3.00%	b
−1.50%	c
0.00%	d
1.50%	c
3.00%	b
4.50%	a
6.00%	a
7.50%	a
9.00%	a

Legend

Grade	Flag	Scores
Very Poor	a	0−20
Poor	b	20−40
Satisfactory	c	40−60
Good	d	60−80
Excellent	e	80−100

6)%Labour Variance(in hrs)/Standard labour usage(calculated at 65% OE)

% Labour Var. to std usage	Grade (Flag)
−40.0%	e
−32.0%	e
−24.0%	e
−16.0%	e
−8.0%	e
0.0%	e
8.0%	b
16.0%	a
24.0%	a
32.0%	a
40.0%	a
48.0%	a

Legend

Grade	Flag	Scoree
Very Poor	a	0−20
Poor	b	20−40
Satiefactory	c	40−60
Good	d	60−80
Excellent	e	80−100

7)%Production hours lost due to Labour,Services & Materials/Total available hrs

Production houre to available hrs.	Grade (Flag)
0.00%	e
1.50%	d
3.00%	d
4.50%	d
6.00%	b
7.50%	b
9.00%	a
10.50%	a
12.00%	a
13.50%	a
15.00%	a
16.50%	a
18.00%	b
19.50%	a

Legend

Grade	Flag	Scoree
Very Poor	a	0−20
Poor	b	20−40
Satiefactory	c	40−60
Good	d	60−80
Excellent	e	80−100

8)%Production hours lost due to Machine breakdowns/Total available hrs

Production houre to available hrs.	Grade (Flag)
0.00%	e
2.50%	e
5.00%	d
7.50%	c
10.00%	b
12.50%	a
15.00%	a
17.50%	a
20.00%	a
22.50%	a
25.00%	a
27.50%	a
30.00%	a
32.50%	a

Legend

Grade	Flag	Scoree
Very Poor	a	0−20
Poor	b	20−40
Satiefactory	c	40−60
Good	d	60−80
Excellent	e	80−100

TECHNICAL QUESTIONNAIRE(ENGINEERING)

E1

1)Engineering store value/value of machinery(CRV)

% Re/Re	Grade (Flag)	
0.50%	e	2
1.50%	e	2
2.50%	e	2
3.50%	d	4
4.50%	c	5.5
5.50%	c	5.5
6.50%	b	7
7.50%	a	9
8.50%	a	9
9.50%	a	9

Legend

Grade	Flag	Scores
Very Poor	a	0–20
Poor	b	20–40
Satisfactory	c	40–60
Good	d	60–80
Excellent	e	80–100

2)Energy Usage/Tonne

E L E C T R I C I T Y

Kwhre/Tonne	Grade (Flag)	
65	e	1.5
70	e	1.5
75	d	4
80	d	4
85	d	4
90	c	6.5
95	c	6.5
100	b	8.5
105	b	8.5
110	a	10

Legend

Grade	Flag	Scores
Very Poor	a	0–20
Poor	b	20–40
Satisfactory	c	40–60
Good	d	60–80
Excellent	e	80–100

S T E A M

Steam Tonne/Tonne	Grade (Flag)	
0.25	e	2
0.30	e	2
0.34	e	2
0.39	d	4.5
0.43	d	4.5
0.48	c	7
0.52	c	7
0.57	c	7
0.61	b	9.5
0.66	b	9.5
0.70	a	11

Legend

Grade	Flag	Scores
Very Poor	a	0–20
Poor	b	20–40
Satisfactory	c	40–60
Good	d	60–80
Excellent	e	80–100

3)Maintenance cost/ Total Direct OH cost

% Re/Re	Grade (Flag)	
4.00%	e	1.5
6.50%	e	1.5
9.00%	d	3.5
11.50%	d	3.5
14.00%	c	5.5
16.50%	c	5.5
19.00%	b	7.5
21.50%	b	7.5
24.00%	a	10
26.50%	a	10
29.00%	a	10

Legend

Grade	Flag	Scores
Very Poor	a	0–20
Poor	b	20–40
Satisfactory	c	40–60
Good	d	60–80
Excellent	e	80–100

COMMERCIAL QUESTIONAIRE

1) Inventory Level of Finished Goods (Invoicable)

Qty(in '000 Casee)	Grade (Flag)
0	a
~~7.5~~ 9.75	a
~~15~~ 19.5	c
~~22.5~~ 29.25	e
~~30~~ 39	d
~~37.5~~ 48.75	b
~~45~~ 58.5	b
~~52.5~~ 68.25	b
~~60~~ 78	b
~~67.5~~ 87.75	b
~~75~~ 97.5	b
~~82.5~~ 107.25	a
~~90~~ 117	a
~~97.5~~ 126.75	a
~~105~~ 136.5	

Legend

Grade	Flag	Scores
Very Poor	a	0–20
Poor	b	20–40
Satisfactory	c	40–60
Good	d	60–80
Excellent	e	80–100

2) Raw material inventory(Rs)/ Total production cost

% Rs/Rs	Grade (Flag)
5.00%	a 2.5
9.00%	b 5
13.00%	b 5
17.00%	d 2
21.00%	e 1
25.00%	c 3
29.00%	b 5
33.00%	a 7.5
37.00%	a 8.5
41.00%	a 8.5

Legend

Grade	Flag	Scores
Very Poor	a	0–20
Poor	b	20–40
Satisfactory	c	40–60
Good	d	60–80
Excellent	e	80–100

3) % Production Target Fullfillment

% Production Target	Grade (Flag)
20%	a 10.5
30%	a 10.5
40%	a 10.5
50%	a 10.5
60%	b 6
70%	b 6
80%	c 3
90%	e 1.5
100%	e 1.5
110%	b 6
120%	b 6
130%	b 6

Legend

Grade	Flag	Scores
Very Poor	a	0–20
Poor	b	20–40
Satisfactory	c	40–60
Good	d	60–80
Excellent	e	80–100

FINANCIAL QUESTIONAIRE

1)Asset turnover ratio(calculated on a monthly basis)

Asset turnover ratio	Grade (Flag)
0.10	a
0.18	b
0.25	c
0.33	d
0.40	d
0.48	e
0.55	e
0.62	e
0.70	e
0.78	e
0.85	e
0.93	e
1.00	e
1.08	e

Legend

Grade	Flag	Scores
Very Poor	a	0–20
Poor	b	20–40
Satisfactory	c	40–60
Good	d	60–80
Excellent	e	80–100

MARKETING QUESTIONAIRE

1) Market share

% Market share	Grade (Flag)	
0.15	a	10
0.24	b	8.5
0.33	b	8.5
0.42	c	6
0.51	c	6
0.60	c	6
0.69	d	4.5
0.78	d	4.5
0.87	e	1.5
0.96	e	1.5

Legend

Grade	Flag	Scores
Very Poor	a	0–20
Poor	b	20–40
Satisfactory	c	40–60
Good	d	60–80
Excellent	e	80–100

APPENDIX 2

PROD TARGET FULFILLMENT	EXPERTS OPINION(GRADE)				EXPERTS OPINION(RANK)			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
20%	a	a	a	a	9	11.5	9.5	10.5
30%	a	a	a	a	9	11.5	9.5	10.5
40%	a	b	a	a	9	7	9.5	10.5
50%	a	b	a	a	9	7	9.5	10.5
60%	a	b	a	b	9	7	9.5	6
70%	a	b	a	b	9	7	9.5	6
80%	b	b	b	c	4.5	7	5.5	3
90%	d	c	b	e	2.5	2.5	5.5	1.5
100%	e	e	e	e	1	1	1	1.5
110%	d	c	d	b	2.5	2.5	2	6
120%	b	b	c	b	4.5	7	3.5	6
130%	a	b	c	b	9	7	3.5	6

COMBINATIONS	RANK CORRELATION	CONDITION
RK 1 VS 2	0.84266	NOT ACCEPTABLE
RK 1 VS 3	0.84965	NOT ACCEPTABLE
RK 1 VS 4	0.81119	NOT ACCEPTABLE
RK 2 VS 3	0.75874	NOT ACCEPTABLE
RK 2 VS 4	0.79021	NOT ACCEPTABLE
RK 3 VS 4	0.72203	NOT ACCEPTABLE

DEGREE OF CONVERGENCE(DOC)	0

PROD TARGET FULFILLMENT	YOUR NEW OPINION	ITERATION NO: 1
20%	a	
30%	a	
40%	a	
50%	a	
60%	a	
70%	a	
80%	b	
90%	d	
100%	e	
110%	c	
120%	b	
130%	a	

INVENT. L OF FP(000 CASES)	EXPERTS OPINION(GRADE) (1)	(2)	(3)	(4) ← Your previous opinion	EXPERTS OPINION(RANK) (1)	(2)	(3)	(4)
0	a	a	a	a	11	13.5	13	12.5
7.5	e	b	b	a	1	8.5	8	12.5
15	d	b	c	c	2	8.5	4	3
22.5	c	b	e	e	3	8.5	1	1
30	b	b	d	d	5	8.5	2	2
37.5	b	d	c	b	5	4	4	6.5
45	b	d	c	b	5	4	4	6.5
52.5	a	e	b	b	11	1.5	8	6.5
60	a	e	b	b	11	1.5	8	6.5
67.5	a	d	b	b	11	4	8	6.5
75	a	b	b	b	11	8.5	8	6.5
82.5	a	b	a	a	11	8.5	13	12.5
90	a	a	a	a	11	13.5	13	12.5
97.5	a	a	a	a	11	13.5	13	12.5
105	a	a	a	a	11	13.5	13	12.5

COMBINATIONS	RANK CORRELATION	CONDITION
RK 1 VS 2	0.26786	NOT ACCEPTABLE
RK 1 VS 3	0.77857	NOT ACCEPTABLE
RK 1 VS 4	0.56607	NOT ACCEPTABLE
RK 2 VS 3	0.56964	NOT ACCEPTABLE
RK 2 VS 4	0.57589	NOT ACCEPTABLE
RK 3 VS 4	0.92143	ACCEPTABLE

DEGREE OF CONVERGENCE(DOC)	0.17

INVENT. L OF FP(000 CASES)	YOUR NEW OPINION	ITERATION NO: 1
0	a	
~~7.5~~ 9.75	d	
~~15~~ 19.5	e	
~~22.5~~ 29.25	d	
~~30~~ 39	b	
~~37.5~~ 48.75	b	
~~45~~ 58.5	b	
~~52.5~~ 68.25	a	
~~60~~ 78	a	
~~67.5~~ 87.75	a	
~~75~~ 97.5	a	
~~82.5~~ 107.25	a	
~~90~~ 117	a	
~~97.5~~ 126.75	a	
~~105~~ 136.5	a	

%R.MAT INV(Rs)/ TOT PROD COST	EXPERTS OPINION(GRADE)				EXPERTS OPINION(RANK)			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
5.00%	a	a	a	a	8	10	10	8.5
9.00%	a	c	b	b	8	4.5	6.5	5
13.00%	b	e	b	b	4.5	1	6.5	5
17.00%	d	d	b	d	2.5	2	6.5	2
21.00%	e	c	c	e	1	4.5	3	1
25.00%	d	c	d	c	2.5	4.5	1.5	3
29.00%	b	c	d	b	4.5	4.5	1.5	5
33.00%	a	b	b	a	8	8	6.5	8.5
37.00%	a	b	b	a	8	8	6.5	8.5
41.00%	a	b	b	a	8	8	6.5	8.5

COMBINATIONS	RANK CORRELATION	CONDITION
RK 1 VS 2	0.72727	NOT ACCEPTABLE
RK 1 VS 3	0.71515	NOT ACCEPTABLE
RK 1 VS 4	0.93333	ACCEPTABLE
RK 2 VS 3	0.50606	NOT ACCEPTABLE
RK 2 VS 4	0.79394	NOT ACCEPTABLE
RK 3 VS 4	0.65152	NOT ACCEPTABLE

DEGREE OF CONVERGENCE(DOC)	0.17

%R.MAT INV(Rs)/ TOT PROD COST	YOUR NEW OPINION	ITERATION NO: 1
5.00%	a	
9.00%	a	
13.00%	b	
17.00%	d	
21.00%	e	
25.00%	c	
29.00%	b	
33.00%	a	
37.00%	a	
41.00%	a	

%MAT.VAR/STD USE(CHEMICAL)	EXPERTS OPINION(GRADE) (1)	(2)	(3)	(4) (Your previous opinion)	EXPERTS OPINION(RANK) (1)	(2)	(3)	(4)
-10.00%	a	a	a	a	8.5	8.5	9	8
-7.50%	a	a	a	a	8.5	8.5	9	8
-5.00%	a	a	b	a	8.5	8.5	4.5	8
-2.50%	b	a	c	b	3.5	8.5	2.5	2.5
0.00%	e	e	e	e	1	1	1	1
2.50%	c	c	c	b	2	2.5	2.5	2.5
5.00%	b	c	b	a	3.5	2.5	4.5	8
7.50%	a	b	a	a	8.5	4	9	8
10.00%	a	a	a	a	8.5	8.5	9	8
12.50%	a	a	a	a	8.5	8.5	9	8
15.00%	a	a	a	a	8.5	8.5	9	8
17.50%	a	a	a	a	8.5	8.5	9	8

COMBINATIONS	RANK CORRELATION	CONDITION
RK 1 VS 2	0.83741	NOT ACCEPTABLE
RK 1 VS 3	0.93007	ACCEPTABLE
RK 1 VS 4	0.91783	ACCEPTABLE
RK 2 VS 3	0.71154	NOT ACCEPTABLE
RK 2 VS 4	0.70629	NOT ACCEPTABLE
RK 3 VS 4	0.88966	ACCEPTABLE

DEGREE OF CONVERGENCE(DOC)	0.5

%MAT.VAR/STD USE(CHEMICAL)	YOUR NEW OPINION	ITERATION NO: 1
-10.00%	a	
-7.50%	a	
-5.00%	b	
-2.50%	c	
0.00%	e	
2.50%	c	
5.00%	b	
7.50%	a	
10.00%	a	
12.50%	a	
15.00%	a	
17.50%	a	

T4

%MAT.VAR/STD USE(PERFUME)	EXPERTS OPINION(GRADE)				EXPERTS OPINION(RANK)			
	(1)	(2)	(3)	(4) Your previous opinion	(1)	(2)	(3)	(4)
−15.00%	a	a	a	a	7	7	7.5	7
−10.00%	a	a	a	a	7	7	7.5	7
−5.00%	a	a	c	b	7	7	2.5	2
0.00%	e	e	e	e	1	1	1	1
5.00%	b	b	c	a	2	2	2.5	7
10.00%	a	a	a	a	7	7	7.5	7
15.00%	a	a	a	a	7	7	7.5	7
20.00%	a	a	a	a	7	7	7.5	7
25.00%	a	a	a	a	7	7	7.5	7
30.00%	a	a	a	a	7	7	7.5	7
35.00%	a	a	a	a	7	7	7.5	7

COMBINATIONS	RANK CORRELATION	CONDITION
RK 1 VS 2	1	ACCEPTABLE
RK 1 VS 3	0.89773	ACCEPTABLE
RK 1 VS 4	0.77273	NOT ACCEPTABLE
RK 2 VS 3	0.89773	ACCEPTABLE
RK 2 VS 4	0.77273	NOT ACCEPTABLE
RK 3 VS 4	0.89773	ACCEPTABLE

DEGREE OF CONVERGENCE(DOC)	0.67

%MAT.VAR/STD USE(PERFUME)	YOUR NEW OPINION	ITERATION NO: 1
−15.00%	a	
−10.00%	a	
−5.00%	b	
0.00%	e	
5.00%	b	
10.00%	a	
15.00%	a	
20.00%	a	
25.00%	a	
30.00%	a	
35.00%	a	

APPENDIX 3

ASSET UTILISATION	EXPERTS OPINION(GRADE)				EXPERTS OPINION(RANK)			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
10%	a	a	a	a	13.5	13.5	12	13.5
15%	a	a	a	a	13.5	13.5	12	13.5
20%	a	a	a	a	13.5	13.5	12	13.5
25%	a	a	a	a	13.5	13.5	12	13.5
30%	b	b	a	b	10.5	10.5	12	10.5
35%	b	b	a	b	10.5	10.5	12	10.5
40%	c	c	a	c	8.5	7.5	12	8
45%	c	c	b	c	8.5	7.5	7.5	8
50%	d	c	b	c	6.5	7.5	7.5	8
55%	d	c	c	d	6.5	7.5	5	5.5
60%	e	d	c	d	3	4.5	5	5.5
65%	e	d	c	e	3	4.5	5	2.5
70%	e	e	d	e	3	3	3	2.5
75%	e	e	e	e	3	3	1.5	2.5
80%	e	e	e	e	3	3	1.5	2.5

COMBINATIONS	RANK CORRELATION	CONDITION
RK 1 VS 2	0.98482	ACCEPTABLE
RK 1 VS 3	0.92411	ACCEPTABLE
RK 1 VS 4	0.96036	ACCEPTABLE
RK 2 VS 3	0.91964	ACCEPTABLE
RK 2 VS 4	0.98125	ACCEPTABLE
RK 3 VS 4	0.93036	ACCEPTABLE

DEGREE OF CONVERGENCE(DOC) 1

%NO PROD HRS TO MACH BK.DOWNS/AV.HRS	EXPERTS OPINION(GRADE)				EXPERTS OPINION(RANK)			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
0.00%	e	e	e	e	1	1.5	1.5	1.5
2.50%	d	e	e	e	2	1.5	1.5	1.5
5.00%	c	d	d	d	3	3.5	4	3
7.50%	b	d	d	c	4	3.5	4	4
10.00%	a	c	d	b	9.5	5.5	4	5
12.50%	a	c	c	a	9.5	5.5	7	10
15.00%	a	b	c	a	9.5	7.5	7	10
17.50%	a	b	c	a	9.5	7.5	7	10
20.00%	a	a	b	a	9.5	11.5	9.5	10
22.50%	a	a	b	a	9.5	11.5	9.5	10
25.00%	a	a	a	a	9.5	11.5	12.5	10
27.50%	a	a	a	a	9.5	11.5	12.5	10
30.00%	a	a	a	a	9.5	11.5	12.5	10
32.50%	a	a	a	a	9.5	11.5	12.5	10

COMBINATIONS	RANK CORRELATION	CONDITION
RK 1 VS 2	0.85714	ACCEPTABLE
RK 1 VS 3	0.80989	NOT ACCEPTABLE
RK 1 VS 4	0.94945	ACCEPTABLE
RK 2 VS 3	0.96154	ACCEPTABLE
RK 2 VS 4	0.8967	ACCEPTABLE
RK 3 VS 4	0.86022	ACCEPTABLE

DEGREE OF CONVERGENCE(DOC)	0.83

%NO PROD HRS TO LAB,SERV & MAT/AV.HRS	EXPERTS OPINION(GRADE)				EXPERTS OPINION(RANK)			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
0.00%	e	e	e	e	1	1.5	1.5	1
1.50%	d	e	e	d	2	1.5	1.5	3
3.00%	c	d	d	d	3.5	3	3.5	3
4.50%	c	c	d	d	3.5	4.5	3.5	3
6.00%	b	c	c	b	5	4.5	6.5	5.5
7.50%	a	b	c	b	10	6.5	6.5	5.5
9.00%	a	b	c	a	10	6.5	6.5	10.5
10.50%	a	a	c	a	10	11	6.5	10.5
12.00%	a	a	b	a	10	11	10	10.5
13.50%	a	a	b	a	10	11	10	10.5
15.00%	a	a	b	a	10	11	10	10.5
16.50%	a	a	a	a	10	11	13	10.5
18.00%	a	a	a	a	10	11	13	10.5
19.50%	a	a	a	a	10	11	13	10.5

COMBINATIONS	RANK CORRELATION	CONDITION
RK 1 VS 2	0.92637	ACCEPTABLE
RK 1 VS 3	0.85385	ACCEPTABLE
RK 1 VS 4	0.94725	ACCEPTABLE
RK 2 VS 3	0.91099	ACCEPTABLE
RK 2 VS 4	0.94615	ACCEPTABLE
RK 3 VS 4	0.87582	ACCEPTABLE

DEGREE OF CONVERGENCE(DOC) 1

%MAT.VAR/STD USE(PERFUME)	EXPERTS OPINION(GRADE)				EXPERTS OPINION(RANK)			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
−15.00%	a	a	a	a	7.5	7.5	7.5	7.5
−10.00%	a	a	a	a	7.5	7.5	7.5	7.5
−5.00%	b	b	b	b	2.5	2.5	3	2.5
0.00%	d	c	d	c	1	1	1	1
5.00%	b	b	c	b	2.5	2.5	2	2.5
10.00%	a	a	a	a	7.5	7.5	7.5	7.5
15.00%	a	a	a	a	7.5	7.5	7.5	7.5
20.00%	a	a	a	a	7.5	7.5	7.5	7.5
25.00%	a	a	a	a	7.5	7.5	7.5	7.5
30.00%	a	a	a	a	7.5	7.5	7.5	7.5
35.00%	a	a	a	a	7.5	7.5	7.5	7.5

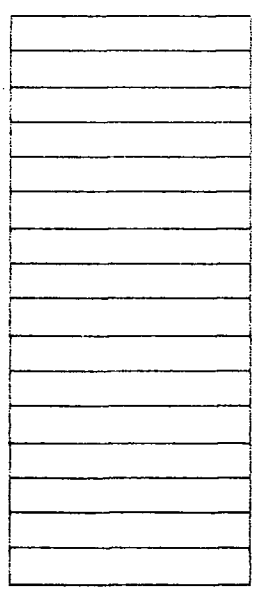
COMBINATIONS	RANK CORRELATION	CONDITION
RK 1 VS 2	1	ACCEPTABLE
RK 1 VS 3	0.99773	ACCEPTABLE
RK 1 VS 4	1	ACCEPTABLE
RK 2 VS 3	0.99773	ACCEPTABLE
RK 2 VS 4	1	ACCEPTABLE
RK 3 VS 4	0.99773	ACCEPTABLE

DEGREE OF CONVERGENCE(DOC) 1

INVENT. L OF FP(000 CASES) – SL	EXPERTS OPINION(GRADE)				EXPERTS OPINION(RANK)			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
0	a	a	a	a	11	11	11	11
9.75	e	d	d	d	1	2	2	2.5
19.5	d	e	e	e	2	1	1	1
29.25	c	c	c	d	3	3.5	3	2.5
39	b	c	b	b	5	3.5	5	5
48.75	b	b	b	b	5	5.5	5	5
58.5	b	b	b	b	5	5.5	5	5
68.25	a	a	a	a	11	11	11	11
78	a	a	a	a	11	11	11	11
87.75	a	a	a	a	11	11	11	11
97.5	a	a	a	a	11	11	11	11
107.25	a	a	a	a	11	11	11	11
117	a	a	a	a	11	11	11	11
126.75	a	a	a	a	11	11	11	11
136.5	a	a	a	a	11	11	11	11

COMBINATIONS	RANK CORRELATION	CONDITION
RK 1 VS 2	0.99107	ACCEPTABLE
RK 1 VS 3	0.99643	ACCEPTABLE
RK 1 VS 4	0.99375	ACCEPTABLE
RK 2 VS 3	0.99464	ACCEPTABLE
RK 2 VS 4	0.99286	ACCEPTABLE
RK 3 VS 4	0.99911	ACCEPTABLE

DEGREE OF CONVERGENCE(DOC)	1



INVENT. L OF FP(000 CASES) – LB	EXPERTS OPINION(GRADE)				EXPERTS OPINION(RANK)			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
0	a	a	a	a	8.5	8.5	8	8
3.15	d	d	e	e	2	2	1	1
6.3	e	e	d	b	1	1	2	2.5
9.45	c	c	b	b	3	3	3	2.5
12.6	b	b	a	a	4	4	8	8
15.75	a	a	a	a	8.5	8.5	8	8
18.9	a	a	a	a	8.5	8.5	8	8
22.05	a	a	a	a	8.5	8.5	8	8
25.2	a	a	a	a	8.5	8.5	8	8
28.35	a	a	a	a	8.5	8.5	8	8
31.5	a	a	a	a	8.5	8.5	8	8
34.65	a	a	a	a	8.5	8.5	8	8

COMBINATIONS	RANK CORRELATION	CONDITION
RK 1 VS 2	1	ACCEPTABLE
RK 1 VS 3	0.93007	ACCEPTABLE
RK 1 VS 4	0.92483	ACCEPTABLE
RK 2 VS 3	0.93007	ACCEPTABLE
RK 2 VS 4	0.92483	ACCEPTABLE
RK 3 VS 4	0.99825	ACCEPTABLE

DEGREE OF CONVERGENCE(DOC)	1

PROD TARGET FULFILLMENT	EXPERTS OPINION(GRADE)				EXPERTS OPINION(RANK)			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
20%	a	a	a	a	9	9	9.5	9
30%	a	a	a	a	9	9	9.5	9
40%	a	a	a	a	9	9	9.5	9
50%	a	a	a	a	9	9	9.5	9
60%	a	a	a	a	9	9	9.5	9
70%	a	a	b	a	9	9	5	9
80%	b	b	b	b	4.5	4.5	5	4.5
90%	d	c	c	d	2.5	3	3	2
100%	e	e	e	e	1	1	1	1
110%	d	d	d	c	2.5	2	2	3
120%	b	b	b	b	4.5	4.5	5	4.5
130%	a	a	a	a	9	9	9.5	9

COMBINATIONS	RANK CORRELATION	CONDITION
RK 1 VS 2	0.99825	ACCEPTABLE
RK 1 VS 3	0.93531	ACCEPTABLE
RK 1 VS 4	0.99625	ACCEPTABLE
RK 2 VS 3	0.93706	ACCEPTABLE
RK 2 VS 4	0.99601	ACCEPTABLE
RK 3 VS 4	0.93007	ACCEPTABLE

DEGREE OF CONVERGENCE(DOC) 1

%LABOUR VAR/ STD USE	EXPERTS OPINION(GRADE)				EXPERTS OPINION(RANK)			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
-40.0%	e	e	e	e	3.5	3.5	2	3.5
-32.0%	e	e	e	e	3.5	3.5	2	3.5
-24.0%	e	e	e	e	3.5	3.5	2	3.5
-16.0%	e	e	d	e	3.5	3.5	4.5	3.5
-8.0%	e	e	d	e	3.5	3.5	4.5	3.5
0.0%	e	e	c	e	3.5	3.5	6.5	3.5
8.0%	b	b	c	b	7	7	6.5	7
16.0%	a	a	b	a	10	10	8.5	10
24.0%	a	a	b	a	10	10	8.5	10
32.0%	a	a	a	a	10	10	11	10
40.0%	a	a	a	a	10	10	11	10
48.0%	a	a	a	a	10	10	11	10

COMBINATIONS	RANK CORRELATION	CONDITION
RK 1 VS 2	1	ACCEPTABLE
RK 1 VS 3	0.91064	ACCEPTABLE
RK 1 VS 4	1	ACCEPTABLE
RK 2 VS 3	0.91064	ACCEPTABLE
RK 2 VS 4	1	ACCEPTABLE
RK 3 VS 4	0.91064	ACCEPTABLE

DEGREE OF CONVERGENCE(DOC) 1

APPENDIX 4

Macro for Ranktech.wk3

MACRO AREA

\0

{HOME}
N ~/XL DO YOU WANT TO EXIT TO MAINMENU(Y/N)?~AA~
~{IF @LEFT(@UPPER(AA),1)="Y"}/FS~R/FRMAINMENU~
1 ~{IF @LEFT(@UPPER(AA),1)="N"}~/XN PLEASE GIVE THE NO: OF ITERATIONS?~BB~
N2 ~/XL PLEASE SELECT THE CRITERIA ?~ANS2~
{GOTO}CC~{DOWN}~/REDD~/C{ESC}CRT18~~{BRANCH GGG0} {CALC}
/RVLOC1~LOC2~
{GOTO}CC~{DOWN}~/REDD~/C{ESC}CRT18~~{BRANCH GGG0}
{BRANCH CORRECT}
{GOTO}ADT~/REAI~
/WTB
/RIAI~
/WTC
y ~/XL HAVE YOU TYPED IN CORRECTLY(Y/N)?~ADF~
~{IF @LEFT(@UPPER(ADF),1)="N"}{BRANCH GGG0}
~{IF @LEFT(@UPPER(ADF),1)="Y"}{\A}

\A
{WINDOWSOFF}{PANELOFF}
{GOTO}AB~~/REABB~/C{ESC}EE~~
{CALC}/REPRINTER1~
{IF DOC>=0.80}{GOTO}OUTPUT1~/C{ESC}PRINT1~~{GOTO}OUTPUT2~/C{ESC}PRINT2~~{A
{GOTO}OUTPUT1~/C{ESC}PRINT1~~{GOTO}OUTPUT2~/C{ESC}PRINT2~~{APP3}/SC{ESC}P
{UP}{UP}/C{ESC}NEWITERATE~~{APP3}/SC{ESC}NEWITERATE~~
/C{ESC}CRT18~~ {CALC}
/RVLOC3~LOC4~
/C{ESC}CRT2~~
{APP3}/PRSPRINTER1~G{APP3}/FRPRINTER1~{WINDOWSON}{PANELON}{\0}

VERTICAL LOOKUP	
A	1
B	2
C	3
D	4
E	5
F	6
G	7
H	8
I	9
J1	10
J2	11
J3	12
J4	13
K	14
L	15
M	16
N1	17
N2	18
O	19
P	20

APPENDIX 5

a0=	52.91667	A0y=	635	A00=	12
a1=	4.029717	A1y=	2304.998	A11=	572
a2=	0.019979	A2y=	239.99	A22=	12012
a3=	0.041958	A3y=	216	A33=	5148
a4=	0.006619	A4y=	53.001	A44=	8008
a5=	0.00396	A5y=	63.009	A55=	15912
a6=	0.004348	A6y=	19.515	A66=	4488

Let X=x−ă (ie Relationship of X with independent variable x)

Where ă = 6.5

ASSET TURN-OVER RATIO

A N O V A

source	df	SS	MS
a0	1	33602.08	33602
a1	1	9288.489	9288.5
a2	1	4.794805	4.7948
a3	1	9.062937	9.0629
a4	1	0.350787	0.3508
a5	1	0.249506	0.2495
a6	1	0.084856	0.0849
residual	5	1.950483	0.3901
Total	12	42907.07	

COEFFICIENTS IN TERMS OF INDEPENDENT VARIABLES

FOR U1(X)	c	−52.69
	x	8.06
FOR U2(X)	c	1.82
	x	−0.78
	x2	0.06
FOR U3(X)	c	−3.82
	x	2.95
	x2	−0.55
	x3	0.03
FOR U4(X)	c	1.20
	x	−1.37
	x2	0.43
	x3	−0.05
	x4	0.00
FOR U5(X)	c	−1.75
	x	2.60
	x2	−1.19
	x3	0.23
	x4	−0.02
	x5	0.00
FOR U6(X)	c	1.92
	x	−3.46
	x2	2.09
	x3	−0.57
	x4	0.08
	x5	−0.01
	x6	0.00

Asset Utilisation	Managers Avg Score	Y Estimated
20.00%	8.500	8.592
25.00%	17.000	17.322
30.00%	25.500	25.474
35.00%	34.000	33.277
40.00%	40.417	40.951
45.00%	48.333	48.566
50.00%	56.250	56.218
55.00%	64.167	63.883
60.00%	72.083	71.705
65.00%	78.167	79.962
70.00%	89.563	89.153
75.00%	100.000	100.076

a0 Coefficient 52.91687

Coefficients from Orthogonal Polynomials

(/FCAN'' ; PLEASE ERASE BEFORE COMBINING)

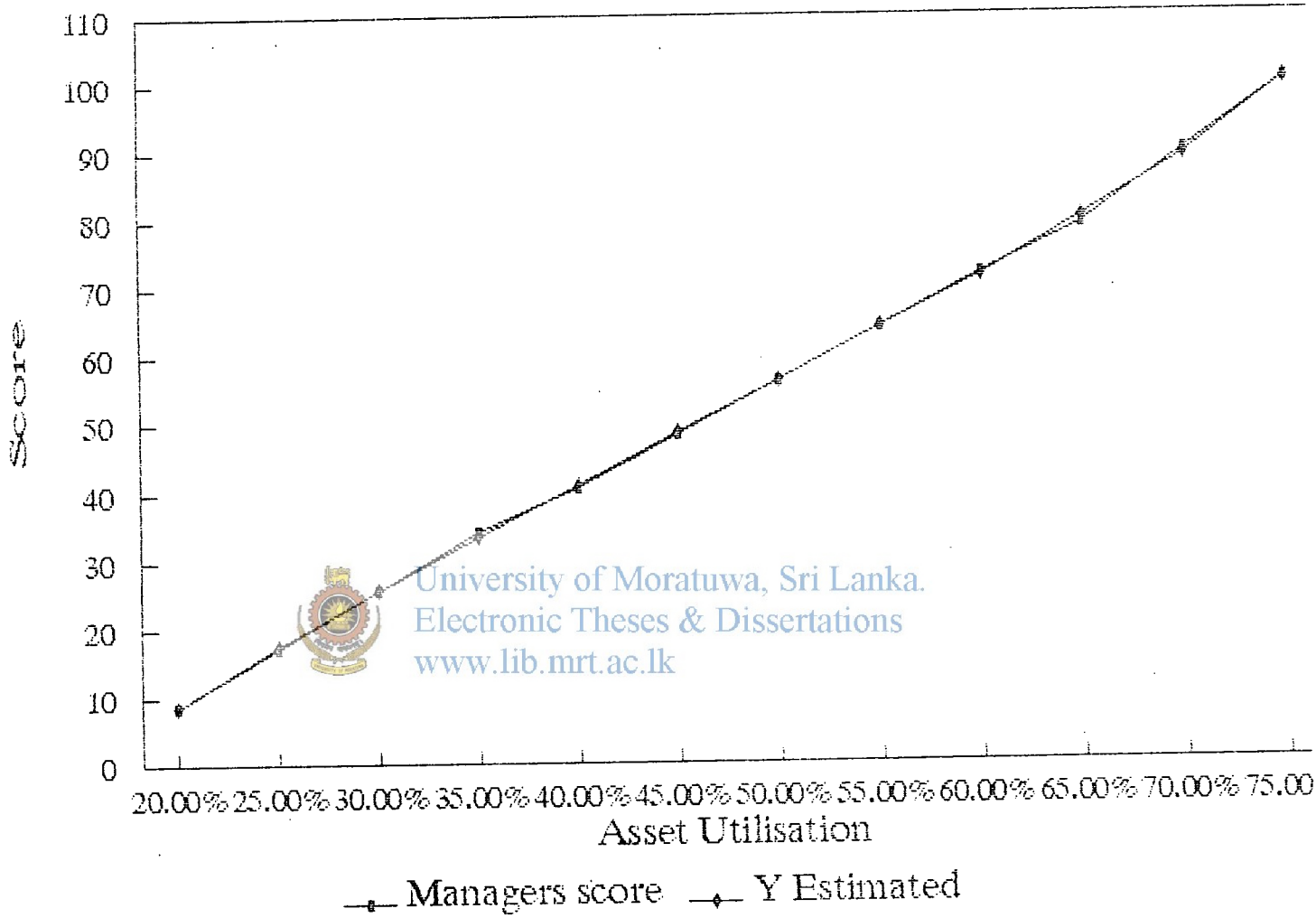
FOR U1(X)	c	−52.39
	x	8.08
FOR U2(X)	c	1.82
	x	−0.76
	x2	0.08
FOR U3(X)	c	−3.32
	x	2.85
	x2	−0.55
	x3	0.03
FOR U4(X)	c	1.20
	x	−0.37
	x2	0.43
	x3	−0.06
	x4	0.00
FOR U5(X)	c	−1.75
	x	2.60
	x2	−1.19
	x3	0.23
	x4	−0.02
	x5	0.00
FOR U6(X)	c	0.00
	x	0.00
	x2	0.00
	x3	0.00
	x4	0.00
	x5	0.00
	x6	0.00

Final Coefficients

FOR U1(X)	c	−76.56461886
	x	161.18887133
FOR U2(X)	c	4.8951060576
	x	−22.77627373
	x2	23.975024975
FOR U3(X)	c	−16.33986434
	x	139.58041958
	x2	−316.6811189
	x3	228.77622378
FOR U4(X)	c	10.708743506
	x	−110.4518425
	x2	395.01452822
	x3	−586.8409091
	x4	308.36363636
FOR U5(X)	c	−28.13663462
	x	384.87633503
	x2	−1779.354836
	x3	4107.6757164
	x4	−4514.218457
	x5	1900.7239819
FOR U6(X)	c	0
	x	0
	x2	0
	x3	0
	x4	0
	x5	0
	x6	0

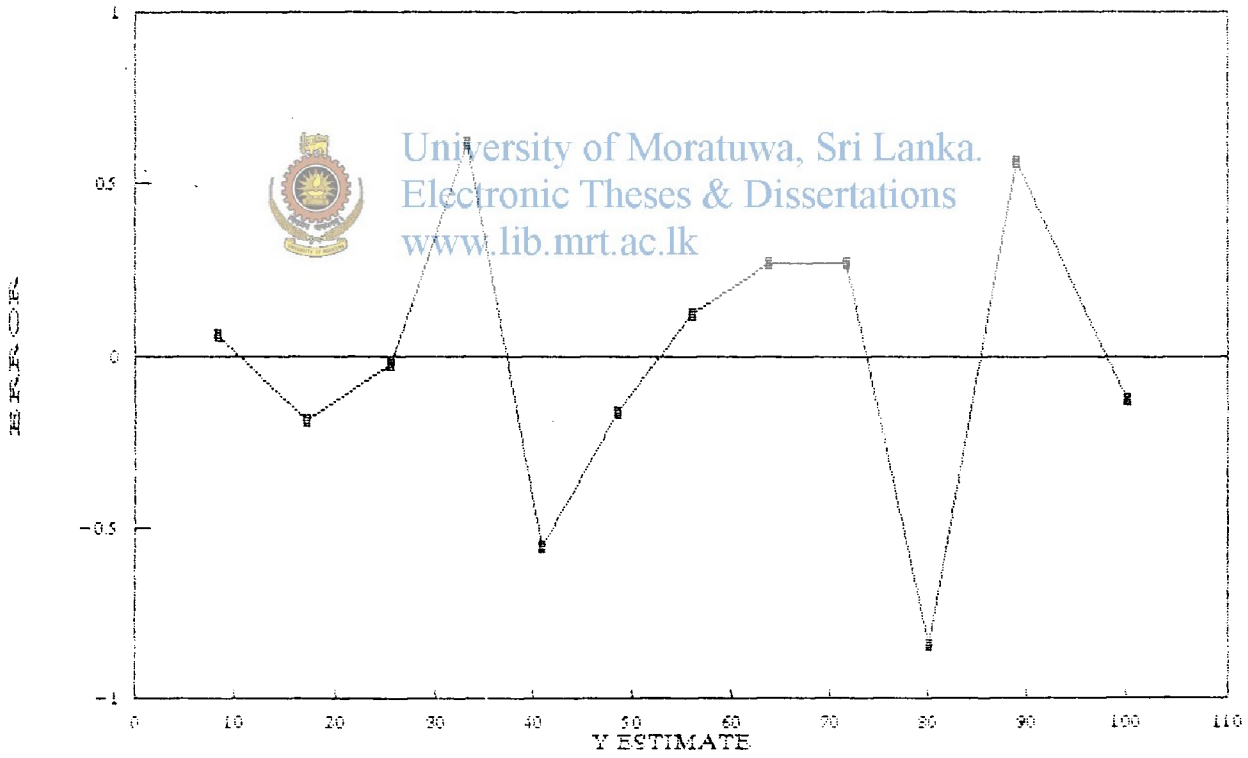
The Final equation would be:

A0	A1 (for X)	A2 (for x2)	A3 (for x3)	A4 (for x4)	A5 (for x5)	A6 (for x6)
-54.7184	532.2173	-1679.2464	3744.6110	-4205.9558	1900.7240	0.0000



FOR RESIDUAL PLOT

x Value	Y Obs.value	Y Estimated	Err	Err ^ 2
1	8.5	8.439589	0.060411	0.0036
2	17	17.18678	−0.18678	0.0349
3	25.5	25.52232	−0.02232	0.0005
4	34	33.38522	0.614782	0.378
5	40.417	40.9679	−0.5509	0.3035
6	48.333	48.50054	−0.16754	0.0281
7	56.25	56.13096	0.119045	0.0142
8	64.167	63.90027	0.266734	0.0711
9	72.083	71.81415	0.268845	0.0723
10	79.167	80.00981	−0.84281	0.7103
11	89.583	89.01852	0.564483	0.3186
12	100	100.1239	−0.12394	0.0154
0	0		0	0
0	0		0	0
0	0		0	0
			SUM	1.9505



a0=	36.04158	A0y=	432.499	A00=	12
a1=	−3.77477	A1y=	−2159.17	A11=	572
a2=	0.233516	A2y=	2804.989	A22=	12012
a3=	−0.1297	A3y=	−667.687	A33=	5148
a4=	0.017128	A4y=	137.161	A44=	8008
a5=	0.010549	A5y=	167.855	A55=	15912
a6=	−0.00744	A6y=	−33.399	A66=	4488

Let X=x−å (ie Relationship of X with independent variable x)

Where å = 6.5

NO PROD HRS DUE TO MACH BREAKDOWNS

A N O V A

source	df	SS	MS
a0	1	15587.95	15588
a1	1	8150.368	8150.4
a2	1	655.0086	655.01
a3	1	86.59789	86.598
a4	1	2.349293	2.3493
a5	1	1.770695	1.7707
a6	1	0.24855	0.2486
residual	5	3.766069	0.7532
Total	12	24488.06	

COEFFICIENTS IN TERMS OF INDEPENDENT VARIABLES

FOR U1(X)	c	49.07
	x	−7.55
FOR U2(X)	c	21.25
	x	−9.11
	x2	0.70
FOR U3(X)	c	11.80
	x	−9.12
	x2	1.69
	x3	−0.09
FOR U4(X)	c	3.12
	x	−3.54
	x2	1.12
	x3	−0.13
	x4	0.00
FOR U5(X)	c	−4.66
	x	6.93
	x2	−3.17
	x3	0.61
	x4	−0.05
	x5	0.00
FOR U6(X)	c	−3.29
	x	5.93
	x2	−3.58
	x3	0.98
	x4	−0.13
	x5	0.01
	x6	−0.00

Prod. hrs lost due to M/bkd	Managers Avg Score	Y Estimated
2.50%	95.000	94.823
5.00%	75.000	75.833
7.50%	60.833	59.549
10.00%	46.667	46.969
12.50%	38.944	37.841
15.00%	31.667	31.153
17.50%	26.250	25.841
20.00%	20.903	21.050
22.50%	16.222	16.338
25.00%	11.542	11.707
27.50%	7.694	7.463
30.00%	3.847	3.914

a0 Coefficient	36.04156

Coefficients from Orthogonal Polynomials

(/FCAN ; PLEASE ERASE BEFORE COMBINING)

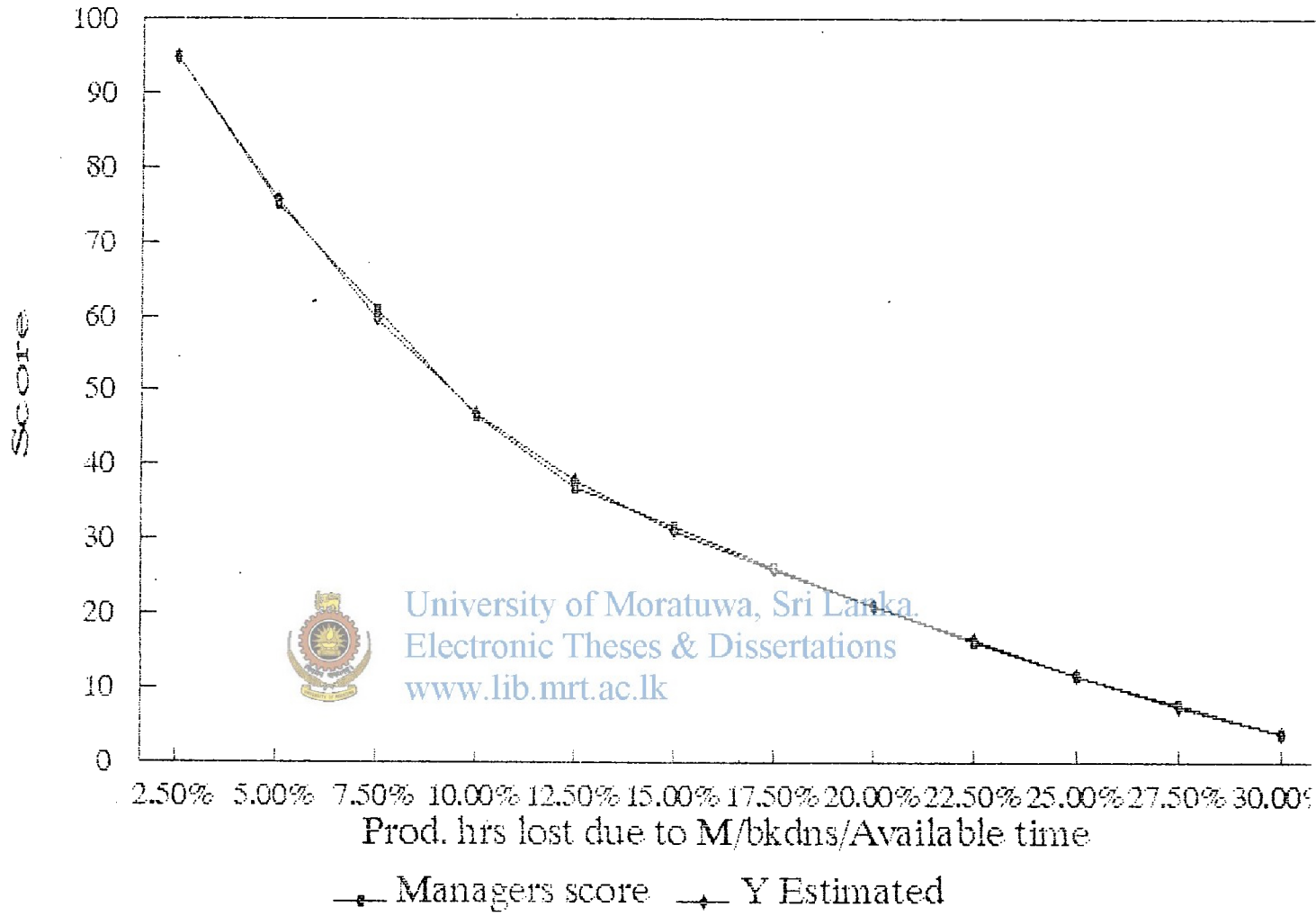
FOR U1(X)	c	49.07
	x	−7.55
FOR U2(X)	c	21.25
	x	−9.11
	x2	0.70
FOR U3(X)	c	11.80
	x	−9.12
	x2	1.69
	x3	−0.09
FOR U4(X)	c	3.12
	x	−3.54
	x2	1.12
	x3	−0.13
	x4	0.00
FOR U5(X)	c	−4.66
	x	6.93
	x2	−3.17
	x3	0.61
	x4	−0.05
	x5	0.00
FOR U6(X)	c	−3.29
	x	5.93
	x2	−3.58
	x3	0.96
	x4	−0.13
	x5	0.01
	x6	−0.00

Final Coefficients

FOR U1(X)	c	49.072022727
	x	−301.9816783
FOR U2(X)	c	21.249916667
	x	−364.2842857
	x2	1120.8747253
FOR U3(X)	c	11.80254798
	x	−364.8648336
	x2	2697.7252525
	x3	−5533.79539
FOR U4(X)	c	3.1172954545
	x	−141.7827219
	x2	787.0210206
	x3	−2312.787879
	x4	2788.904429
FOR U5(X)	c	−4.662638889
	x	277.09296359
	x2	−2074.048203
	x3	6892.68309
	x4	−11650.8804
	x5	7620.97587
FOR U6(X)	c	−3.289295455
	x	237.15175287
	x2	−2721.257299
	x3	12680.101604
	x4	−34239.1.016
	x5	90310.3.52941
	x6	−93138.8.2353

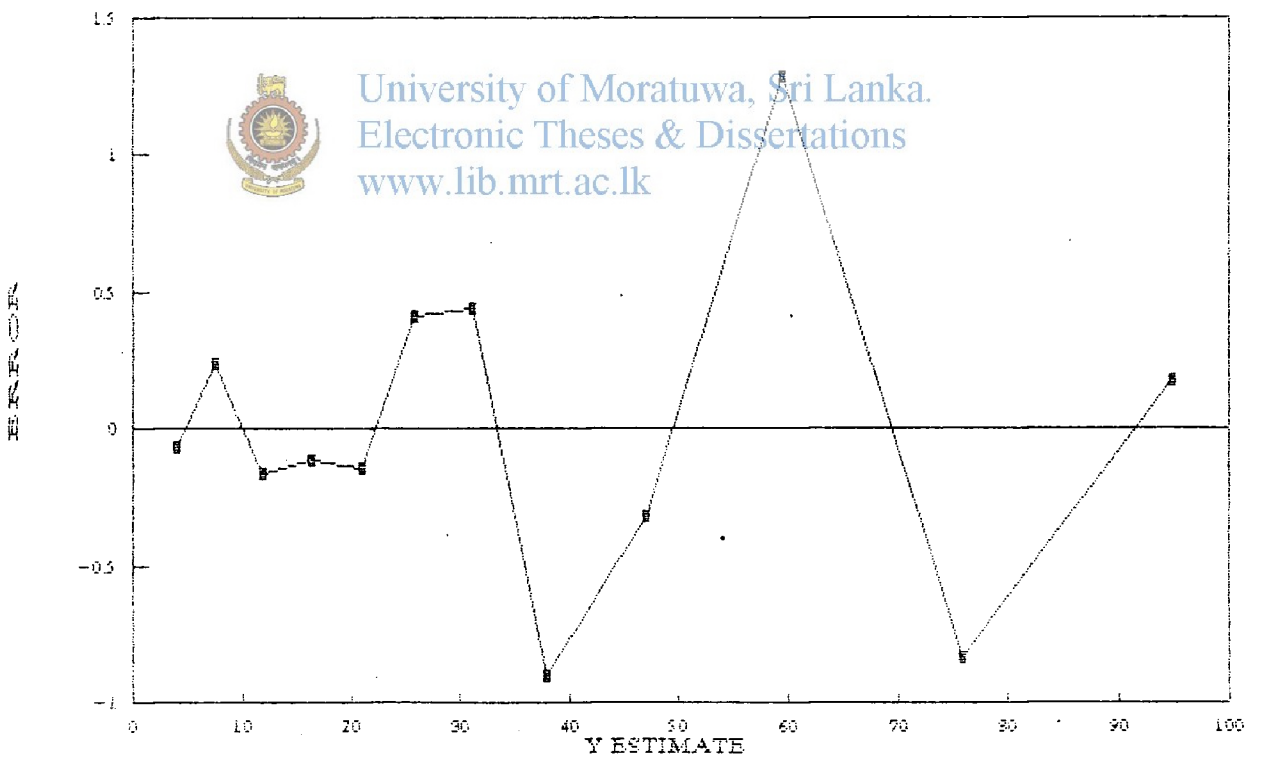
The Final equation would be:

A0	A1 (for x)	A2 (for x2)	A3 (for x3)	A4 (for x4)	A5 (for x5)	A6 (for x6)
113.5314	−658.8668	−5189.6645	87776.2014	−461253.0920	1070135.5053	−931388.2353



FOR RESIDUAL PLOT

x Value	Y Obs.value	Y Estimated	Err	Err ^ 2
1	95	94.82271	0.177287	0.0314
2	75	75.83285	−0.83285	0.6936
3	60.833	59.54927	1.283725	1.648
4	46.667	46.98859	−0.32159	0.1034
5	36.944	37.84129	−0.89729	0.8051
6	31.597	31.15286	0.444137	0.1973
7	26.25	25.84106	0.408944	0.1672
8	20.903	21.04951	−0.14651	0.0215
9	16.222	16.33763	−0.11563	0.0134
10	11.542	11.70675	−0.16475	0.0271
11	7.694	7.462579	0.231421	0.0536
12	3.847	3.913893	−0.06689	0.0045
0	0		0	0
0	0		0	0
0	0		0	0
			SUM	3.7661



a0=	36.45842	A0y=	437.501	A00=	12
a1=	−3.66695	A1y=	−2097.49	A11=	572
a2=	0.207084	A2y=	2487.497	A22=	12012
a3=	−0.05746	A3y=	−295.829	A33=	5148
a4=	−0.02924	A4y=	−234.161	A44=	8008
a5=	−0.01118	A5y=	−177.965	A55=	15912
a6=	0.047925	A6y=	215.089	A66=	4488

Let X=x−å (ie Relationship of X with independent variable x)

Where å = 6.5

NO PROD HRS DUE TO LAB,SERV & MAT

A N O V A

source	df	SS	MS
a0	1	15950.59	15951
a1	1	7691.393	7691.4
a2	1	515.1217	515.12
a3	1	16.99977	17
a4	1	6.847075	6.8471
a5	1	1.990419	1.9904
a6	1	10.30822	10.308
residual	5	5.898185	1.1796
Total	12	24199.15	

COEFFICIENTS IN TERMS OF INDEPENDENT VARIABLES:

FOR U1(X)	c	47.67
	x	−7.33
FOR U2(X)	c	18.84
	x	−8.08
	x2	0.62
FOR U3(X)	c	5.23
	x	−4.04
	x2	0.75
	x3	−0.04
FOR U4(X)	c	−5.32
	x	6.05
	x2	−1.91
	x3	0.22
	x4	−0.01
FOR U5(X)	c	4.94
	x	−7.34
	x2	3.36
	x3	−0.64
	x4	0.05
	x5	−0.00
FOR U6(X)	c	21.18
	x	−38.18
	x2	23.03
	x3	−6.31
	x4	0.86
	x5	−0.06
	x6	0.00

No Prd. hrs due to Lab,serv & mat	Managers Avg Score	Y Estimated
1.50%	90.000	90.012
3.00%	73.333	73.132
4.50%	61.667	62.585
6.00%	52.500	51.739
7.50%	41.250	40.695
9.00%	29.375	30.922
10.50%	24.286	23.945
12.00%	20.833	19.693
13.50%	17.024	17.294
15.00%	13.185	13.931
16.50%	9.345	8.747
18.00%	4.673	4.608

a0 Coefficient	36.45642

Coefficients from Orthogonal Polynomials

(IF CAN'T ; PLEASE ERASE BEFORE COMBINING)

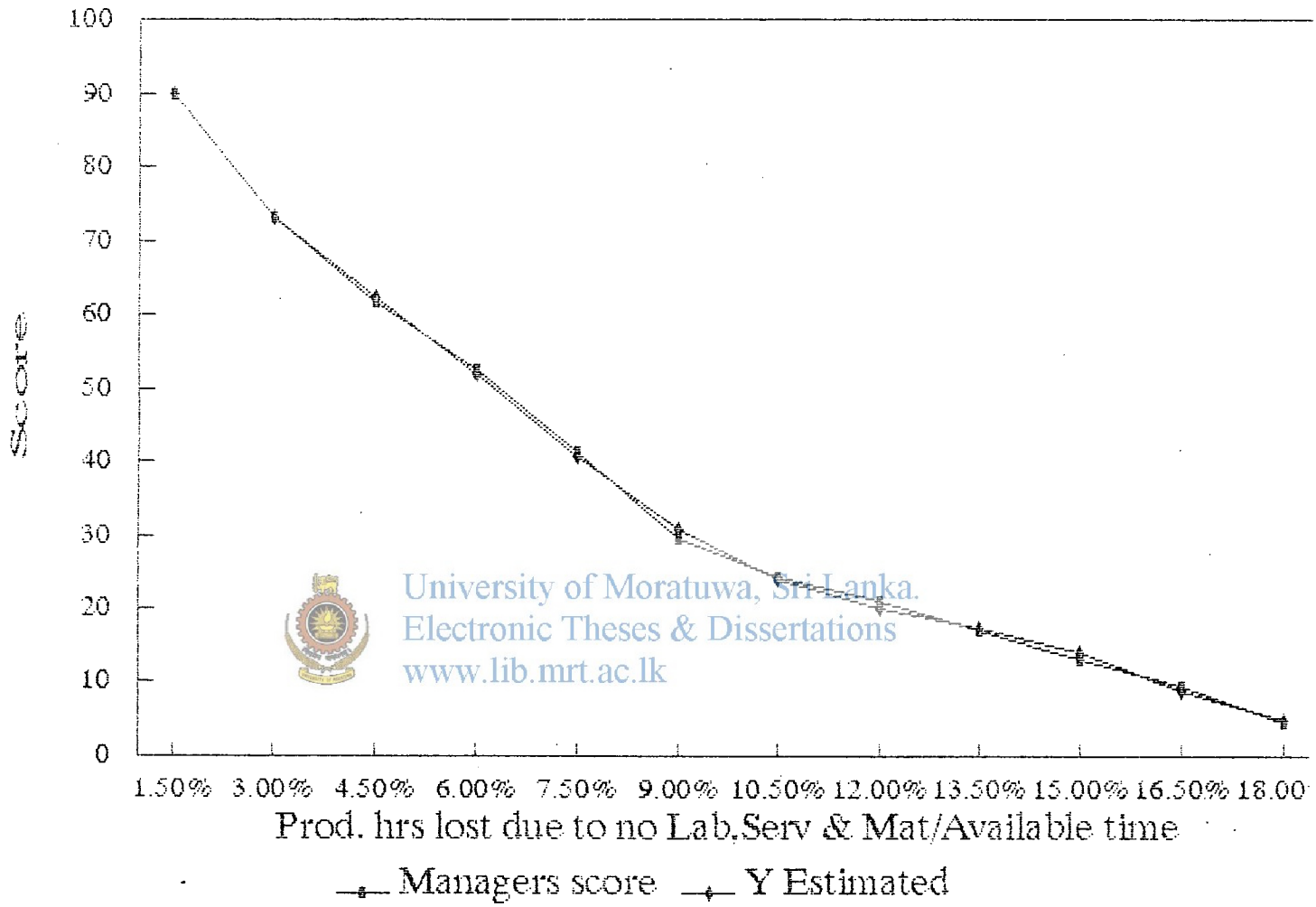
FOR U1(X)	c	47.67
	x	−7.33
FOR U2(X)	c	18.84
	x	−6.08
	x2	0.62
FOR U3(X)	c	5.23
	x	−4.04
	x2	0.75
	x3	−0.04
FOR U4(X)	c	−5.32
	x	6.05
	x2	−1.91
	x3	0.22
	x4	−0.01
FOR U5(X)	c	4.94
	x	−7.34
	x2	3.36
	x3	−0.64
	x4	0.05
	x5	−0.00
FOR U6(X)	c	21.18
	x	−36.18
	x2	23.03
	x3	−6.31
	x4	0.86
	x5	−0.06
	x6	0.00

Final Coefficients

FOR U1(X)	c	47.670295455
	x	−466.9381072
FOR U2(X)	c	18.844674242
	x	−586.4192841
	x2	2761.1244311
FOR U3(X)	c	5.2283005051
	x	−269.4482531
	x2	3320.1907989
	x3	−11351.07985
FOR U4(X)	c	−5.321840909
	x	403.36175144
	x2	−8474.441415
	x3	85701.739818
	x4	−168485.999
FOR U5(X)	c	4.9434722222
	x	−489.8373781
	x2	14943.502633
	x3	−181100.0937
	x4	1077009.1987
	x5	−2209249.658
FOR U6(X)	c	21.183007576
	x	−2545.422185
	x2	102346.66987
	x3	−1883088.904
	x4	17013830.268
	x5	−75207966.86
	x6	128590627.12

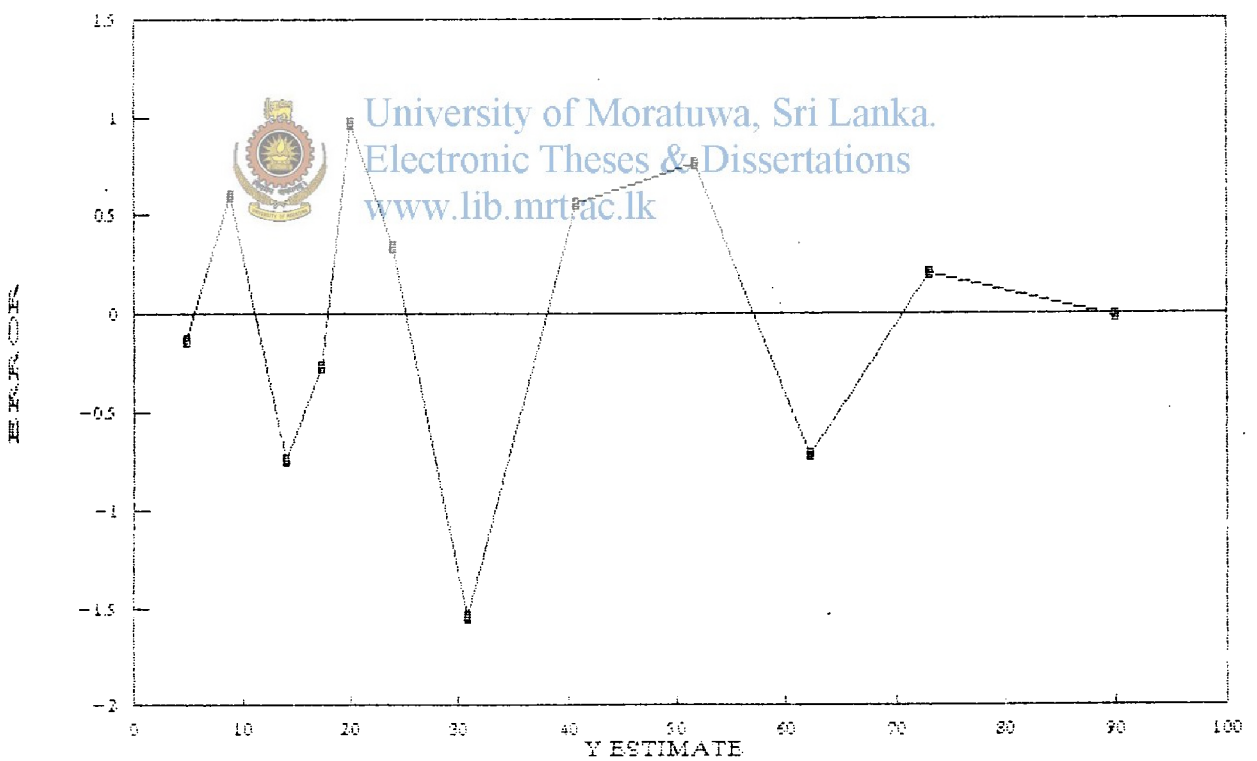
The Final equation would be:

A0	A1 (for x)	A2 (for x2)	A3 (for x3)	A4 (for x4)	A5 (for x5)	A6 (for x6)
129.0073	−3928.4894	114897.0461	−2005838.3375	17922573.4656	−77417216.5015	128560827.1183



FOR RESIDUAL PLOT

x Value	Y Obs.value	Y Estimated	Err	Err ^ 2
1	90	90.01211	−0.01211	0.0001
2	73.333	73.13195	0.201046	0.0404
3	61.667	62.38462	−0.71762	0.515
4	52.5	51.7387	0.761298	0.5796
5	41.25	40.6949	0.555102	0.3081
6	29.375	30.92159	−1.54659	2.3919
7	24.286	23.94483	0.341165	0.1164
8	20.863	19.89267	0.970334	0.9415
9	17.024	17.29379	−0.26979	0.0728
10	13.185	13.93064	−0.74564	0.556
11	9.345	8.746732	0.598268	0.3579
12	4.673	4.808458	−0.13546	0.0183
0	0		0	0
0	0		0	0
0	0		0	0
			SUM	5.8982



a0=	23.18182	A0y=	255	A00=	11
a1=	−2.89395	A1y=	−318.334	A11=	110
a2=	−1.1014	A2y=	−945.004	A22=	858
a3=	0.540791	A3y=	2319.995	A33=	4290
a4=	−0.338	A4y=	−96.669	A44=	286
a5=	−1.60256	A5y=	−250.003	A55=	156
a6=	0.163098	A6y=	1829.963	A66=	11220

Let X=x−å (ie Relationship of X with independent variable x)

Where å = 6

%MAT.VAR/STD
USE(PERF)

A N O V A

source	df	SS	MS
a0	1	5911.364	5911.4
a1	1	921.2412	921.24
a2	1	1040.83	1040.8
a3	1	1254.633	1254.6
a4	1	32.67446	32.674
a5	1	400.6506	400.65
a6	1	298.4639	298.46
residual	4	176.2579	44.064
Total	11	10036.12	

COEFFICIENTS IN TERMS OF INDEPENDENT VARIABLES

FOR U1(X)	c	17.36
	x	−2.89
FOR U2(X)	c	−28.64
	x	13.22
	x2	−1.10
FOR U3(X)	c	−49.21
	x	40.65
	x2	−8.11
	x3	0.45
FOR U4(X)	c	−13.18
	x	15.89
	x2	−5.38
	x3	0.68
	x4	−0.03
FOR U5(X)	c	83.33
	x	−130.24
	x2	63.70
	x3	−13.15
	x4	1.20
	x5	−0.04
FOR U6(X)	c	144.18
	x	−271.59
	x2	173.92
	x3	−51.05
	x4	7.51
	x5	−0.54
	x6	0.01

% Mat Var/Std Use(Perfume)	Managere Avg Score	Y Estimated
−15.00%	10.000	10.133
−10.00%	20.000	15.978
−5.00%	40.000	50.018
−0.00%	70.000	60.636
5.00%	45.000	46.551
10.00%	20.000	25.644
15.00%	16.667	12.910
20.00%	13.333	11.363
25.00%	10.000	12.064
30.00%	6.667	5.562
35.00%	3.333	4.025

a0 Coefficient	23.18182

Coefficients from Orthogonal Polynomials

(/FCAN " ; PLEASE ERASE BEFORE COMBINING)

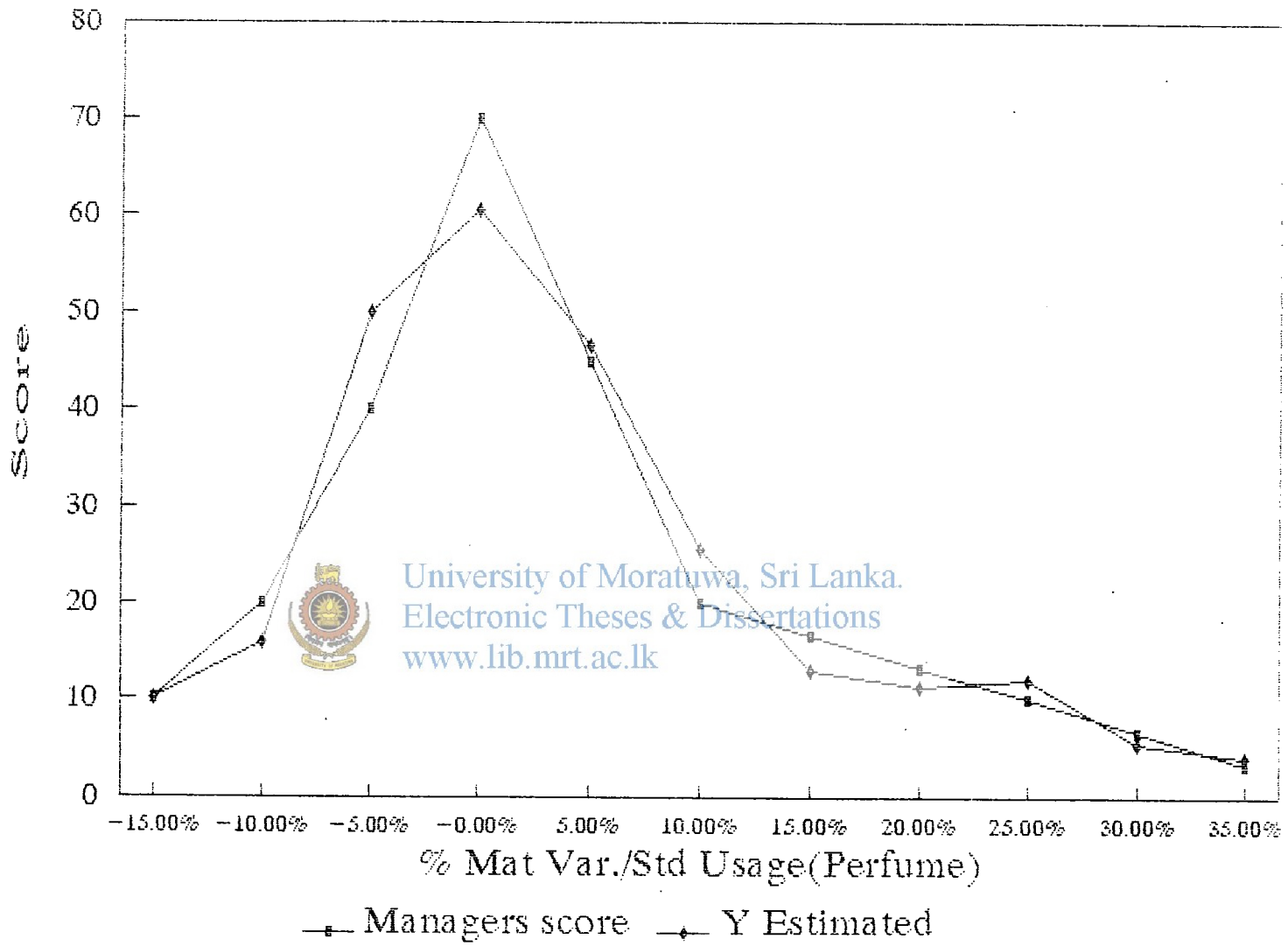
FOR U1(X)	c	17.36
	x	−2.89
FOR U2(X)	c	−28.64
	x	13.22
	x2	−1.10
FOR U3(X)	c	−49.21
	x	40.65
	x2	−8.11
	x3	0.45
FOR U4(X)	c	−13.18
	x	15.89
	x2	−5.38
	x3	0.68
	x4	−0.03
FOR U5(X)	c	83.33
	x	−130.24
	x2	63.70
	x3	−13.15
	x4	1.20
	x5	−0.04
FOR U6(X)	c	144.18
	x	−271.59
	x2	173.92
	x3	−51.05
	x4	7.51
	x5	−0.54
	x6	0.01

Final Coefficients

FOR U1(X)	c	5.7878909091
	x	−57.87890909
FOR U2(X)	c	6.6084195804
	x	88.112261072
	x2	−440.5613054
FOR U3(X)	c	12.436201632
	x	−52.27649961
	x2	−1081.582751
	x3	3605.2756353
FOR U4(X)	c	0.3380034965
	x	−38.30706294
	x2	11.286783217
	x3	1602.68531.47
	x4	−4506.713287
FOR U5(X)	c	6.4103333333
	x	87.607666667
	x2	−1762.841667
	x3	−2670.972222
	x4	64103.333333
	x5	−128206.6667
FOR U6(X)	c	5.8715390374
	x	−105.6877027
	x2	−1933.258594
	x3	18962.223886
	x4	53278.780154
	x5	−574106.0892
	x6	956843.39869

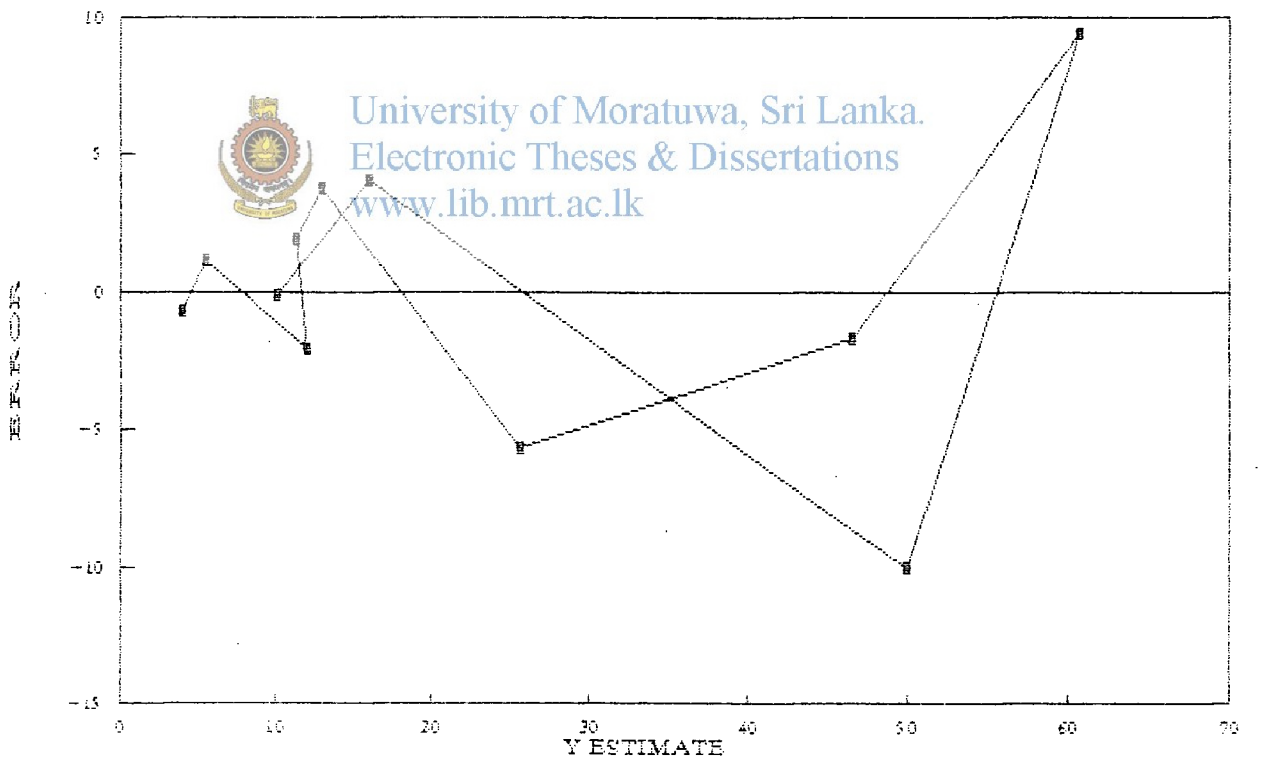
The Final equation would be:

A0	A1 (for x)	A2 (for x2)	A3 (for x3)	A4 (for x4)	A5 (for x5)	A6 (for x6)
60.6362	−78.4300	−5206.9775	19699.2122	112875.4002	−702312.7059	956843.3987



FOR RESIDUAL PLOT

x Value	Y Obs.value	Y Estimated	Err	Err ^ 2
1	10	10.13296	−0.13296	0.0177
2	20	15.97773	4.022269	16.179
3	40	50.01776	−10.0178	100.36
4	70	60.63621	9.363794	87.681
5	45	46.66061	−1.66061	2.7576
6	20	25.6439	−5.6439	31.854
7	16.667	12.9099	3.757104	14.116
8	13.333	11.36335	1.969646	3.8795
9	10	12.06443	−2.06443	4.2619
10	6.667	5.567671	1.099329	1.2085
11	3.333	4.025487	−0.69249	0.4795
0	0		0	0
0	0		0	0
0	0		0	0
0	0		0	0
			SUM	262.79



a0=	35.83333	A0y=	430	A00=	12
a1=	−3.09441	A1y=	−1770	A11=	572
a2=	−0.13528	A2y=	−1625	A22=	12012
a3=	0.612062	A3y=	3151	A33=	5148
a4=	−0.4749	A4y=	−3803	A44=	8008
a5=	0.191239	A5y=	3043	A55=	15912
a6=	−0.09291	A6y=	−417	A66=	4488

Let X=x−å (ie Relationship of X with independent variable x)

Where å = 6.5

INVENTORY L
OF FP(000 CASES)

A N O V A

source	df	SS	MS
a0	1	15408.33	15408
a1	1	5477.098	5477.1
a2	1	219.8323	219.83
a3	1	1928.672	1928.7
a4	1	1806.045	1806
a5	1	581.9412	581.94
a6	1	38.74532	38.745
residual	5	81.83335	16.367
Total	12	25542.5	

COEFFICIENTS IN TERMS OF INDEPENDENT VARIABLES

FOR U1(X)	c	40.23
	x	−6.19
FOR U2(X)	c	−12.31
	x	5.28
	x2	−0.41
FOR U3(X)	c	−55.70
	x	43.05
	x2	−7.96
	x3	0.41
FOR U4(X)	c	−86.43
	x	98.26
	x2	−30.97
	x3	3.60
	x4	−0.14
FOR U5(X)	c	−84.53
	x	125.58
	x2	−57.49
	x3	11.03
	x4	−0.93
	x5	0.03
FOR U6(X)	c	−41.07
	x	74.02
	x2	−44.65
	x3	12.23
	x4	−1.67
	x5	0.11
	x6	−0.00

Invent. Level of FP ('000 cases)	Managers Avg Score	Y Estimated
0.000	20.000	19.228
9.750	85.000	88.740
19.500	95.000	88.878
29.250	65.000	67.212
39.000	42.500	46.164
48.750	35.000	32.683
58.500	27.500	25.575
68.250	20.000	21.189
78.000	16.000	16.756
87.750	12.000	11.617
97.500	8.000	7.567
107.250	4.000	4.170

a0 Coefficient	35.83333

Coefficients from Orthogonal Polynomials

//FOAN™ ; PLEASE ERASE BEFORE COMBINING)

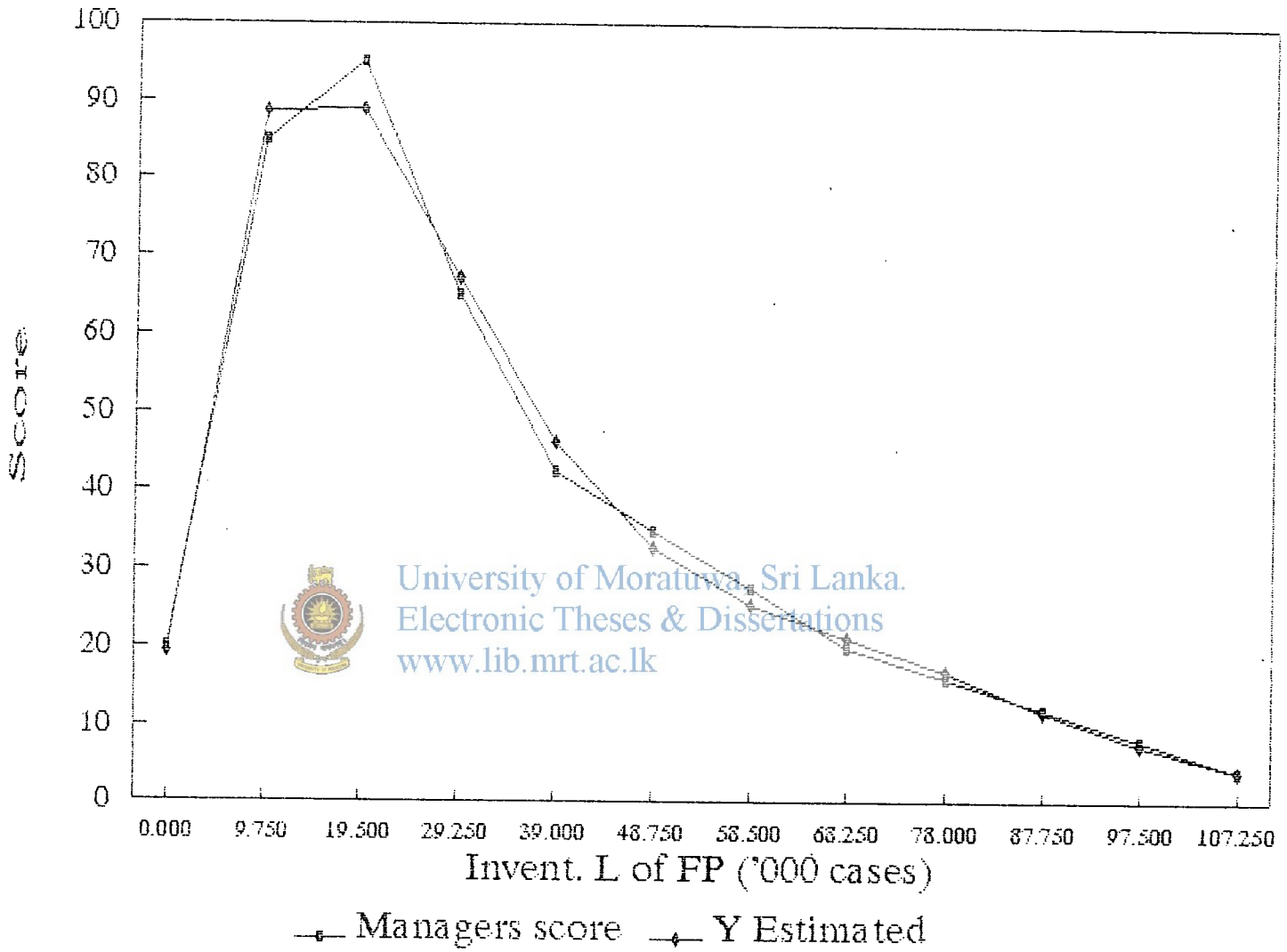
FOR U1(X)	c	40.23
	x	−6.19
FOR U2(X)	c	−12.31
	x	5.28
	x2	−0.41
FOR U3(X)	c	−55.70
	x	43.05
	x2	−7.96
	x3	0.41
FOR U4(X)	c	−86.45
	x	95.26
	x2	−30.97
	x3	3.60
	x4	−0.14
FOR U5(X)	c	−84.53
	x	125.58
	x2	−57.49
	x3	11.03
	x4	−0.98
	x5	0.03
FOR U6(X)	c	−41.07
	x	74.02
	x2	−44.65
	x3	12.23
	x4	−1.67
	x5	0.11
	x6	−0.00

Final Coefficients

FOR U1(X)	c	34.0384615
	x	−0.6347499
FOR U2(X)	c	−7.4404762
	x	0.45787546
	x2	−0.0042692
FOR U3(X)	c	−20.198718
	x	2.90569909
	x2	−0.0708261
	x3	0.00044026
FOR U4(X)	c	−15.671703
	x	4.77741383
	x2	−0.2208499
	x3	0.00328774
	x4	−1.533E−05
FOR U5(X)	c	−5.3108974
	x	4.11278947
	x2	−0.3125713
	x3	0.00818444
	x4	−8.729E−05
	x5	3.256E−07
FOR U6(X)	c	−1.0220588
	x	1.56715686
	x2	−0.1778848
	x3	0.00712168
	x4	−0.0001282
	x5	1.063E−06
	x6	−3.305E−09

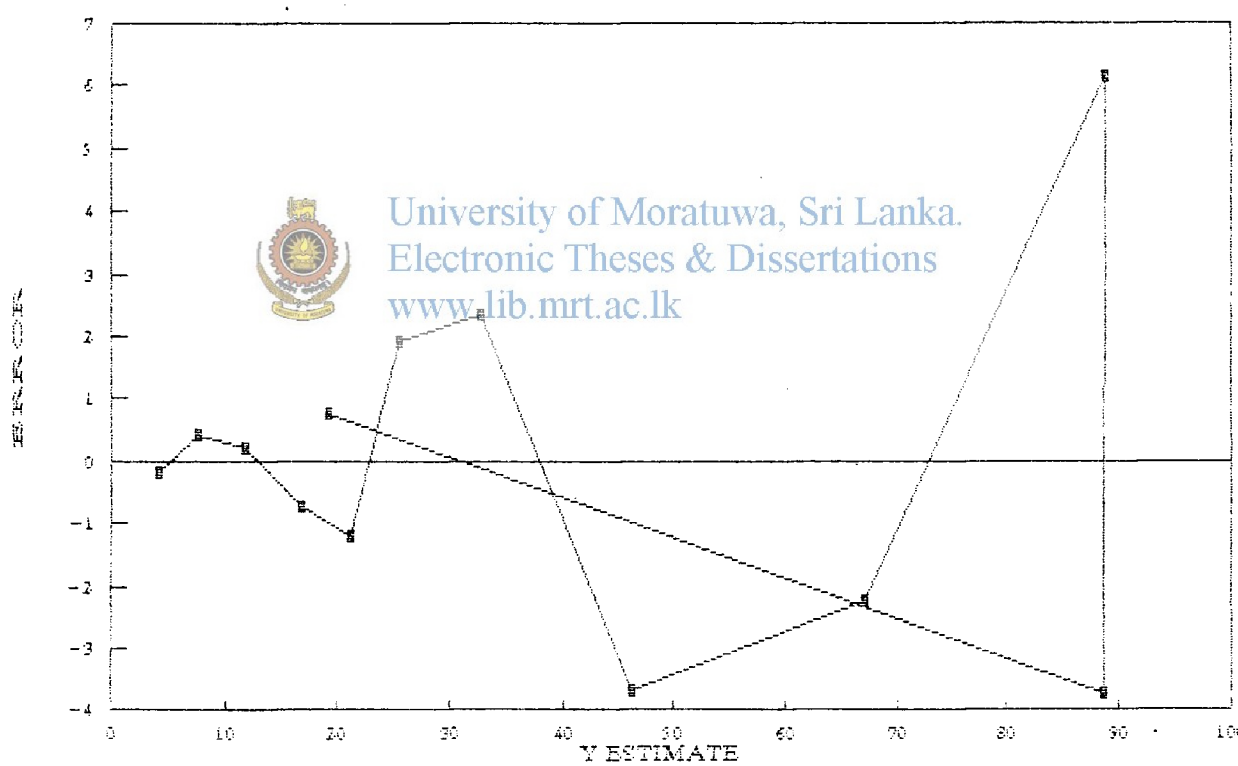
The Final equation would be:

A0	A1 (for x)	A2 (for x2)	A3 (for x3)	A4 (for x4)	A5 (for x5)	A6 (for x6)
19.2279	13.1892	−0.7854	0.0190	−0.0002	0.0000	−0.0000



FOR RESIDUAL PLOT

x Value	Y Obs.value	Y Estimated	Err	Err ^ 2
1	20	19.22794	0.772059	0.5961
2	85	88.74049	−3.74049	13.991
3	95	88.87829	6.121709	37.475
4	65	67.2121	−2.2121	4.8934
5	42.5	46.18429	−3.68429	13.574
6	35	32.68346	2.316536	5.3663
7	27.5	25.57507	1.924928	3.7053
8	20	21.18778	−1.18778	1.4108
9	16	16.75581	−0.75581	0.5712
10	12	11.8171	0.182898	0.0335
11	8	7.567411	0.432589	0.1871
12	4	4.170249	−0.17025	0.029
0	0		0	0
0	0		0	0
0	0		0	0
			SUM	81.833



a0=	28.54167	A0y=	342.5	A00=	12
a1=	−2.95891	A1y=	−1692.5	A11=	572
a2=	0.021024	A2y=	252.536	A22=	12012
a3=	0.47543	A3y=	2447.516	A33=	5148
a4=	−0.49856	A4y=	−3992.5	A44=	8008
a5=	0.245929	A5y=	3913.22	A55=	15912
a6=	−0.17952	A6y=	−805.7	A66=	4488

Let X=x−å (ie Relationship of X with independent variable x)

Where å = 6.5

INVENTORY L
OF FP(000 CASES)

A N O V A

source	df	SS	MS
a0	1	9775.521	9775.5
a1	1	5007.942	5007.9
a2	1	5.309227	5.3092
a3	1	1163.624	1163.6
a4	1	1990.515	1990.5
a5	1	962.3737	962.37
a6	1	144.6418	144.64
residual	5	10.77799	2.1556
Total	12	19060.7	

COEFFICIENTS IN TERMS OF INDEPENDENT VARIABLES

FOR U1(X)	c	38.47
	x	−5.92
FOR U2(X)	c	1.91
	x	−0.82
	x2	0.06
FOR U3(X)	c	−43.26
	x	33.44
	x2	−6.18
	x3	0.32
FOR U4(X)	c	−90.74
	x	103.16
	x2	−32.51
	x3	3.78
	x4	−0.15
FOR U5(X)	c	−103.70
	x	161.50
	x2	−73.93
	x3	14.18
	x4	−1.20
	x5	0.04
FOR U6(X)	c	−79.35
	x	143.02
	x2	−86.26
	x3	23.63
	x4	−3.23
	x5	0.21
	x6	−0.01

Invent. Level of FP('000cs)-LB	Managers Avg Score	Y Estimated
0.00%	20.000	20.014
3.15%	90.000	90.168
6.30%	80.000	78.901
9.45%	47.500	49.726
12.60%	30.000	28.320
15.75%	18.750	18.805
18.90%	16.071	16.068
22.05%	13.393	14.142
25.20%	10.714	10.629
28.35%	8.036	7.180
31.50%	5.357	6.019
34.65%	2.679	2.527

a0 Coefficient	28.54167

Coefficients from Orthogonal Polynomials

(/FCAN ; PLEASE ERASE BEFORE COMBINING)

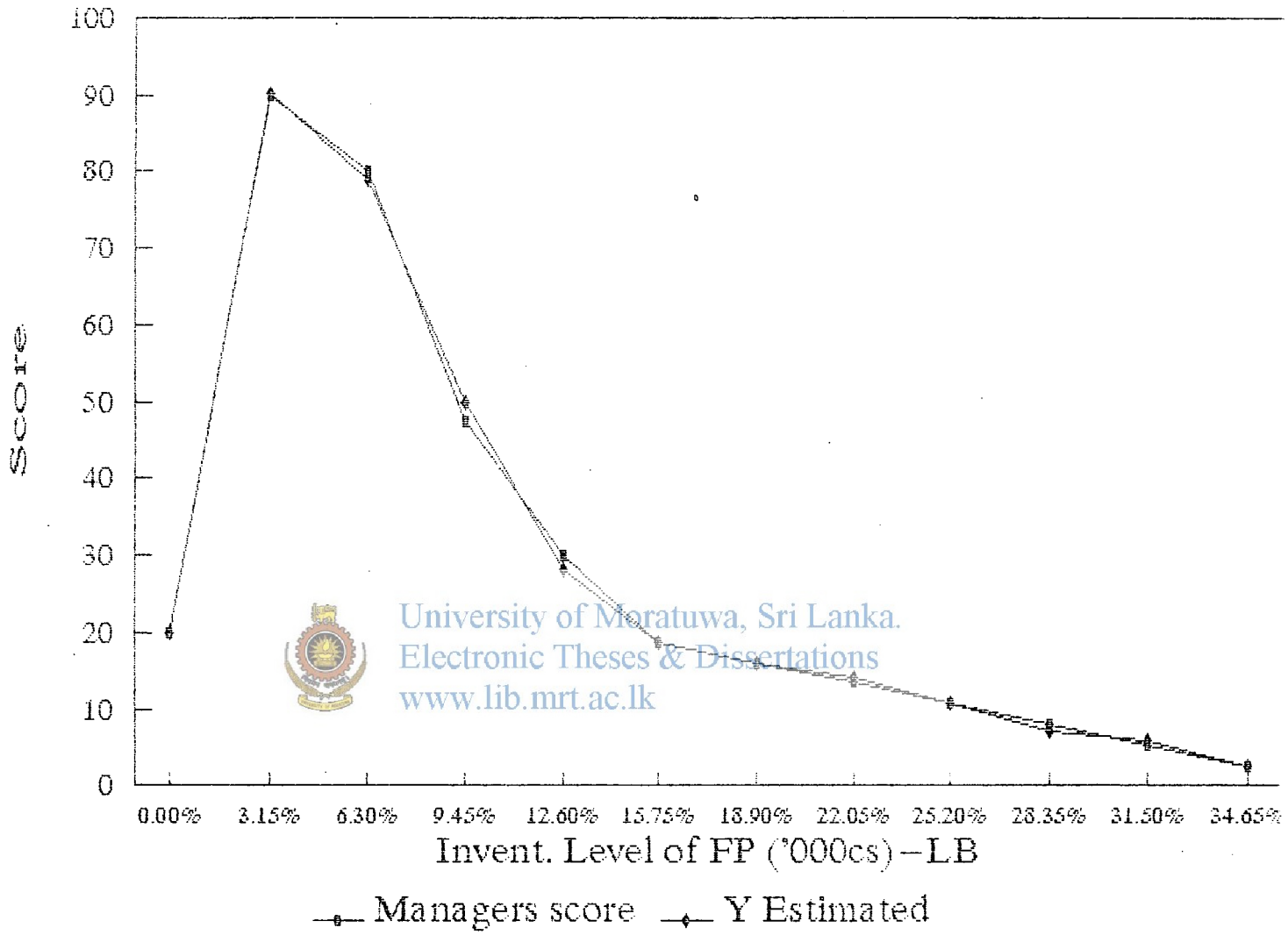
FOR U1(X)	c	38.47
	x	-5.92
FOR U2(X)	c	1.91
	x	-0.82
	x2	0.06
FOR U3(X)	c	-43.26
	x	33.44
	x2	-6.18
	x3	0.32
FOR U4(X)	c	-30.74
	x	108.16
	x2	-32.51
	x3	3.78
	x4	-0.15
FOR U5(X)	c	-108.70
	x	161.50
	x2	-73.93
	x3	14.18
	x4	-1.20
	x5	0.04
FOR U6(X)	c	-79.35
	x	143.02
	x2	-86.26
	x3	23.63
	x4	-3.23
	x5	0.21
	x6	-0.01

Final Coefficients

FOR U1(X)	c	32.548
	x	-187.8672439
FOR U2(X)	c	1.1563003663
	x	-22.02476888
	x2	68.568546557
FOR U3(X)	c	-15.68920513
	x	699.31040975
	x2	-5270.582064
	x3	10140.610012
FOR U4(X)	c	-16.45260165
	x	1552.4059756
	x2	-22212.81898
	x3	102352.50132
	x4	-147694.8071
FOR U5(X)	c	-8.115652338
	x	1637.0534241
	x2	-38509.64618
	x3	312107.02189
	x4	-1030365.318
	x5	1189454.913
FOR U6(X)	c	-1.974754902
	x	937.22494553
	x2	-32927.9101
	x3	408039.30168
	x4	-2274165.886
	x5	5836760.4659
	x6	-5614969.183

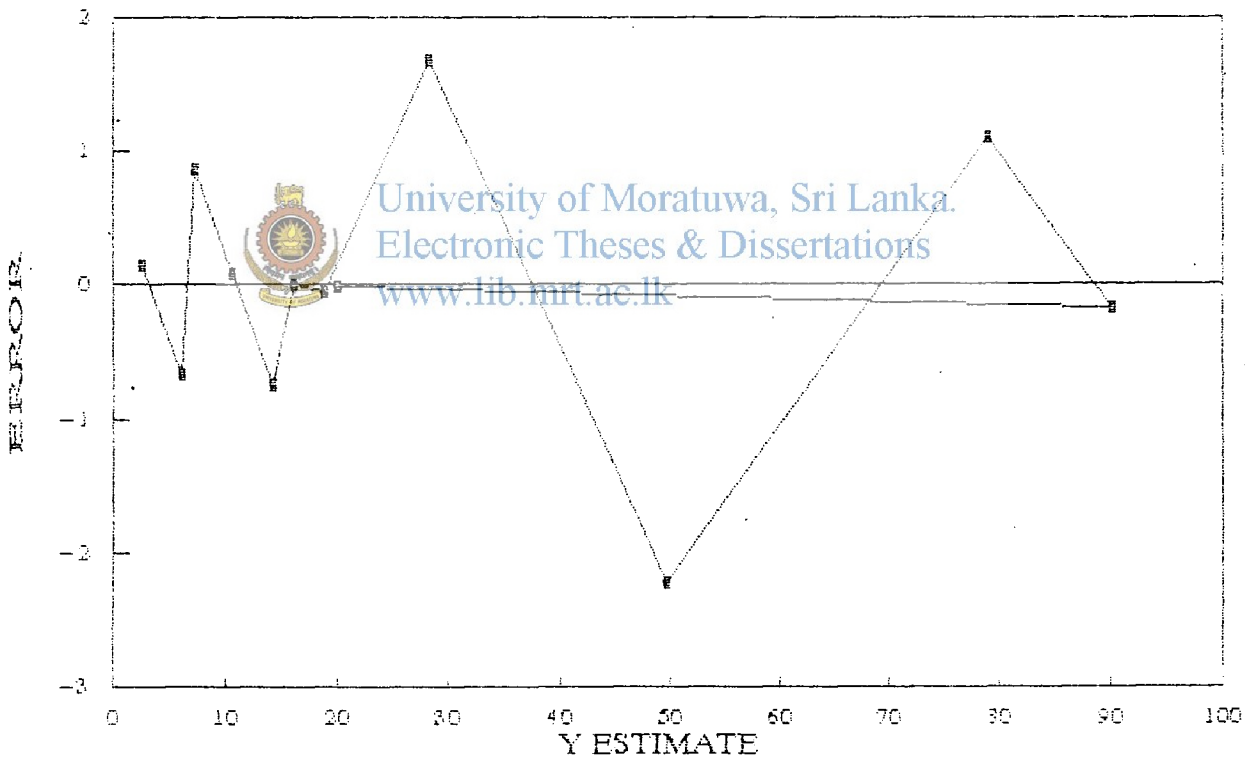
The Final equation would be:

A0	A1 (for x)	A2 (for x2)	A3 (for x3)	A4 (for x4)	A5 (for x5)	A6 (for x6)
20.0138	4616.1027	−98857.3938	832639.4349	−3452226.0111	7026215.3788	−5614969.1832



FOR RESIDUAL PLOT

x Value	Y Obs.value	Y Estimated	Err	Err ^ 2
1	20	20.01375	−0.01375	0.0002
2	90	90.16811	−0.16811	0.0283
3	80	78.90145	1.098554	1.2068
4	47.5	49.72588	−2.22588	4.9546
5	30	28.32016	1.67984	2.8219
6	18.75	18.80486	−0.05486	0.003
7	16.071	16.06817	0.002826	8E−06
8	13.393	14.14209	−0.74909	0.5611
9	10.714	10.62914	0.084857	0.0072
10	8.036	7.179628	0.856372	0.7334
11	5.357	6.019277	−0.66228	0.4386
12	2.679	2.527468	0.151532	0.023
0	0		0	0
0	0		0	0
0	0		0	0
			SUM	10.778



a0=	35	A0y=	420	A00=	12
a1=	2.683566	A1y=	1535	A11=	572
a2=	−0.34216	A2y=	−4110	A22=	12012
a3=	−0.81177	A3y=	−4179	A33=	5148
a4=	−0.24938	A4y=	−1997	A44=	8008
a5=	0.154789	A5y=	2463	A55=	15912
a6=	0.377005	A6y=	1692	A66=	4488

Let X=x−å (ie Relationship of X with independent variable x)

Where å = 6.5

PROD TARGET FULFILLMENT

A N O V A

source	df	SS	MS
a0	1	14700	14700
a1	1	4119.274	4119.3
a2	1	1406.269	1406.3
a3	1	3392.393	3392.4
a4	1	498.0031	498
a5	1	381.2449	381.24
a6	1	637.893	637.89
residual	5	169.9224	33.984
Total	12	25305	

COEFFICIENTS IN TERMS OF INDEPENDENT VARIABLES

FOR U1(X)	c	134.89
	x	5.37
FOR U2(X)	c	−31.14
	x	13.34
	x2	−1.03
FOR U3(X)	c	73.87
	x	−57.09
	x2	10.55
	x3	−0.54
FOR U4(X)	c	−45.39
	x	51.60
	x2	−16.26
	x3	1.89
	x4	−0.07
FOR U5(X)	c	−68.42
	x	101.65
	x2	−46.53
	x3	8.93
	x4	−0.75
	x5	0.02
FOR U6(X)	c	166.64
	x	−300.35
	x2	181.15
	x3	−49.62
	x4	6.78
	x5	−0.45
	x6	0.01

Prod Target Fulfilled	Managere Avg Score	Y Estimated
20.00%	3.500	4.260
30.00%	7.000	3.728
40.00%	10.500	14.453
50.00%	14.000	15.283
60.00%	17.500	13.153
70.00%	22.500	20.991
80.00%	40.000	43.915
90.00%	70.000	73.722
100.00%	100.000	97.685
110.00%	75.000	79.616
120.00%	40.000	39.256
130.00%	20.000	19.958

a0 Coefficient	35

Coefficients from Orthogonal Polynomials

(/FCAN "", PLEASE ERASE BEFORE COMBINING)

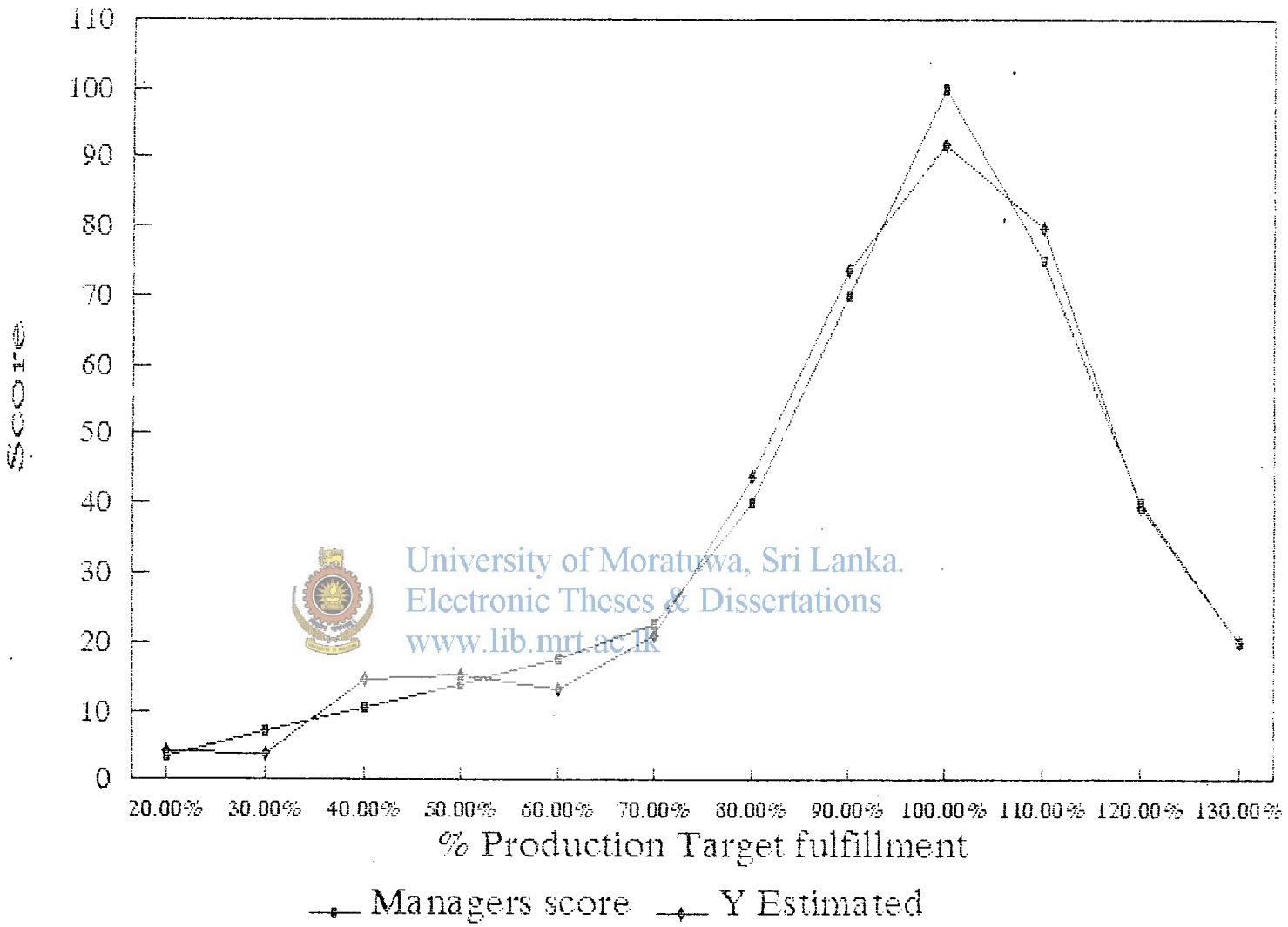
FOR U1(X)	c	−34.89
	x	5.37
FOR U2(X)	c	−31.14
	x	13.34
	x2	−1.09
FOR U3(X)	c	73.87
	x	−57.09
	x2	10.65
	x3	−0.54
FOR U4(X)	c	45.39
	x	−31.65
	x2	6.01
	x3	−0.49
	x4	0.01
FOR U5(X)	c	−88.42
	x	101.65
	x2	−46.53
	x3	8.93
	x4	−0.75
	x5	0.02
FOR U6(X)	c	166.64
	x	−300.35
	x2	181.15
	x3	−49.62
	x4	5.78
	x5	−0.45
	x6	0.01

Final Coefficients

FOR U1(X)	c	−40.2534965
	x	53.671328671
FOR U2(X)	c	−45.50699301
	x	153.971028897
	x2	−102.8473626
FOR U3(X)	c	142.060023331
	x	−795.2420357
	x2	1217.8573427
	x3	−541.161.3412
FOR U4(X)	c	−115.2115385
	x	800.86944306
	x2	−2237.107184
	x3	2192.03671.33
	x4	−727.3455711
FOR U5(X)	c	−226.3012821
	x	2246.2698276
	x2	−7807.162048
	x3	12176.721971
	x4	−8706.872172
	x5	2321.8325792
FOR U6(X)	c	705
	x	−8409.418449
	x2	37533.91934
	x3	−81.448.86364
	x4	91847.41535
	x5	−51.858.23529
	x6	11519.607843

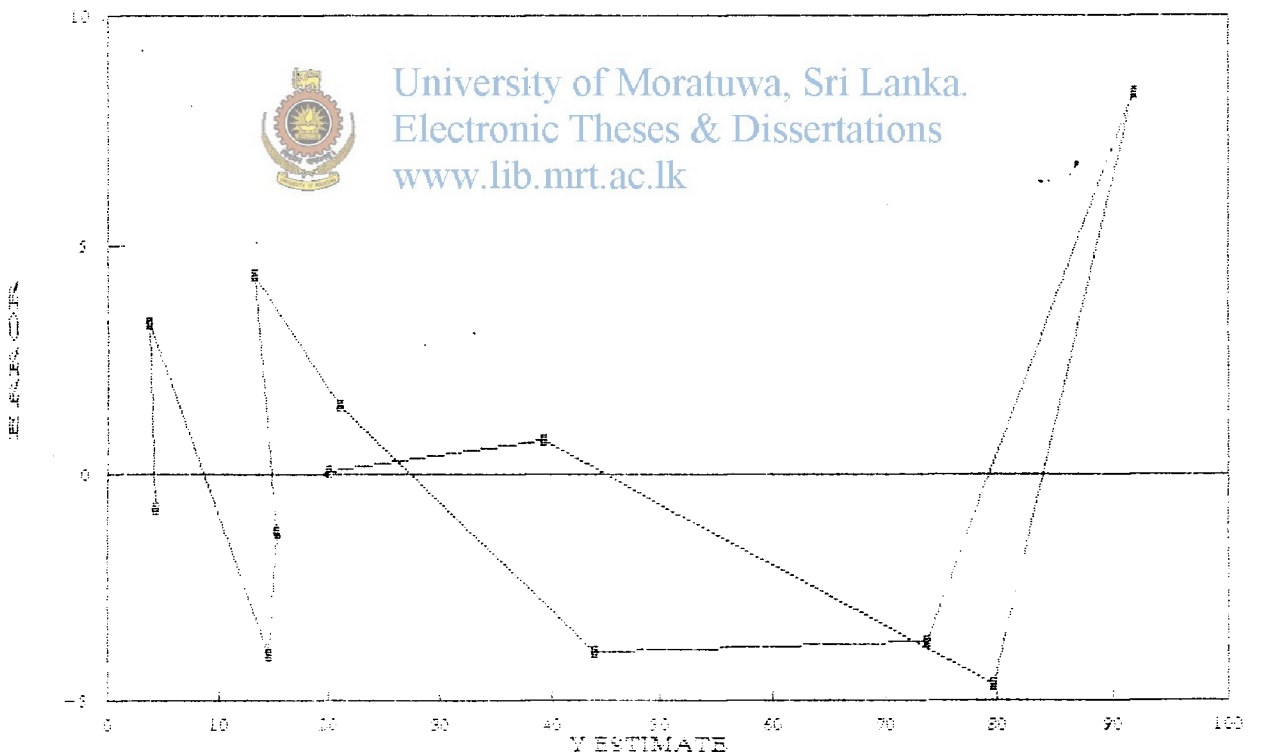
The Final equation would be:

A0	A1 (for x)	A2 (for x2)	A3 (for x3)	A4 (for x4)	A5 (for x5)	A6 (for x6)
454.7867	−5852.8789	28804.6801	−67631.2860	82513.1978	−49516.4027	11519.6073



FOR RESIDUAL PLOT

x Value	Y Obs.valu	Y Estimated	Err	Err ^ 2
1	3.5	4.260181	−0.76018	0.5779
2	7	3.727581	3.272419	10.709
3	10.5	14.45269	−3.95269	15.624
4	14	15.2827	−1.2827	1.6453
5	17.5	13.15302	4.346977	18.896
6	22.5	20.99116	1.508844	2.2766
7	40	43.91464	−3.91464	15.324
8	70	73.72316	−3.72316	13.862
9	100	91.6847	8.315302	69.144
10	75	79.6159	−4.6159	21.307
11	40	39.25648	0.743521	0.5528
12	20	19.93778	0.062217	0.0039
0	0		0	0
0	0		0	0
0	0		0	0
			SUM	169.92



a0=	54.16667	A0y=	650	A00=	12
a1=	−5.10198	A1y=	−2918.33	A11=	572
a2=	−0.0537	A2y=	−644.998	A22=	12012
a3=	0.346157	A3y=	1782.018	A33=	5148
a4=	0.048266	A4y=	386.518	A44=	8008
a5=	−0.11227	A5y=	−1786.48	A55=	15912
a6=	−0.0536	A6y=	−241.472	A66=	4488

Let X=x−å (ie Relationship of X with independent variable x)

Where å = 6.5

%LABOUR VAR/
STD USE

A N O V A

source	df	SS	MS
a0	1	35208.33	35208
a1	1	14889.27	14889
a2	1	34.6339	34.634
a3	1	616.8586	616.86
a4	1	18.65586	18.656
a5	1	200.573	200.57
a6	1	12.99214	12.992
residual	5	190.623	38.125
Total	12	51171.94	

COEFFICIENTS IN TERMS OF INDEPENDENT VARIABLES

FOR U1(X)	c	66.83
	x	−10.20
FOR U2(X)	c	−4.89
	x	2.09
	x2	−0.16
FOR U3(X)	c	−31.50
	x	24.35
	x2	−4.50
	x3	0.23
FOR U4(X)	c	8.78
	x	−9.99
	x2	3.15
	x3	−0.37
	x4	0.01
FOR U5(X)	c	49.62
	x	−73.73
	x2	33.75
	x3	−6.47
	x4	0.55
	x5	−0.02
FOR U6(X)	c	−23.78
	x	42.86
	x2	−25.85
	x3	7.08
	x4	−0.97
	x5	0.06
	x6	−0.00

Labour Var/Std Usage	Managers Avg Score	Y Estimated
−40.00%	100.000	100.618
−32.00%	95.833	93.746
−24.00%	91.667	92.554
−16.00%	87.500	90.527
−8.00%	82.500	82.911
0.00%	77.500	68.244
8.00%	42.500	48.709
16.00%	25.000	29.285
24.00%	19.500	15.687
32.00%	14.000	11.305
40.00%	9.333	12.632
48.00%	4.667	3.811

a0 Coefficient 54.16667

Coeficients from Orthogonal Polynomials

//FCAN ; PLEASE ERASE BEFORE COMBINING)

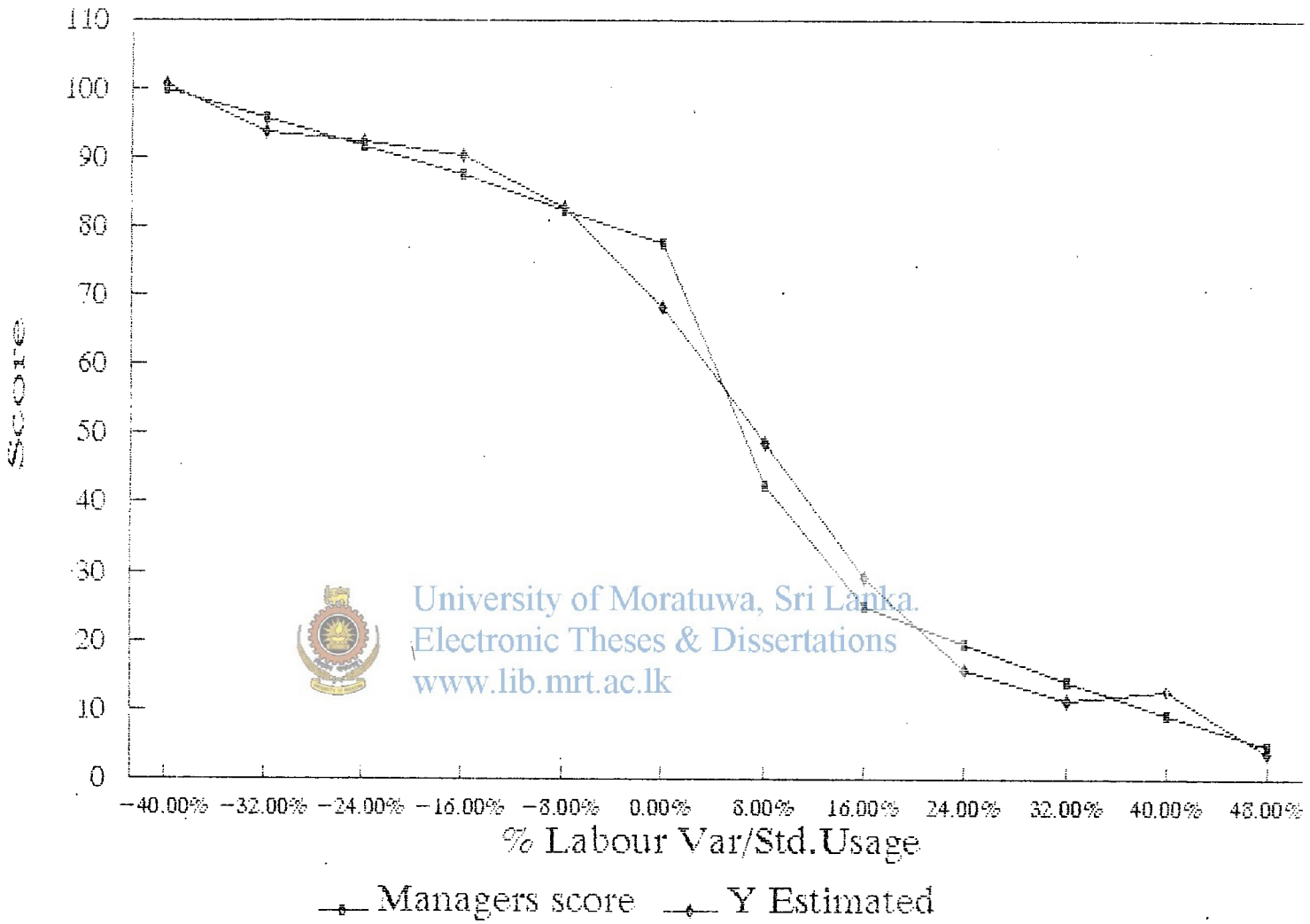
FOR U1(X)	c	66.33
	x	−10.20
FOR U2(X)	c	−4.89
	x	2.09
	x2	−0.16
FOR U3(X)	c	−31.50
	x	24.35
	x2	−4.50
	x3	0.23
FOR U4(X)	c	8.78
	x	−9.99
	x2	3.15
	x3	−0.32
	x4	0.01
FOR U5(X)	c	2.62
	x	−3.73
	x2	33.75
	x3	−6.47
	x4	0.55
	x5	−0.02
FOR U6(X)	c	−23.78
	x	42.86
	x2	−25.65
	x3	7.08
	x4	−0.97
	x5	0.06
	x6	−0.00

Final Coefficients

FOR U1(X)	c	5.101979020979
	x	−127.549475524
FOR U2(X)	c	1.879364801865
	x	2.013805144865
	x2	−25.17006493107
FOR U3(X)	c	2.423101398601
	x	−59.13582712704
	x2	−54.08708647902
	x3	450.7257065651
FOR U4(X)	c	1.351461538462
	x	5.178591480623
	x2	−62.5327488267
	x3	−54.9911107772
	x4	348.8944423576
FOR U5(X)	c	2.245462486888
	x	−52.18338602319
	x2	−146.9190254631
	x3	1169.506504625
	x4	1027.986676243
	x5	−5139.43288121
FOR U6(X)	c	1.076078431373
	x	9.830424836601
	x2	−111.3675789756
	x3	−294.6073932516
	x4	1678.453490455
	x5	1505.134931577
	x6	−6271.39554824

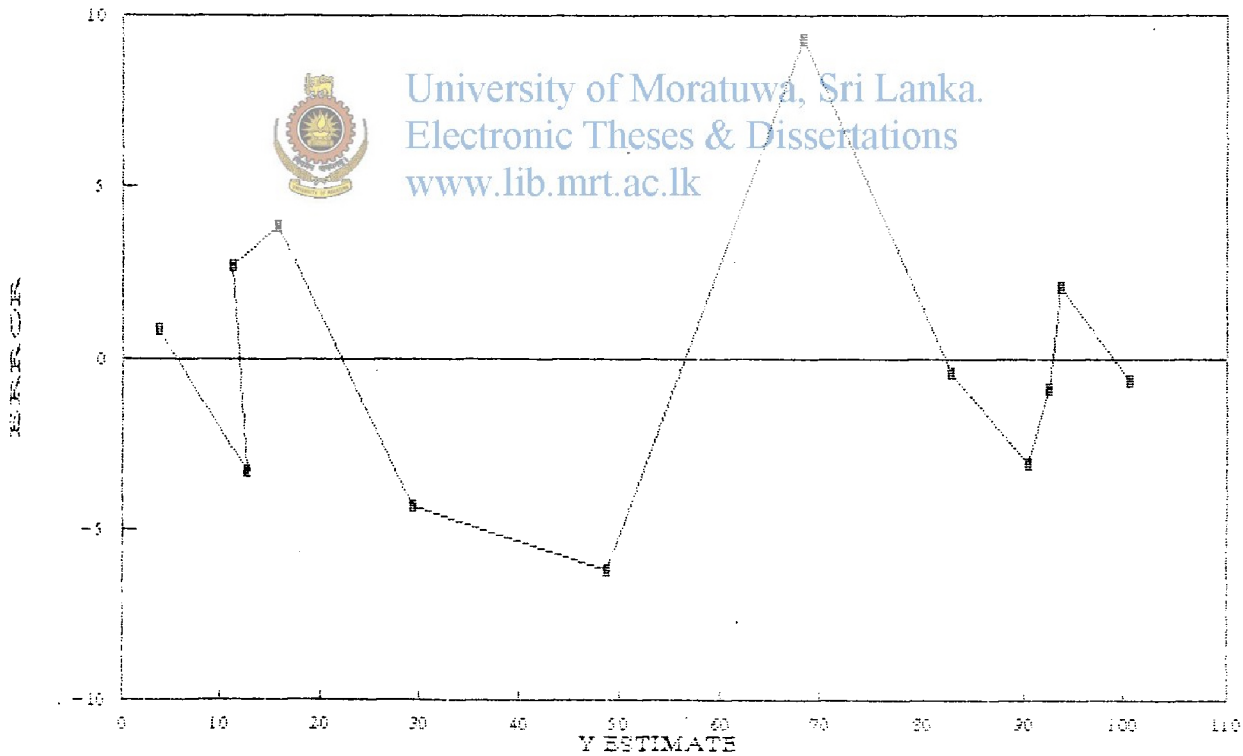
The Final equation would be:

A0	A1 (for x)	A2 (for x2)	A3 (for x3)	A4 (for x4)	A5 (for x5)	A6 (for x6)
68.2441	−221.8454	−400.0767	1280.6338	3050.0345	−3694.2979	−6271.3965



FOR RESIDUAL PLOT

x Value	Y Obs.value	Y Estimated	Err	Err ^ 2
1	100	100.6179	−0.6179	0.3818
2	95.833	93.74573	2.087267	4.3567
3	91.667	92.55377	−0.88677	0.7864
4	87.5	90.52667	−3.02667	9.1608
5	82.5	82.91076	−0.41076	0.1687
6	77.5	68.2441	9.255896	85.672
7	42.5	48.70304	−6.20304	38.478
8	25	29.26491	−4.26491	18.189
9	19.5	15.6872	3.812796	14.537
10	14	11.3029	2.697099	7.2743
11	9.333	12.63225	−3.29925	10.885
12	4.667	3.810756	0.856244	0.7332
0	0		0	0
0	0		0	0
0	0		0	0
			SUM	190.62



APPENDIX 6

Macros of UTCURVES.wk3

MACRO AREA

```
\0
{HOME}
Y   /FDA:~
    ~/XL CALC,PRINT,SAVE THE CURVE(Y/N)?~AA~
N   ~{IF @LEFT(@UPPER(AA),1)="N"}/FS~R/FRMAINMENU~
    ~{IF @LEFT(@UPPER(AA),1)="Y"}~/XL DO YOU WANT THE DATABASE OF THE CURVE COEFFICIENTS PRINTED(Y/N)?~CCCC~
    ~{IF @LEFT(@UPPER(CCCC),1)="Y"}{WINDOWSOFF}{PANELOFF}{APP3}PRSDBASECURVE~LMT2~QCAQCOPQG
    {WINDOWSON}{PANELON}{\A}

\A
N   {GOTO}AB~~/XL DO YOU WANT TO QUIT(Y/N)?~QUIT~
    ~{IF @LEFT(@UPPER(QUIT),1)="Y"}{\0}
CANNOT BE PEFORMED(PRESS "ENTER")   Y   /XL DATA SHOULD BE EQUALLY SPACED(Y/N)?~SPACED~
    ~{IF @LEFT(@UPPER(SPACED),1)="N"}{MENUBRANCH PETER}~
{\A}
    {GOTO}AB~/REANS1~/REANS2~
    {GOTO}ANS1~
    ~/XL (ES/EY)?~ANS1~
    {GOTO}ANS2~
    ~/XL CRITERIA CHOICE?~ANS2~
Y   ~/XL HAVE YOU TYPED IN CORRECTLY(Y/N)?~AC~
    ~{IF @LEFT(@UPPER(AC),1)="N"}{\A}
    ~{IF @LEFT(@UPPER(AC),1)="Y"}{\B}

\B
{GOTO}AD~{RIGHT}REA~/C{ESC}CRT17~~{BRANCH GGG0}   {RECALC LOC1}
    {RECALC LOGIC}{CALC}
    /RVLOC1~LOC2~
    {GOTO}AD~{RIGHT}REA~/C{ESC}CRT17~~{BRANCH GGG0}
    {\A}
    {HOME}{GOTO}AD~{GOTO}ADT~/REAI~
    /WTB
    /RIAI~
    /WTC
Y   ~/XL HAVE YOU TYPED IN CORRECTLY(Y/N)?~ADF~
    ~{IF @LEFT(@UPPER(ADF),1)="N"}{BRANCH GGG0}
    ~{IF @LEFT(@UPPER(ADF),1)="Y"}{WINDOWSOFF}{PANELOFF}{\C}

\C
{GOTO}TPLACE~/C{ESC}TABLE7~~   {CALC}{LET RCOUNT,1}{LET RLOGIC,1}{LET ILOGIC,0}
    /RVLOC3~LOC4~
    {GOTO}TPLACE~/C{ESC}TABLE7~~
RCOUNT   13 {FOR RCOUNT,1,+COUNT-2,1,ROUTE1}
QUERY1    0 {IF RLOGIC=COUNT-1}{LET QUERY1,1}{LET QUERY2,0}{\D}
QUERY2    1 {WINDOWSON}{PANELON}{MENUBRANCH PETER}~{\A}

\D
{IF ILOGIC=0}{CALC}/RECOE~/REAJY~/REAJJ~{LET C215,(B45-K45/K61)}
{LET RCOUNT,1}{LET G204,T45}{LET E204,C60}{LET C204,E204/G204}
{FOR RCOUNT,1,+L63,1,ROUTE2}
{\E}
```

VERTICAL LOOKUP

A	1
B	2
C	3
D	4
E	5
F	6
G	7
H	8
I	9
J1	10
J2	11
J3	12
J4	13
K	14
L	15
M	16
N1	17
N2	18
O	19
B1	20

17

ROUTE1

```
{IF @ABS(H57-H58)<0.000001}{LET RLOGIC,R{CALC}
                            /RVLOC5~LOC6~
RLOGIC   11                 {IF @ABS(H54-H55)<0.000001}{LET RLOGIC,RLOGIC+1}
                            {RETURN}
```

ROUTE2

```
                            {CALC}{LET RRCOUNT,1}
RRCOUNT   13                {FOR RRCOUNT,1,+COUNT,1,ROUTE22}
{LET G217,T58}              {CALC}
{LET C217,(E217/G217)}      /RVLOC9~LOC10~
                            /RVLOC11~LOC12~
                            {LET G210,T51}
                            {LET C210,(E210/G210)}
{IF RCOUNT<6}/CPOL14~POL1~  /RVLOC13~LOC14~
                            {IF RCOUNT<6}/CPOL7~POL1~
                            {RETURN}
```

ROUTE22

```
{LET E217,E217+C57*K57}   {CALC}
                          /RVLOC7~LOC8~
                          {LET E210,E210+C56*K56}
                          {RETURN}
```

```
{LET DBE171,(C204+D234+D236+D239+D243+D248+D254)}
{LET DBE172,(D235+D237+D240+D244+D249+D255)}
{LET·DBE173,(D238+D241+D245+D250+D256)}
{LET DBE174,(D242+D246+D251+D257)}
{LET DBE175,(D247+D252+D258)}
{LET DBE176,(D253+D259)}
{LET DBE177,D260}
```

```
\E
{CALC}
{IF ILOGIC=0}/CPORTION1~PORTION2~
/RVLOC15~LOC16~
/RVLOC17~LOC18~
/RVLOC19~LOC20~
/RVLOC21~LOC22~
/RVLOC23~LOC24~
/RVLOC25~LOC26~
/RVLOC27~LOC28~
{LET DBE171,(C204+D234+D236+D239+D243+D248+D254)}
{LET DBE172,(D235+D237+D240+D244+D249+D255)}
{LET DBE173,(D238+D241+D245+D250+D256)}
{LET DBE174,(D242+D246+D251+D257)}
{LET DBE175,(D247+D252+D258)}
{LET DBE176,(D253+D259)}
{LET DBE177,D260}
{\F}
```

```
\F
{CALC}
{LET RCOUNT,1}/REYEST~
{FOR RCOUNT,1,+COUNT,1,ROUTE3}
{CALC}{GOTO}YEST~/GRGQ/GTXX.{DOWN +COUNT-1}~A{
{APP3}GAMRESIDUAL.CGM~GRAPHIC~Q
{APP3}PRSPRINT1~LCAQLML0.5~R0.5~T0.5~B0.5~QP2QG
{APP3}PRSPRINT2~LCAQLML0.5~R0.5~T0.5~B0.5~QP2QG
{\G}
```

```
ROUTE3    {LET D281,(DBE171+DBE172*B281+DBE173*B281^2+DBE174*B281^3+DBE175*B281^4+DBE176*B281^5+DBE177*B281^6)}
```

```
{CALC}
/RVLOC29~LOC30~
{LET D280,(DBE171+DBE172*B280+DBE173*B280^2+DBE174*B280^3+DBE175*B280^4+DBE176*B280^5+DBE177*B280
{RETURN}
```

```
          \G
          {LET C344,1}{LET C345,1}{LET C346,1}{LET C347,1}{LET C348,1}{LET C349,1}{LET C350,1}
          {WINDOWSON}{PANELON}{GOTO}INTERACT~
GGA    Y  ~/XL DO YOU WANT TO CHANGE(Y/N)?~GGA~
          ~{IF @LEFT(@UPPER(GGA),1)="N"}{\A}
          /CPORTION2~PORTION1~{GOTO}INTVAR~/WTB/RIINTVAR~/WTC
          {IF C344=0}{LET C204,0}{LET E204,0}
          {IF C345=0}{LET C205,0}{LET E205,0}
          {IF C346=0}{LET C206,0}{LET E206,0}
          {IF C347=0}{LET C207,0}{LET E207,0}
          {IF C348=0}{LET C208,0}{LET E208,0}
          {IF C349=0}{LET C209,0}{LET E209,0}
          {IF C350=0}{LET C210,0}{LET E210,0}
ILOGIC  1 {LET ILOGIC,1}{LET QUERY1,0}{LET QUERY2,1}{WINDOWSOFF}{PANELOFF}{\E}
```

APPENDIX 7

Historical Ratios

		% Total Rej/ Total Prod.-SL	% Total Rej/ Total Prod.-LB	Quality Index -SL	Quality Index -LB	%Mat Var/St use(Perf)-SL	%Mat Var/St use(Perf)-LB	%Mat Var/St use(Chemica	%Mat Var/Std use(Wrappers)-S	%Mat Var/Std use(Wrappers)-L	%Mat Var/Std use(Corr Box)-	%Mat Var/Std use(Corr Box)-L	%Labour Var /Std Usage	% No Prod due to Lab,Serv & Mat/Av hr	% No Prod due to Mach. Bk downs/Av hr	Asset Utilisation
1991	JC 1	0.0000%	0.0000%	78.2140	76.6070	0.9100%	-0.2893%	0.2106%	4.0809%	1.2000%	0.5818%	-2.4100%	13.8313%	9.7370%	16.3830%	20.1510%
	JC 2	0.0000%	0.0000%	76.7270	77.1740	-0.9301%	-1.8500%	1.1507%	0.6398%	1.8400%	0.1353%	4.5100%	38.3877%	14.3000%	18.6140%	31.3890%
	JC 3	0.0000%	0.0000%	79.1250	78.0833	-4.5800%	-4.1604%	-4.4931%	1.0000%	1.4900%	0.3726%	0.3600%	16.5721%	8.6900%	14.4120%	30.9580%
	JC 4	0.0000%	0.0000%	79.9560	78.4620	-1.5400%	-0.9917%	-1.1469%	3.4700%	1.2800%	0.4068%	0.6500%	15.8017%	9.2260%	14.7720%	33.2180%
	JC 5	0.0000%	0.0000%	78.3550	78.3120	-2.4800%	-6.2109%	-1.9943%	3.7000%	1.4000%	0.3400%	0.3000%	17.2114%	9.1740%	21.1370%	29.3810%
	JC 6	0.0000%	0.0000%	78.2610	79.0450	-3.7200%	1.1198%	-4.1880%	3.3800%	1.3700%	4.2700%	-0.1200%	14.2540%	4.4630%	13.0750%	29.4360%
	JC 7	0.0000%	0.0000%	77.1330	76.5000	-3.6200%	-5.0002%	-3.5844%	2.4600%	5.8900%	3.6500%	0.5800%	8.0899%	6.3380%	9.7680%	36.8630%
	JC 8	0.0000%	0.0000%	79.5220	77.9550	-2.5900%	0.9200%	-1.0059%	3.3800%	2.7000%	0.3448%	0.4900%	27.0969%	9.8970%	18.2460%	27.2610%
	JC 9	0.0000%	0.0000%	79.9580	78.0000	-0.8600%	-2.4200%	-1.0923%	3.3900%	1.6600%	0.2700%	0.3400%	-39.3658%	10.5940%	13.5850%	30.1000%
	JC 10	0.0000%	0.0000%	78.4740	77.2260	1.0280%	-1.3240%	0.4563%	2.8460%	1.1243%	0.1748%	0.2168%	11.0791%	5.7150%	16.0340%	32.4220%
	JC 11	0.0000%	0.0000%	77.8750	78.4170	1.2200%	-3.8900%	1.1230%	3.9400%	1.3000%	-0.1700%	0.7800%	5.6605%	6.5270%	14.9480%	32.9080%
	JC 12	0.0000%	0.0000%	79.4170	77.2000	3.5100%	-0.7400%	3.5590%	3.8500%	1.5500%	-3.7400%	0.5600%	0.3580%	8.3500%	11.5960%	38.4890%
1992	JC 13	0.0000%	0.0000%	79.1110	77.2860	2.0600%	-2.6200%	2.5250%	3.4100%	2.3800%	0.2100%	0.5100%	4.7508%	5.6820%	11.0430%	35.1790%
	JC 14	0.0000%	0.0000%	80.4610	79.3910	5.5700%	-2.8200%	3.0740%	3.0200%	0.7500%	2.3400%	1.7400%	3.3005%	12.1880%	10.8010%	30.4640%
	JC 15	0.0000%	0.0000%	79.6500	78.8710	-2.6300%	-8.0800%	-3.3980%	3.9800%	0.8500%	-0.1400%	-5.6300%	-1.7359%	6.6690%	10.6280%	37.0140%
	JC 16	0.0000%	0.0000%	78.9380	78.4370	-2.2300%	-3.4600%	-2.4039%	5.4300%	1.8000%	0.5100%	0.1600%	-11.5373%	9.1580%	13.8710%	20.8750%
	JC 17	0.0000%	0.0000%	77.1150	77.0770	-2.3800%	-7.8200%	-8.1886%	4.5300%	2.1400%	0.5000%	0.1600%	0.1966%	4.2400%	9.4320%	35.3850%
	JC 18	0.0000%	0.0000%	78.2600	76.6400	21.5400%	10.8000%	15.9840%	2.7500%	0.3400%	1.6700%	0.6500%	4.8293%	3.5500%	9.2820%	38.4800%
	JC 19	0.0000%	0.0000%	80.0330	77.7370	-18.4600%	26.5900%	-1.6307%	3.2400%	2.1200%	2.2000%	0.7000%	2.0668%	6.7070%	7.8520%	36.2900%
	JC 20	0.0000%	0.0000%	80.2650	77.8580	22.6200%	-6.0151%	3.0706%	3.7500%	1.5200%	3.1700%	0.4700%	5.0669%	1.9290%	11.2620%	35.5370%
	JC 21	0.0000%	0.0000%	78.1390	76.8470	-2.3000%	22.9200%	0.7128%	3.8400%	1.1200%	1.2100%	1.0300%	7.7066%	6.3810%	12.5070%	37.9190%
	JC 22	0.0000%	0.0000%	76.6450	76.1610	-0.2000%	21.1600%	3.4950%	3.0500%	1.3400%	0.1500%	0.3200%	4.1523%	1.5340%	11.8030%	33.8020%
	JC 23	0.0000%	0.0000%	79.2000	76.4170	2.6800%	25.0000%	6.5170%	-2.2300%	1.6600%	0.1900%	0.4800%	6.5421%	10.9400%	8.8470%	35.6670%
	JC 24	0.0000%	0.0000%	79.8460	78.7690	33.7100%	26.0800%	9.2350%	5.2500%	1.3600%	0.0100%	0.5100%	4.7539%	12.2460%	11.5260%	38.9980%
1993	JC 25	0.0000%	0.0000%	78.8760	77.8500	5.7900%	24.2200%	6.3560%	2.9750%	1.8200%	-0.1800%	0.5900%	9.3387%	11.7980%	11.0870%	37.4120%
	JC 26	0.0000%	0.0000%	76.3850	76.2690	1.1700%	19.6300%	2.9520%	2.9940%	0.9600%	0.2900%	0.5700%	9.8398%	6.0700%	13.2030%	38.0150%
	JC 27	0.0000%	0.0000%	79.5420	77.3330	3.8200%	19.9700%	5.2380%	-0.9362%	2.2900%	0.0800%	0.4000%	1.0340%	4.8390%	10.1690%	38.8610%
	JC 28	0.0000%	0.0000%	79.1250	78.1200	-0.9900%	-2.3800%	0.7169%	0.2420%	2.4200%	-0.1400%	-0.5200%	-3.8501%	13.9370%	12.4470%	25.2890%
	JC 29	0.0000%	0.0000%	78.9570	76.3330	2.7600%	14.3400%	4.6400%	1.9035%	2.1000%	0.0300%	0.6700%	8.9549%	16.1250%	13.9410%	34.2050%
	JC 30	0.0000%	0.0000%	76.7040	74.9570	-0.1200%	29.1500%	0.7362%	3.6980%	1.9000%	0.0900%	0.6700%	11.9436%	9.6190%	12.6080%	40.6400%
	JC 31	0.0000%	0.0000%	79.0000	76.7040	-2.2200%	8.7600%	-1.1985%	1.1894%	1.3400%	0.0600%	0.4600%	4.5589%	3.6240%	14.5470%	41.5450%
	JC 32	0.0000%	0.0000%	78.8080	77.3080	-2.6400%	-0.9200%	-1.5023%	-0.8887%	1.1400%	0.1400%	0.2900%	4.6504%	13.5250%	12.4210%	37.0470%
	JC 33	0.0000%	0.0000%	78.8280	78.1000	-1.1700%	3.0600%	-1.9526%	-0.1708%	1.0600%	0.2400%	0.3500%	10.1053%	4.4090%	22.2560%	35.4850%
	JC 34	0.0000%	0.0000%	77.4640	77.9640	-1.7300%	1.3500%	-1.5501%	1.2514%	4.2100%	-3.1400%	0.4000%	-2.8697%	6.5080%	12.4900%	40.3830%
	JC 35	0.0000%	0.0000%	78.2220	77.4230	-0.5800%	-1.0100%	-1.4966%	1.0296%	3.6700%	4.5800%	0.5000%	0.9662%	3.8264%	9.3555%	41.1860%
	JC 36	0.0928%	0.9401%	78.3200	76.3330	-0.4600%	-1.3400%	-1.2511%	-3.9306%	6.2300%	-0.1000%	-0.0700%	-1.1352%	11.7340%	13.1880%	33.3800%

		% Eng stores Value/CRV	Energy use/ Tonne(Steam)	Energy use/ Tonne(Elect	% Maint co TotalDirect	Invent.L of F (000 cs)-SL	Invent.L of F (00000 cs)-L	% Raw Mat.I /Tot Prod co	Prod Target Fulfillment-SL	Prod Target Fulfillment-LB	% Market Share -SL	% Market Share -LB	Asset Turnover ratio
1991	JC 1	5.0080%	0.5266	85.9627	7.3370%	12.9310	0.0000	22.0710%	0.8692	0.9047	77.1000%	33.4000%	0.4087
	JC 2	5.2100%	0.7603	106.5443	9.5010%	6.9310	0.0000	36.6070%	0.6160	0.777	80.5000%	33.9000%	0.2874
	JC 3	5.6880%	0.5235	82.7399	7.1400%	0.0000	0.0000	22.7770%	0.8358	0.8561	79.4000%	31.4000%	0.3861
	JC 4	5.6960%	0.5526	99.5325	5.0380%	0.0000	0.0000	22.4080%	0.7754	0.7377	80.8000%	28.4000%	0.3835
	JC 5	5.6910%	0.5411	115.3778	8.3480%	0.4750	0.0080	25.6450%	0.7918	1.022	79.3000%	27.4000%	0.3174
	JC 6	5.8940%	0.4564	84.3423	15.4690%	1.6840	0.0000	17.4710%	0.9223	1.1172	79.5000%	29.1000%	0.4581
	JC 7	5.9520%	0.4529	80.3398	6.8540%	30.6140	0.0000	11.1000%	0.9661	1.2107	77.4000%	28.9000%	0.5316
	JC 8	5.9170%	0.5903	105.9096	8.1460%	10.5360	0.0013	19.3260%	0.6329	0.6477	79.2000%	28.5000%	0.4088
	JC 9	5.9150%	0.5737	89.8816	10.1420%	12.7490	0.0000	15.8190%	0.8254	1.0405	80.1000%	26.9000%	0.4206
	JC 10	5.9190%	0.5429	86.7001	9.2700%	50.9360	0.0000	11.3370%	0.8528	0.8728	77.3000%	29.0000%	0.4892
	JC 11	5.9770%	0.6188	90.7300	5.6930%	18.2860	0.0000	12.2130%	0.8331	1.0194	79.5000%	27.1000%	0.4202
	JC 12	5.9620%	0.6275	99.2437	6.2790%	9.2460	0.1193	17.6350%	0.9962	0.9172	81.6000%	27.1000%	0.4764
1992	JC 13	5.1690%	0.5170	80.2501	8.8960%	13.9190	0.1518	14.2810%	0.9889	0.8841	81.9000%	29.3000%	0.5776
	JC 14	5.2310%	0.4340	95.5155	9.4780%	5.8790	0.0567	22.3770%	0.7987	0.8159	83.4000%	28.0000%	0.5275
	JC 15	5.2080%	0.3841	81.9264	11.7980%	12.5820	0.0000	11.6070%	0.8838	0.859	83.6000%	30.2000%	0.5466
	JC 16	5.3140%	0.5110	99.4653	8.2050%	0.0000	0.0000	16.0100%	0.6486	0.8532	81.9000%	26.8000%	0.4712
	JC 17	5.4120%	0.4601	87.7620	11.7980%	0.0000	0.0000	12.5870%	0.9083	0.9051	82.6000%	27.0000%	0.5194
	JC 18	5.3930%	0.4701	86.9042	8.4700%	0.0000	0.0000	11.6430%	0.9001	0.9073	80.7000%	26.7000%	0.5891
	JC 19	5.2620%	0.4574	87.1441	7.0760%	11.0420	0.0000	10.5770%	0.9498	0.8892	80.5000%	27.6000%	0.6958
	JC 20	5.1970%	0.4767	91.9569	6.9720%	0.0000	0.0147	12.2540%	0.9517	1.0084	80.7000%	28.9000%	0.5754
	JC 21	5.2340%	0.4879	85.4250	7.3750%	18.5620	0.0000	13.1030%	0.9263	0.8558	80.7000%	28.2000%	0.5471
	JC 22	5.3080%	0.4951	93.9029	5.6580%	2.5460	0.1386	13.9370%	0.9233	0.9641	80.0000%	29.6000%	0.6678
	JC 23	5.3620%	0.5040	92.1085	7.6920%	2.5840	0.1443	13.1970%	0.8912	0.9544	82.3000%	27.8000%	0.5894
	JC 24	5.7520%	0.5357	93.0930	7.9080%	26.2630	0.1703	12.6370%	0.7830	0.833	80.6000%	27.6000%	0.5974
1993	JC 25	5.0220%	0.5346	94.0792	9.7510%	58.0610	0.1140	11.5300%	0.9052	0.8728	81.2000%	27.4000%	0.6133
	JC 26	4.9760%	0.3886	89.1056	11.7380%	66.7040	0.1256	10.6770%	0.8774	1.05	80.7000%	29.8000%	0.5468
	JC 27	4.9490%	0.3951	86.5927	6.7830%	67.8670	0.0518	9.8120%	0.9230	0.8514	86.6000%	28.5000%	0.6327
	JC 28	5.1560%	0.4540	90.2278	5.8280%	20.7260	0.0000	16.2700%	0.8500	0.9074	81.7000%	26.9000%	0.6810
	JC 29	5.2180%	0.4461	98.3864	9.7820%	11.6390	0.0000	15.8200%	0.9213	0.73087	78.3000%	29.3000%	0.5478
	JC 30	5.2660%	0.4265	87.6218	11.1980%	23.2090	0.0000	13.6460%	0.9897	0.55178	82.4000%	29.8000%	0.5585
	JC 31	5.2460%	0.4281	83.6842	9.1740%	58.6180	0.0150	7.0740%	1.0013	1.07272	80.8000%	27.6000%	0.7134
	JC 32	5.3700%	0.3988	92.9518	8.8420%	72.4640	0.0047	10.1550%	0.9136	1.21621	81.5000%	27.3000%	0.6247
	JC 33	5.5200%	0.4381	94.7821	13.7460%	40.4040	0.0061	16.3940%	0.8798	1.12268	82.1000%	29.0000%	0.7159
	JC 34	5.7050%	0.3771	81.7068	11.3980%	55.6660	0.1381	12.0650%	0.9679	1.15984	83.5000%	29.4000%	0.7987
	JC 35	5.6880%	0.4186	84.8087	13.3730%	61.5890	0.2126	13.8280%	1.0031	0.96386	81.0000%	29.6000%	0.6454
	JC 36	5.6340%	0.4379	89.7106	9.2160%	107.1210	0.3386	10.8840%	0.8902	1.02327	83.8000%	30.4000%	0.3453

Components of input and output		Period1 Qty	Period1 Price	Period1 Value	Period 2 Defl. Value	Period 3 Defl. Value	Period 4 Defl. Value	Period 5 Defl. Value	Period 6 Defl. Value	Period 7 Defl. Value	Period 8 Defl. Value	Period 9 Defl. Value
Output -	SL	2416.794	29,353.50	70,941,381.17	45,864,973.26	65,128,288.24	60,988,739.58	44,789,550.08	71,948,927.30	94,531,447.36	53,398,627.74	62,789,330.53
	LB	424.644	32,893.98	13,968,245.80	10,097,072.05	11,831,505.68	11,632,405.01	12,663,623.30	15,274,920.88	20,722,479.27	9,067,906.35	13,824,154.39
Total Output(Deflated)				84,909,626.97	55,962,045.31	76,959,793.92	72,621,144.60	57,453,173.38	87,223,848.19	115,253,926.64	62,466,534.10	76,613,484.92
Materials	S/L Perfume	12193.93	166.95	2,035,789.00	1,292,177.49	1,767,366.83	1,876,472.65	1,552,657.80	1,969,970.23	2,590,969.58	1,480,470.67	1,353,375.75
	Cresylic Acid	4119.64	81.54	335,903.00	290,364.60	241,223.08	278,745.58	284,146.59	340,096.45	463,046.06	232,580.36	242,417.23
	Napthaline	592.78	82.98	49,187.00	34,998.79	40,045.44	40,673.58	41,938.14	54,548.96	69,523.79	32,403.82	35,766.79
	Tinapol CBS	1688.20	1278.44	2,158,269.00	1,365,582.64	1,915,978.31	2,010,877.20	1,678,379.51	2,099,435.01	2,756,069.37	1,590,989.62	1,454,038.18
	Titox	2868.15	136.24	390,769.00	253,914.36	342,317.81	355,718.80	308,993.83	388,956.95	550,828.77	281,539.02	263,336.10
	S/L Wrappers-130g	17355986	0.20	3,488,553.00	2,264,018.59	3,464,991.81	3,652,501.12	3,058,120.09	3,917,902.25	5,101,798.64	2,395,658.80	2,463,973.82
	S/L Wrappers-200g	1289737.58	0.25	318,565.00	134,681.32	0.00	0.00	0.00	0.00	0.00	408,907.16	0.00
	S/L Wrapper reels	0	0.00	0	0	0	0	0	0	0	0	0
	L/B Wrappers	3305690	0.28	912,371.00	663,687.00	775,019.72	760,400.59	828,658.38	999,396.21	1,416,270.79	600,561.59	680,123.37
	L/B Corrugated	33206	8.75	290,685.00	225,024.09	253,207.44	249,665.65	270,810.08	325,336.77	444,456.56	195,686.16	224,761.17
	S/L Corr. Boxes-96x130g	174395	8.23	1,435,971.00	963,217.56	1,469,297.94	834,097.51	0.00	0.00	0.00	0.00	0.00
	S/L Corr. Boxes-90x200g	21199.83	7.87	166,927.00	68,701.25	0	0	0	0	0	209,925.08	0
	S/L Corr. Boxes-120x130g	0	0	0	0.00	95.19	626,628.22	1,166,592.59	1,430,324.15	2,034,733.90	272,263.63	363,740.02
Labour	Direct Labour hrs	46417	37.51	1,741,101.67	1,454,412.74	1,549,613.12	1,679,847.84	1,435,357.66	1,660,267.62	2,052,809.77	1,481,232.39	1,478,306.61
Energy	Steam tonnes	1,496.352	435.50	651,661.296	618,960.91	587,803.93	585,124.74	450,308.74	579,480.22	759,474.98	538,567.17	639,494.73
	Electricity Kwhrs	244,257.664	2.46	600,873.853	489,983.951	524,816.474	595,319.744	542,355.492	604,911.461	760,982.447	545,781.204	565,892.176
Repairs	Repairs cost			501,000.00	510,011.69	378,808.07	330,259.19	432,716.20	792,568.61	433,878.23	407,778.07	501,782.44
Other Direct OH excl. Steam,Elect. Repair,Wages	OH Cost			3,826,596.38	2,531,170.27	2,642,705.19	3,813,644.60	2,768,022.58	1,967,039.81	3,221,524.33	2,918,398.82	2,614,266.35
Distribution	Distribution cost			2,159,328.51	1,405,534.45	1,937,817.14	1,806,123.65	1,403,025.69	1,760,109.65	2,300,020.90	1,227,327.93	1,493,813.87
Capital tied up	Inven,RM/PM,Spares & Tech			3,001,777.59	2,685,307.45	2,615,818.25	2,455,633.49	2,519,323.85	2,480,265.03	2,353,283.63	2,613,133.69	2,424,681.30
Loss in Contribution	Due to Stock out/fall in plan			2,432,845.75	4,912,561.10	5,280,926.40	13,938,380.57	7,502,315.80	1,392,314.10	957,757.81	10,040,068.86	3,535,397.50
Total input	In Deflated amounts			26,498,174.05	22,164,310.25	25,787,852.14	35,890,114.71	26,746,723.01	22,762,923.47	28,267,429.55	27,473,274.05	20,355,167.42
						3	4	5	6	7	8	9
Productivity Value				0.00	(4,699,953.50)	(1,770,622.44)	(13,226,869.12)	(8,314,022.43)	4,457,461.22	7,700,442.61	(7,979,028.79)	3,573,987.89
in Millions					(4.70)	(1.77)	(13.23)	(8.31)	4.46	7.70	(7.98)	3.57
Discounting Factor				1.0000	0.9827	0.9713	0.9601	0.9489	0.9380	0.9271	0.9164	0.9057

Components of input and output		Period 10 Defl. Value	Period 11 Defl. Value	Period 12 Defl. Value	Period 13 Defl. Value	Period 14 Defl. Value	Period 15 Defl. Value	Period 16 Defl. Value	Period 17 Defl. Value	Period 18 Defl. Value
Output -	SL	85,308,587.91	65,190,564.83	56,264,433.89	82,375,186.51	58,578,276.74	68,977,518.99	49,476,764.68	67,953,163.86	71,877,034.70
	LB	14,847,162.34	13,887,784.50	20,629,702.47	15,907,527.33	10,565,677.02	11,697,164.05	11,653,033.49	11,864,962.80	12,691,641.08
Total Output(Deflated)		100,155,750.26	79,078,349.13	76,894,136.36	98,282,713.84	69,143,953.76	80,674,683.03	61,129,798.17	79,818,126.66	84,568,675.78
Materials	S/L Perfume	2,005,565.86	1,878,396.56	1,654,554.51	2,385,628.32	1,759,717.31	1,912,709.32	1,313,866.22	1,882,938.89	2,483,791.19
	Cresylic Acid	315,754.40	328,270.25	505,009.10	401,849.07	201,291.04	252,456.23	264,659.42	264,814.41	313,902.89
	Napthaline	46,587.34	47,111.38	72,011.79	54,711.53	36,286.59	37,985.11	39,728.78	38,615.70	49,655.20
	Tinapol CBS	1,893,925.15	2,014,248.94	1,773,848.38	2,563,432.51	1,893,950.66	2,046,817.91	1,473,017.10	1,879,862.10	2,562,140.55
	Titox	343,001.76	364,469.19	356,428.17	454,356.39	334,930.33	358,654.11	272,111.74	354,611.63	466,915.81
	S/L Wrappers-130g	3,209,388.12	3,564,991.89	3,074,040.15	4,484,467.11	3,182,792.15	3,777,854.89	2,748,407.28	3,739,966.82	3,890,827.60
	S/L Wrappers-200g	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	S/L Wrapper reels	0	0	0	0	0	0	0	0	0
	L/B Wrappers	885,877.91	910,166.92	1,354,810.26	1,050,729.03	683,162.71	764,633.21	763,608.96	781,961.31	817,783.20
	L/B Corrugated	292,760.22	298,600.49	438,579.46	338,144.25	194,505.97	188,407.17	197,280.28	208,240.30	219,594.92
	S/L Corr. Boxes-96x130g	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	S/L Corr. Boxes-90x200g	0	0	0	0	0	0	0	0	0
	S/L Corr. Boxes-120x130g	436,686.94	1,038,655.94	204,854.89	399,319.99	326,056.03	1,756,749.77	232,384.63	997,730.33	399,458.86
Labour	Direct Labour hrs	2,009,373.19	1,567,692.94	1,450,961.82	1,719,908.52	1,339,557.12	1,426,880.40	1,161,084.54	1,453,174.91	1,595,900.46
Energy	Steam tonnes	793,914.76	712,327.75	695,184.73	740,755.02	437,929.22	452,529.79	453,982.62	536,083.08	580,281.98
	Electricity Kwhrs	716,119.100	589,923.414	621,077.610	649,479.163	544,378.409	545,261.868	499,109.990	577,667.906	605,972.575
Repairs	Repairs cost	566,697.44	275,200.85	300,002.83	669,378.29	565,592.05	697,885.85	601,455.60	685,852.24	488,143.01
Other Direct OH excl. Steam,Elect. Repair,Wages	OH Cost	2,916,181.73	2,224,177.61	2,300,119.32	4,003,912.91	3,209,943.93	2,960,092.93	4,713,669.03	2,675,537.15	2,785,906.15
Distribution	Distribution cost	1,923,200.15	1,505,551.97	1,462,189.84	2,458,930.71	1,716,629.87	1,987,257.18	1,485,321.23	1,931,482.43	2,028,402.55
Capital tied up	Inven,RM/PM,Spares & Tech	2,489,791.12	2,442,375.36	2,159,796.14	2,195,572.40	2,247,871.26	1,962,987.43	2,250,504.16	1,829,662.20	1,728,110.58
Loss in Contribution	Due to Stock out/fall in plan	4,019,840.38	2,924,717.71	626,318.40	1,086,792.28	5,834,016.29	6,188,819.75	8,920,007.92	2,504,661.62	2,832,096.49
Total input	In Deflated amounts	24,884,665.56	22,686,879.16	18,049,787.41	25,657,367.49	24,508,610.95	27,317,982.93	27,390,199.49	22,342,863.03	23,848,884.02
		10	11	12	13	14	15	16	17	18
Productivity Value		6,391,442.81	1,991,498.70	4,946,952.20	5,014,213.00	(2,930,509.77)	(2,141,429.12)	(8,313,116.13)	2,566,380.93	2,542,887.67
in Millions		6.39	1.99	4.95	5.01	(2.93)	(2.14)	(8.31)	2.57	2.54
Discounting Factor		0.8953	0.8849	0.8746	0.8671	0.8596	0.8521	0.8447	0.8374	0.8302

	Period 19 Defl. Value	Period 20 Defl. Value	Period 21 Defl. Value	Period 22 Defl. Value	Period 23 Defl. Value	Period 24 Defl. Value	Period 25 Defl. Value	Period 26 Defl. Value	Period 27 Defl. Value
	86,252,350.06	55,730,963.30	70,664,018.73	69,176,711.87	66,093,114.45	72,443,933.07	85,686,367.52	68,939,054.15	71,704,858.78
	15,197,846.35	23,163,925.52	11,379,526.64	26,168,908.74	13,002,094.43	13,736,406.42	11,904,475.05	14,699,068.40	11,882,922.91
	101,450,196.41	78,894,888.82	82,043,545.37	95,345,620.61	79,095,208.89	86,180,339.49	97,590,842.57	83,638,122.55	83,587,781.70
	1,999,943.66	1,943,012.80	1,962,510.71	1,947,754.06	1,930,901.35	2,754,843.48	2,575,778.34	1,979,212.43	2,114,336.00
	339,882.21	659,621.81	347,106.48	715,737.67	403,432.48	417,097.64	324,104.24	339,081.14	332,124.86
	67,950.33	76,883.92	49,408.89	111,980.28	57,403.36	61,161.74	52,217.82	62,112.79	50,351.89
	2,588,885.21	1,557,950.00	2,080,655.06	2,086,075.27	2,069,961.35	2,348,778.02	2,747,869.96	2,173,692.86	2,266,800.45
	468,871.87	364,583.81	390,134.58	442,110.76	382,590.05	429,515.73	479,849.06	403,620.61	392,438.69
	4,694,135.08	3,043,423.85	3,869,769.29	3,760,403.01	3,405,422.36	4,018,542.19	3,837,217.23	3,180,263.26	3,180,832.80
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0	0	0	0	0	0	771,539.14	536,289.30	549,685.84
	1,003,231.22	1,522,271.77	744,575.81	1,708,665.83	852,562.82	899,325.98	781,615.46	960,761.07	784,086.73
	261,939.87	400,460.02	196,632.57	447,334.09	223,565.64	234,630.71	205,962.77	251,760.76	204,344.76
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0	0	0	0	0	0	0	0	0
	1,831,046.46	1,195,853.29	1,485,804.06	368,242.83	401,150.54	285,306.26	1,761,319.49	1,417,370.92	1,487,010.17
	1,848,717.86	1,451,374.43	1,586,860.55	1,761,282.05	1,522,906.00	1,708,467.97	1,975,839.25	1,661,055.33	1,590,686.57
	677,285.25	540,314.83	585,078.57	679,700.09	580,995.32	673,206.35	763,876.84	473,060.13	482,473.20
	728,964.243	588,792.688	578,591.513	728,168.954	599,752.760	660,823.148	759,343.334	612,760.142	597,313.626
	505,313.85	394,876.49	414,103.56	393,680.21	424,449.89	432,594.11	740,301.87	707,301.07	405,481.18
	3,707,739.37	2,899,806.85	2,564,389.18	3,699,589.24	2,571,421.79	2,174,515.43	3,394,743.43	2,541,032.38	3,179,806.92
	2,412,311.43	1,830,485.04	1,919,545.24	2,178,648.64	1,813,551.01	1,959,965.66	2,922,627.99	2,451,374.21	2,451,319.58
	1,800,848.01	1,796,885.63	1,743,665.03	1,896,184.52	1,830,836.89	1,833,570.39	2,192,839.72	2,285,359.46	2,234,903.16
	2,025,028.55	823,594.14	2,304,463.23	1,874,018.29	2,351,483.81	6,212,475.66	3,271,548.71	2,816,813.67	2,478,217.11
	26,962,094.48	21,090,191.36	22,823,294.34	24,799,575.81	21,422,387.43	27,104,820.45	29,558,594.65	24,852,921.53	24,782,213.54
	19	20	21	22	23	24	25	26	27
Productivity Value	4,697,978.21	3,530,933.13	2,780,447.22	4,955,411.23	3,261,251.94	(210,088.76)	897,070.09	1,248,447.75	1,303,445.61
in Millions	4.70	3.53	2.78	4.96	3.26	(0.21)	0.90	1.25	1.30
Discounting Factor	0.8230	0.8159	0.8088	0.8018	0.7948	0.7880	0.7817	0.7755	0.7694

	Period 28 Defl. Value	Period 29 Defl. Value	Period 30 Defl. Value	Period 31 Defl. Value	Period 32 Defl. Value	Period 33 Defl. Value	Period 34 Defl. Value	Period 35 Defl. Value	Period 36 Defl. Value
	59,176,771.22	63,645,102.61	73,471,493.59	95,552,597.08	67,774,119.22	67,138,533.65	92,253,779.77	74,045,718.60	60,745,128.98
	11,598,126.86	7,340,041.00	8,973,898.00	19,400,512.44	17,009,765.03	16,674,680.66	27,278,330.49	19,170,623.01	18,559,466.08
	70,774,898.08	70,985,143.60	82,445,391.59	114,953,109.52	84,783,884.25	83,813,214.31	119,532,110.26	93,216,341.61	79,304,595.05
	1,670,012.73	1,857,684.13	2,076,045.90	2,655,888.37	1,874,606.90	1,885,486.41	2,577,302.73	2,082,224.35	1,725,774.76
	314,046.20	187,061.23	245,518.10	485,126.22	418,346.43	399,364.40	640,746.46	493,400.45	413,395.29
	39,990.47	29,647.00	40,935.76	74,514.42	59,515.38	60,755.42	98,716.80	65,873.66	64,697.73
	1,784,865.12	2,023,940.64	2,215,317.06	2,847,303.39	2,009,896.29	1,993,093.67	2,763,192.81	2,233,066.34	1,854,265.50
	317,602.24	342,430.25	385,381.74	522,303.60	377,401.29	373,926.75	538,299.84	429,707.78	361,014.99
	2,655,256.94	2,844,514.23	3,468,196.95	4,341,159.96	3,105,307.72	2,948,603.03	4,134,444.45	3,352,397.34	2,603,087.21
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	450,238.97	538,449.30	515,877.29	712,346.54	417,949.51	553,829.60	741,480.19	563,837.23	442,755.23
	768,140.22	483,347.47	591,204.78	1,266,157.70	1,107,770.99	1,120,880.53	1,838,872.20	1,175,547.19	1,165,344.01
	195,940.92	126,270.92	153,892.68	330,741.19	293,655.55	288,638.34	468,015.43	302,643.50	299,927.25
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0	0	0	0	0	0	0	0	0
	1,261,604.08	1,299,988.43	1,607,453.37	1,918,850.91	1,387,574.58	1,421,868.58	1,852,693.39	1,609,621.54	1,225,467.54
	1,387,344.86	1,451,336.92	1,653,778.39	2,112,038.06	1,591,999.42	1,687,124.78	2,121,490.58	1,679,097.64	1,513,078.38
	468,288.40	464,619.36	515,616.32	716,852.38	490,833.93	533,074.38	652,309.84	566,106.45	502,203.44
	525,734.412	578,785.023	598,322.745	791,549.418	646,197.683	651,497.924	798,394.307	647,868.006	581,215.932
	432,043.15	575,539.19	653,628.78	664,110.32	508,007.20	783,492.78	805,678.87	750,205.96	512,895.15
	4,596,507.21	2,887,645.13	2,619,775.48	3,154,361.46	2,610,510.77	2,155,950.97	2,793,990.10	2,085,622.60	2,594,618.62
	2,047,848.46	2,068,989.58	2,380,761.09	3,243,774.17	2,354,290.64	2,309,916.80	3,243,764.40	2,524,234.99	2,115,003.66
	2,312,375.70	1,880,958.26	1,720,587.51	1,835,572.33	2,072,028.85	2,046,236.98	1,969,170.02	2,074,546.11	2,434,549.00
	3,592,771.04	2,625,520.38	2,895,448.68	626,164.94	2,342,684.61	3,285,335.48	1,178,997.82	335,774.71	2,704,845.76
	24,820,611.12	22,266,727.43	24,337,742.63	28,298,815.39	23,668,577.72	24,499,076.82	29,215,560.23	22,971,775.84	23,114,139.46
	28	29	30	31	32	33	34	35	36
Productivity Value	(2,733,532.96)	(114,036.89)	1,391,405.10	7,575,179.26	2,790,355.16	1,656,934.23	8,087,426.19	6,118,716.40	1,634,844.11
in Millions	(2.73)	(0.11)	1.39	7.58	2.79	1.66	8.09	6.12	1.63
Discounting Factor	0.7633	0.7573	0.7513	0.7454	0.7395	0.7336	0.7278	0.7220	0.7163

APPENDIX 8

		TECHNICAL(PRODUCTION)								TECHNICAL (ENG.)			COMMERCIAL			MARKETTING	FINANCIAL
		D	G	J	K	L	M	I	H	N	O	B	C	A	F	E	
		Productivity Score	% Total Rej/ Total Prod.	Quality Index	%Mat Var/Std usage	%Labour Var /Std Usage	% No Prod due to Lab,Serv & Mat/Av hr	% No Prod due to Mach. Bk downs/Av	Asset Utilisation	% Eng stores Value/CRV	Energy usage/ Tonne	% Maint cost/ TotalDirect OH	Invent.L of FP (000 cs)	% Raw Mat.Inv(Rs /Tot Prod cost	Prod Target Fulfillment	% Market Shar	Asset Turnove ratio
1991	JC 1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	JC 2	17.67983	99.74396	62.45152	66.03847	12.43912	15.71938	23.67860	27.66443	56.10764	14.10493	78.89264	63.42694	14.62452	19.72013	72.84808	44.81319
	JC 3	30.49494	99.74396	66.88648	59.40924	28.03689	32.74680	32.56375	26.98729	50.48744	56.07697	87.78030	19.43236	87.31141	56.23693	71.43177	56.60963
	JC 4	9.21163	99.74396	68.38194	56.61310	29.69782	29.66907	31.69028	30.51859	50.39177	36.34447	95.31027	19.43236	88.46530	34.72866	71.77530	56.32659
	JC 5	10.25179	99.74396	65.79519	54.44649	26.70386	29.95121	18.90607	24.49063	50.45157	24.20070	83.29503	32.00572	70.73946	54.69920	70.33307	48.62534
	JC 6	63.96248	99.74396	66.05350	44.83826	33.19508	62.63815	36.12553	24.57827	48.00961	61.23122	54.35853	34.28104	79.13744	78.10528	70.94672	63.69474
	JC 7	77.03377	99.74396	62.73483	47.05251	48.47299	49.24001	47.99923	36.14381	47.30702	64.86692	88.82415	52.53683	29.84859	74.30764	69.11576	69.42883
	JC 8	10.52376	99.74396	67.42992	55.34929	12.88620	26.36651	24.38565	21.07346	47.73124	26.20117	84.05392	73.70573	87.85125	14.37176	70.54694	58.99654
	JC 9	59.59063	99.74396	68.12281	56.75940	99.71702	23.61296	34.70185	25.63295	47.75546	45.38115	76.39261	74.27645	67.47918	61.74536	70.83283	60.18291
	JC 10	72.36838	99.74396	65.36031	59.69869	40.88369	53.81684	28.84586	29.27992	47.70702	50.97496	79.78437	27.99299	31.44454	61.40553	69.05266	66.30298
	JC 11	51.15153	99.74396	65.07679	54.55409	54.66599	47.83660	31.27441	30.03676	47.00356	41.05467	92.99699	72.34210	37.83345	63.74928	70.41257	60.14332
	JC 12	66.25076	99.74396	66.82991	45.92950	67.44477	34.87974	40.80788	38.63768	47.18568	30.79203	90.90325	72.93859	80.12080	88.03077	72.01192	65.26284
1992	JC 13	66.55710	99.74396	66.40186	54.06873	56.95352	54.06390	42.80398	33.55261	56.57999	58.73890	81.21776	74.52994	54.82168	85.26957	72.78319	72.33273
	JC 14	24.84227	99.74396	69.65481	51.51521	60.53592	19.53143	43.72444	26.20861	55.86507	52.35082	78.98165	76.00536	88.55066	44.85635	73.45753	69.14697
	JC 15	28.62150	99.74396	68.14263	50.28307	71.96815	46.78190	44.40071	36.37569	56.13072	69.82006	69.76413	74.14939	33.33573	67.20225	74.15477	70.42572
	JC 16	10.25242	99.74396	66.79288	47.86241	87.14685	30.03876	33.94005	10.03726	54.90218	40.23210	83.83264	19.43276	68.96231	26.80029	72.11339	64.82700
	JC 17	54.28885	99.74396	63.04755	37.96218	67.80651	64.16383	49.51704	33.87017	53.75701	57.91469	69.76413	19.43276	40.75810	75.73821	72.65355	68.57777
	JC 18	54.16199	99.74396	64.66796	37.42652	56.75738	68.96323	50.21568	38.62390	53.97971	57.70967	82.83492	19.43276	33.59347	74.25755	71.20915	72.99562
	JC 19	65.09959	99.74396	68.08292	59.62230	63.50003	46.49985	57.55195	35.26327	55.50621	58.73242	88.01447	72.79076	26.55661	81.62783	71.30536	78.68461
	JC 20	59.37037	99.74396	68.50210	40.57747	56.16157	83.86415	41.99599	34.10438	56.25759	52.18610	88.39428	32.21740	38.14905	87.44357	71.80345	72.20344
	JC 21	55.43870	99.74396	64.59601	54.43875	49.45378	48.92091	37.81864	37.76415	55.83038	57.25333	86.91756	72.01593	44.93701	75.33039	71.61887	70.45806
	JC 22	66.28939	99.74396	61.70781	55.82031	58.44279	89.46915	40.09737	31.42449	54.97201	48.27925	93.12129	41.57057	51.91301	81.88867	71.44478	77.19200
	JC 23	57.97697	99.74396	66.02446	55.85717	52.42805	22.49163	52.31671	34.30460	54.34238	49.37562	85.74639	41.39175	45.71252	75.18897	72.66709	73.01264
	JC 24	38.86352	99.74396	68.38541	28.31310	56.94583	19.42415	41.05257	39.41720	49.72076	45.34515	84.94342	59.54492	41.15637	42.94943	71.38146	73.46178
1993	JC 25	45.05143	99.74396	66.36958	47.68341	45.28259	20.30764	42.63976	36.98656	58.25957	44.35234	77.92206	28.31738	32.78877	72.76305	72.00454	74.33098
	JC 26	47.02064	99.74396	61.33159	56.77024	44.00820	51.22306	35.75996	37.91132	58.78055	63.24348	70.00839	23.79198	27.16050	73.10324	72.25143	70.43866
	JC 27	47.32829	99.74396	67.11804	60.51424	65.90891	60.04813	46.27120	39.20744	59.08530	64.97708	89.08227	38.51108	22.36248	74.47996	75.75855	75.36062
	JC 28	25.75664	99.74396	66.91515	67.61270	76.12614	16.48350	38.00580	17.80874	56.72941	56.16446	92.51677	69.58815	70.93346	63.26894	72.23301	77.88826
	JC 29	39.39613	99.74396	65.61714	57.06096	51.37537	10.15021	33.75734	32.04838	56.01529	47.80819	77.80131	73.73202	67.48702	65.74974	70.18584	70.50324
	JC 30	47.81987	99.74396	61.08223	55.21180	38.73662	27.65748	37.50948	41.92918	55.45984	61.24310	72.19323	65.76650	49.45953	71.15653	73.48275	71.18058
	JC 31	76.62394	99.74396	65.90428	65.61884	57.43269	68.43438	32.23247	43.31233	55.69154	64.46953	80.15352	37.02590	13.55492	90.37434	71.75962	79.66330
	JC 32	55.49165	99.74396	65.95168	68.26012	57.20450	17.24989	38.08691	36.42636	54.24887	58.43597	81.42367	24.80591	24.14802	65.82383	72.19725	74.93916
	JC 33	49.29950	99.74396	66.43449	65.21253	43.33519	63.00785	16.79699	34.02427	52.48510	52.80814	61.68703	43.98854	71.85234	69.03575	73.07282	79.80576
	JC 34	78.25184	99.74396	64.13965	58.39058	74.25281	47.97775	37.87224	41.53624	50.28408	70.58892	71.38690	26.37644	36.70539	80.46051	74.11951	85.19352
	JC 35	71.28970	99.74396	65.07668	56.86922	66.06452	67.01118	49.87170	42.76375	50.48744	64.41198	63.25381	21.86779	50.99260	90.81920	72.42760	76.02414
	JC 36	49.17669	86.58506	64.59837	51.03445	70.70914	20.44573	35.80251	30.77011	51.13196	58.21419	79.99212	4.59669	28.44944	76.36208	74.55903	51.99618

APPENDIX 9

Macro for PCA.wk3

```
                                MACRO AREA
                                \Q{INPUT DATA}


                                {HOME}
                                {WINDOWSOFF}{PANELOFF}
                                /REJ3..X38~{LET CC,1}
                    AA          35 ~/X/N PLEASE INPUT THE NUMBER OF ROWS{1,2,...36}?~AA~
                    AAA1         8 ~/X/N PLEASE INPUT THE NUMBER OF COLUMNS{1,2,...15}?~AAA1~
                    BB          Y ~/X/L HAVE YOU TYPED IN CORRECTLY{Y/N}?~BB~
YOU HAVE EXCEEDED A DIMENSION OF 15{PRESS"ENTER"}  ~{IF @LEFT(@UPPER(BB),1)="N"}{\Q}
                                {IF AAA1>15}~{MENUBRANCH FLAG}~{\Q}
                                {WINDOWSOFF}{PANELON}
                    GGO1        /RED3..D38~{IF CC>+AAA1}/WTC{\A}
                                {GOTO}D3~/WTB
{IF CC<>+AAA1}/C{ESC}D3..D38~COL1~{LET CC,CC+1}{BRANCH GGO1}
                                /WTC/RVLOC1~LOC2~
                    CC          1 {IF CC<=+AAA1}/C{ESC}D3..D38~COL6~{LET CC,CC+1}{BRANCH GGO1}



                                \A{CALCULATION OF COVARIANCE MATRIX}

YOU HAVE EXCEEDED THE SPECIFIED NUMBER OF ROWS{PRESS"ENTER"}  {IF +J41<>+AA}{MENUBRANCH FLAG1}~{\Q}
                                {HOME}{WINDOWSOFF}{PANELOFF}
                    {GOTO}J40~/RV{RIGHT +7}~{DOWN +6}{DOWN +34}~  /REAREA1~/REAREA2~/REAREA3~/REAREA4~/REAREA5~/REAREA6~/REAREA7~/REAREA8~/REAREA12~/REAREA13~
                                {CALC}/RVLOC3~LOC4~{LET COUNT,1}
                                {GOTO}J40~/RV{RIGHT +7}~{DOWN +6}{DOWN +34}~
                    COUNT       9 {FOR COUNT,1,+AA,1,ROUTE1}
                    {GOTO}AREA2~/RT{RIGHT +7}{DOWN +34}~AREA3~  {CALC}/RVLOC23~LOC24~
                                {GOTO}AREA2~/RT{RIGHT +7}{DOWN +34}~AREA3~
/DMM{ESC}AA87..B94~{ESC}J87..Q121~J127~  {CALC}/RVLOC25~LOC26~{LET COUNT,1}/RVAG51~AH51~/RVAG53~AH53~
                                /DMM{ESC}AA87..B94~{ESC}J87..Q121~J127~
                                {FOR COUNT,1,+AAA1,1,ROUTE2}
                                {\B}

                                \B{CALCULATING THE LARGEST EIGEN VALUE AND VECTOR}

/DMM{ESC}J148..Q153~{ESC}Z148..Z153~J184~  /RVAF148~AG148~{CALC}/CAREA5~CONTROL~
                                {CALC}/RVLOC45~LOC46~
                                /DMM{ESC}J146..Q153~{ESC}Z148..Z153~J184~
                                {CALC}                  MESS
{IF J188=L200}{LET P188,L200^1}{BRANCH ME LOGIC1/RE  5 {LET LOGIC1,1}{BRANCH MESS}  {IF LOGIC1>+AAA1}{LET P188,L200^-1}{CALC}{BRANCH MESSOVER}
                    MESSOVER    {CALC}{IF +P190<0.001}/REP188~/  {CALC}/RVLOC47~LOC48~
                                /CP188~P188~            {IF J186=L200}{LET P188,L200^1}{BRANCH ME
/DMM{ESC}J148..Q153~{ESC}R184..R191~J184~  {CALC}/RVLOC49~LOC50~  {LET LOGIC1,LOGIC1+1}
                                /DMM{ESC}J146..Q153~{ESC}R18  {BRANCH MESS}
                                {CALC}{BRANCH REMESS}

                                \C{INTERMEDIATE EIGEN VALUES)
                                /REAREA9~/REAREA10~/REAREA11~/REAREA13~{LET COUNT,1}
                    CINTER      /CP188~C52~             {calc}/RVLOC81~LOC82~
                                /CP188~C50~
                                {calc}/RVAH62~AI62~{CALC}/RVLOC51~LOC52~
                                {CALC}/RVR184..R191~P205~
                                {IF C60=(AAA1-1)}{WINDOWSON}{PANELON}{HOME}{\D}
                                {CALC}/RVLOC53~LOC54~
                                /RTV184..V191~X184~     {CALC}/RVLOC55~LOC56~
                                /DMM{ESC}V184..V191~{ESC}X184..AE184~X  /RTV184..V191~X184~
                                /DMM{ESC}J184..V191~{ESC}X184..AE184~X187~
                                {FOR COUNT,1,+AAA1,1,ROUTE3}
/DMM{ESC}J164..Q171~{ESC}Z146..Z153~J184~  /RVAH165~AI165~{CALC}
                                {CALC}/RVLOC75~LOC76~
                                /DMM{ESC}J164..Q171~{ESC}Z148..Z153~J184~
                                {CALC}                  MESS1
{IF J188=L200}{LET P188,L200^1}{BRANCH ME LOGIC1/RE  2 {LET LOGIC1,1}{BRANCH MESS1}  {IF LOGIC1>+AAA1}{LET P188,L200^-1}{CALC}
                    MESSOVER1   {CALC}{IF +P190<0.001}/REP188~/  {CALC}/RVLOC77~LOC78~
                                /CP188~P188~            {IF J187=L200}{LET P188,L200^1}{BRANCH ME
/DMM{ESC}J164..Q171~{ESC}R184..R191~J184~  {CALC}/RVLOC79~LOC80~  {LET LOGIC1,LOGIC1+1}
                                /DMM{ESC}J164..Q171~{ESC}R18  {BRANCH MESS1}
                                {CALC}{BRANCH REMESS1}

                                \D{SMALLEST EIGEN VALUE}

                    /DM{ESC}J146..Q153~J164~  {CALC}/CCONTROL~AREA5~/RVLOC83~LOC84~
{CALC}/DMM{ESC}J164..Q171~{ESC}Z146..Z153~J184~  /DM{ESC}J146..Q153~J164~
                                {CALC}/RVLOC85~LOC86~
                                {CALC}/DMM{ESC}J164..Q171~{ESMESS2
{IF J188=L200}{LET P188,L200^1}{BRANCH ME LOGIC1/RE  2 {LET LOGIC1,1}{BRANCH MESS2}  {IF LOGIC1>+AAA1}{LET P188,L200^-1}{CALC}{BRANCH MESSOVER2}
                    MESSOVER2   {CALC}{IF +P190<0.001}/E  {CALC}/RVLOC87~LOC88~
                                /CP188~P186~            {IF J188=L200}{LET P188,L200^1}{BRANCH MESSOVER2}
/DMM{ESC}J164..Q171~{ESC}R184..R191~J184~  {CALC}/RVLOC89~LOC90~  {LET LOGIC1,LOGIC1+1}
                                /DMM{ESC}J164..Q171~{ESC}R18  {BRANCH MESS2}
                                {CALC}{BRANCH REMESS2}

                                \E{PRINTING EIGEN VALUES AND VECTORS}

                    /CP188~C52~  {calc}/RVLOC91~LOC92~
                                /CP188~C51~
                                {calc}/RVAH62~AI62~/RVLOC93~LOC94~
                    /RVR184..R191~Q205~  /RVR184..R191~Q205~
                    SCOUNT      9 {LET SCOUNT,1}
                                {FOR SCOUNT,1,+AAA1,1,CROUTE}  CROUTE
                    DD          Y {WINDOWSON}{PANELON}{HOME}{GOTO}A41~  {LET E52,1)  {CALC}/RVLOC95~LOC96~
                                ~/XL DO YOU WANT TO DISCARD ANY EIGEN VECTORS{Y/N}?~DD~  {LET E51,1)
                                ~{IF @LEFT(@UPPER(DD),1)="N"}{\F}  {RETURN}
                                {GOTO}E44~/WTB
                                /RIE44..E58~
                                /WTC
                    EE          Y ~/XL HAVE YOU TYPED IN CORRECTLY{Y/N}?~EE~
                                ~{IF @LEFT(@UPPER(EE),1)="N"}{BRANCH BETHESDA}~
                                {APP3}PRSPRINT1~L.CAMT1~L1~R1~QOCOPP3OG
                                {APP3}PRSPRINT2~LCAMT1~L0 02~R0 02~QOCOLP3OG


ROUTE1
{LET J95,(J11-J54)}
{LET K95,(K11-K54
{LET L95,(L11-L54)}
{LET M95,(M11-M54)}
{LET N95,(N11-N54)}
{LET O95,(O11-O54)}
{LET P95,(P11-P54)}
{LET Q95,(Q11-O54)}
{LET R95,(R11-R54)}
{LET S95,(S11-S54)}
{LET T95,(T11-T54)}
{LET U95,(U11-U54)}
{LET V95,(V11-V54)}
{LET W95,(W11-W54)}
{LET X95,(X11-X54)}
 9 {LET COUNT,1,1)
   {FOR COUNT,1,1,+AAA1,1,ROUTE11)
   {RETURN}

ROUTE11
/RVLOC13~LOC20~  {CALC}/RVLOC21~LOC22~
                 /RVLOC12~LOC20~
                 {LET Q121,(Q37-Q80)}
                 {RETURN}

ROUTE2
{LET K154,K135/(+AA-1)}
{LET L154,L135/(+AA-1)}
{LET M154,M135/(+AA-1)}
{LET N154,N135/(+AA-1)}
{LET O154,O135/(+AA-1)}
{LET P154,P135/(+AA-1)}
{LET Q154,Q135/(+AA-1)}
{LET R154,R135/(+AA-1)}
{LET S154,S135/(+AA-1)}
{LET T154,T135/(+AA-1)}
{LET U154,U135/(+AA-1)}
{LET V154,V135/(+AA-1)}
{LET W154,W135/(+AA-1)}
{LET X154,X135/(+AA-1)}
   {LET COUNT,1,1)
   {FOR COUNT,1,1,+AAA1,1,ROUTE21)
   {RETURN}

ROUTE21
/RVLOC35~LOC42~  {CALC}/RVLOC43~LOC44~
                 /RVLOC34~LOC42~
                 {LET Q153,Q134/(+AA-1)}
                 {RETURN}

ROUTE3
{LET J172,(J154-P188*X195)}
{LET K172,(K154-P188*Y195)}
{LET L172,(L154-P188*Z195)}
{LET M172,(M154-P188*AA195)}
{LET N172,(N154-P188*AB195)}
{LET O172,(O154-P188*AC195)}
{LET P172,(P154-P188*AD195)}
{LET Q172,(Q154-P188*AE195)}
{LET R172,(R154-P188*AF195)}
{LET S172,(S154-P188*AG195)}
{LET T172,(T154-P188*AH195)}
{LET U172,(U154-P188*AI195)}
{LET V172,(V154-P188*AJ195)}
{LET W172,(W154-P188*AK195)}
{LET X172,(X154-P188*AL195)}
   {LET COUNT,1,1)
   {FOR COUNT,1,1,+AAA1,1,ROUTE31)
   {RETURN}

ROUTE31
/RVLOC65~LOC74  {CALC}/RVLOC72~LOC73~
                /RVLOC64~LOC74~
                {LET Q171,(Q153-P188*AE194)
                {RETURN}
```


\F /DRRX.{DOWN +AA-1}{END}{RIGHT}~YC63..C97~ICOOUTPUT~G

			{LET SCOUNT,1}/REYRANGE~	CLEONNE	PETER	
1 J241	J11		{FOR SCOUNT,1,+AA,1,CLEONNE}			{CALC}/RVLOC97~LOC98~
2 K241	K11		{GOTO}A61~{GOTO}C63~/WTB/RIC63..C98~/WTC	{calc}{LET COUNT,1}	{IF R241<>0}/DMM{ESC}J11..Q11~{ESC}R225..R232~R2	{IF X241<>0}/DMM{ESC}J37..X37~{ESC}X225..X239~X279~
3 L241	L11	R241	~/XL HAVE YOU TYPED IN CORRECTLY(Y/N)?~FF~	{FOR COUNT,1,+AAA1,1,PETER}		{RETURN}
4 M241	M11	Y	~{IF @LEFT(@UPPER(EE),1)="N"}{\F}	{RETURN}		
5 N241	N11	Q11	{goto}245~			
6 O241	O11		{CALC}/RVLOC99~LOC100~			
7 P241	P11		/DRRX.{DOWN +AA-1}{END}{RIGHT}~YC63..C97~ICOOUTPUT~G			
8 Q241	Q11		{calc}{CALC}			
9 R241	R11		/RTJ205..X219~CF135~			
10 S241	S11		{\G}			
11 T241	T11		{WINDOWSON}{PANELON}{HOME}			
12 U241	U11		{CALC}/RVLOC131~LOC132~	/GRGTXXD151..D185~AE151..E185~OTXYestimate~TYError~QQ		
13 V241	V11					
14 W241	W11		{APP3}GACGRAPH~Q{APP3}PRSPPRINT~COPQG			
15 X241	X11		~/XL DO YOU WANT TO QUIT(Y/N)?~GG~			
			~{IF @LEFT(@UPPER(GG),1)="Y"}/FS~R/QY			
			{\0}			

1 J225				
2 K225				
3 L225	R225			
4 M225				
5 N225				
6 O225				
7 P225		1 K291		
8 Q225		2 L291		
9 R225		3 M291		
10 S225		4 N291	R291	
11 T225		5 O291		
12 U225		6 P291		
13 V225		7 Q291		
14 W225		8 R291		
15 X225		9 S291		
		10 T291		
1 J232		11 U291		
2 K232		12 V291		
3 L232		13 W291		
4 M232	R232	14 X291		
5 N232		15 Y291		
6 O232				
7 P232				
8 Q232		/DMM{ESC}K291..R291~{ESC}CF135..CF142~C108~		
9 R232		/DMM{ESC}K291..R291~{ESC}CG135..CG142~C109~		
10 S232		/DMM{ESC}K291..R291~{ESC}CH135..CH142~C110~		
11 T232		/DMM{ESC}K291..R291~{ESC}CI135..CI142~C111~		
12 U232		/DMM{ESC}K291..R291~{ESC}CJ135..CJ142~C112~		
13 V232		/DMM{ESC}K291..R291~{ESC}CK135..CK142~C113~		
14 W232		/DMM{ESC}K291..R291~{ESC}CL135..CL142~C114~		
15 X232		/DMM{ESC}K291..R291~{ESC}CM135..CM142~C115~		
		/DMM{ESC}K291..R291~{ESC}CN135..CN142~C116~		
		/DMM{ESC}K291..R291~{ESC}CO135..CO142~C117~		
1 J253		/DMM{ESC}K291..R291~{ESC}CP135..CP142~C118~		
2 K253		/DMM{ESC}K291..R291~{ESC}CQ135..CQ142~C119~		
3 L253	R253	/DMM{ESC}K291..R291~{ESC}CR135..CR142~C120~		
4 M253		/DMM{ESC}K291..R291~{ESC}CS135..CS142~C121~		
5 N253		/DMM{ESC}K291..R291~{ESC}CT135..CT142~C122~		
6 O253				
7 P253				
8 Q253				
9 R253				
10 S253				
11 T253				
12 U253				
13 V253				
14 W253				
15 X253				

\G

{CALC}/RVLOC101~LOC102~
{CALC}/RVLOC103~LOC104~
{CALC}/RVLOC105~LOC106~
{CALC}/RVLOC107~LOC108~
{CALC}/RVLOC109~LOC110~
{CALC}/RVLOC111~LOC112~
{CALC}/RVLOC113~LOC114~
{CALC}/RVLOC115~LOC116~
{CALC}/RVLOC117~LOC118~
{CALC}/RVLOC119~LOC120~
{CALC}/RVLOC121~LOC122~
{CALC}/RVLOC123~LOC124~
{CALC}/RVLOC125~LOC126~
{CALC}/RVLOC127~LOC128~
{CALC}/RVLOC129~LOC130~

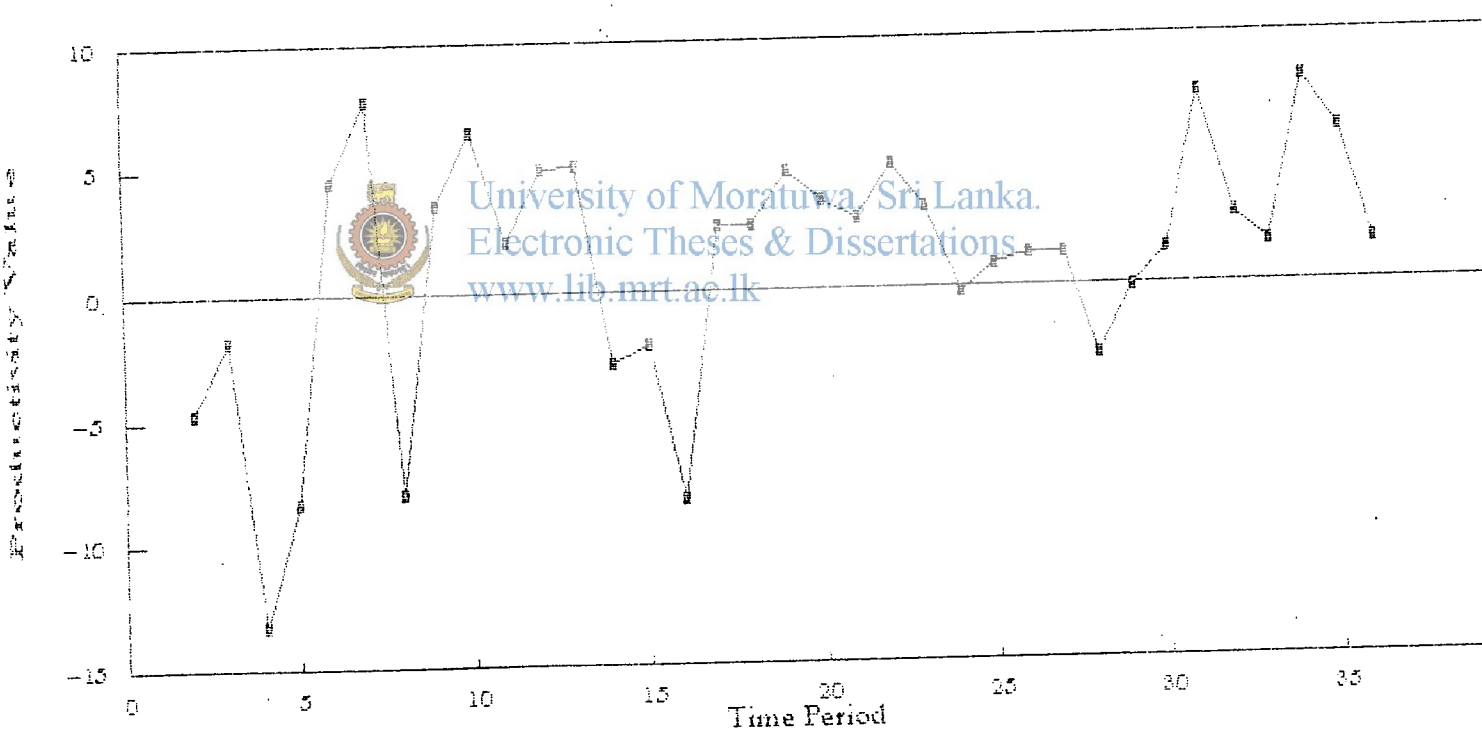
{CALC}

APPENDIX 10

UTILITY FUNCTION CURVES FOR PRODUCTIVITY

Productivity value(mn's	Grade	Score
(15.00)	a	4
(12.00)	a	8.00
(9.00)	a	12.00
(6.00)	a	16.00
(3.00)	a	20.00
0.00	b	40.00
3.00	c	60.00
6.00	d	70.00
9.00	d	80.00
12.00	e	88.67
15.00	e	99.33
18.00	e	100.00

The above Gradings were given after examination of the historical data and looking at the best and worst possible situation.



a0=	49.16667	A0y=	590	A00=	12
a1=	4.959196	A1y=	2836.66	A11=	572
a2=	0.050776	A2y=	609.92	A22=	12012
a3=	−0.26147	A3y=	−1346.06	A33=	5148
a4=	0.008989	A4y=	71.98	A44=	8008
a5=	0.07492	A5y=	1192.12	A55=	15912
a6=	−0.03384	A6y=	−151.86	A66=	4488

Let X=x−å (ie Relationship of X with independent variable x)

Where å = 6.5

PRODUCTIVITY

0

A N O V A

source	df	SS	MS
a0	1	29008.33	29008
a1	1	14067.55	14068
a2	1	30.96923	30.969
a3	1	351.9576	351.96
a4	1	0.646993	0.647
a5	1	89.3131	89.313
a6	1	5.138471	5.1385
residual	5	48.26674	9.6533
Total	12	43602.18	

COEFFICIENTS IN TERMS OF INDEPENDENT VARIABLES

FOR U1(X)	c	−64.47
	x	9.92
FOR U2(X)	c	4.62
	x	−1.98
	x2	0.15
FOR U3(X)	c	23.79
	x	−18.39
	x2	3.40
	x3	−0.17
FOR U4(X)	c	1.64
	x	−1.86
	x2	0.59
	x3	−0.07
	x4	0.00
FOR U5(X)	c	−33.11
	x	49.20
	x2	−22.52
	x3	4.32
	x4	−0.37
	x5	0.01
FOR U6(X)	c	−14.96
	x	26.96
	x2	−16.26
	x3	4.45
	x4	−0.61
	x5	0.04
	x6	−0.00

Productivity Values(Rs Mn)	Managers Avg Score	Y Estimated
(15.00)	4.000	3.489
(12.00)	8.000	10.095
(9.00)	12.000	9.917
(6.00)	16.000	13.835
(3.00)	20.000	24.525
0.00	40.000	40.030
3.00	60.000	56.606
6.00	70.000	70.809
9.00	80.000	80.846
12.00	86.670	87.181
15.00	93.330	92.389
18.00	100.000	100.279

a0 Coefficient	49.16667

Coefficients from Orthogonal Polynomials

(/FCAN "; PLEASE ERASE BEFORE COMBINING)

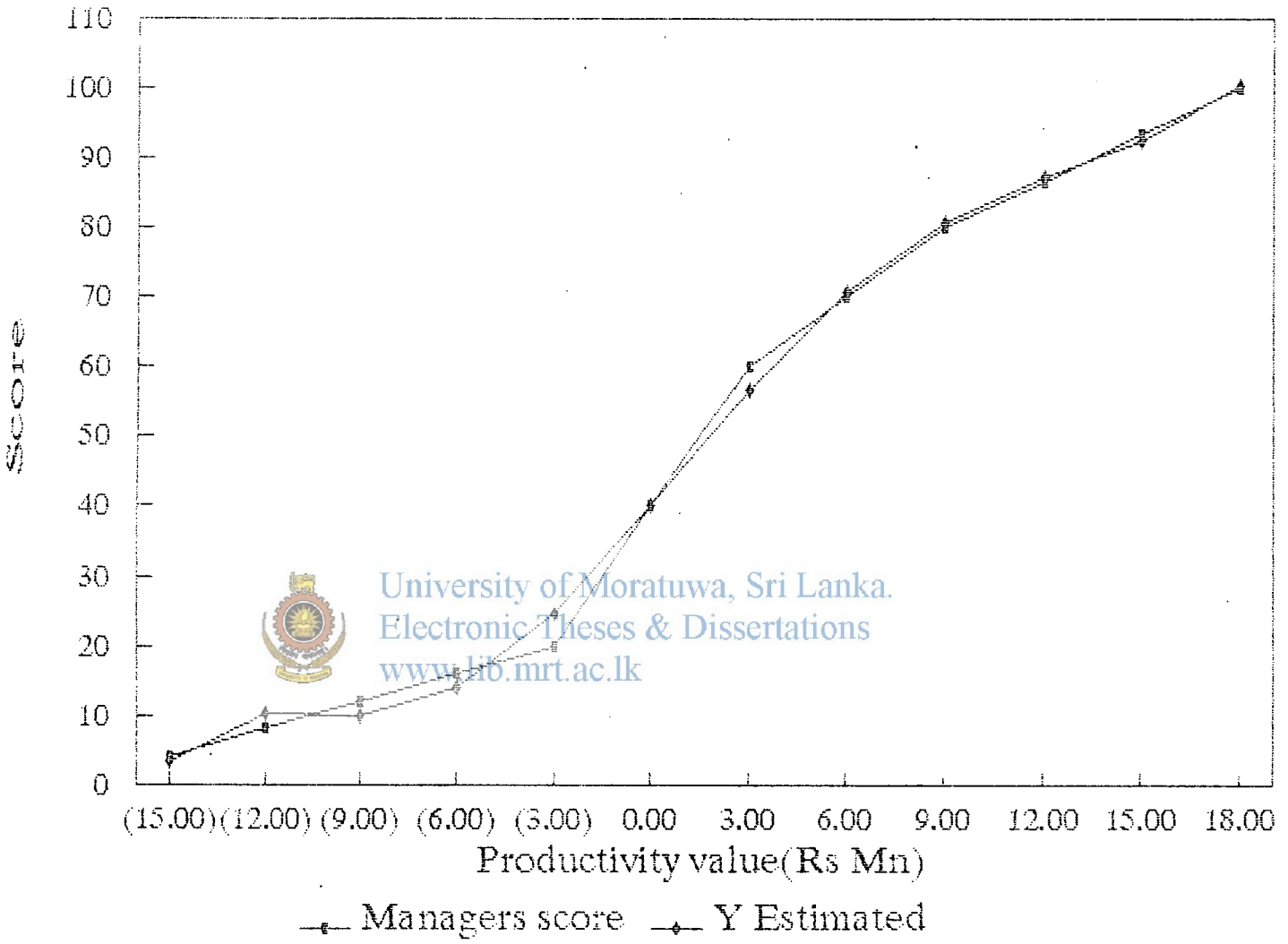
FOR U1(X)	c	−64.47
	x	9.92
FOR U2(X)	c	4.62
	x	−1.93
	x2	0.15
FOR U3(X)	c	23.79
	x	−18.39
	x2	3.40
	x3	−0.17
FOR U4(X)	c	4.64
	x	−1.85
	x2	0.09
	x3	−0.00
	x4	0.00
FOR U5(X)	c	−33.11
	x	49.20
	x2	−22.52
	x3	4.32
	x4	−0.37
	x5	0.01
FOR U6(X)	c	−14.96
	x	26.96
	x2	−16.25
	x3	4.45
	x4	−0.61
	x5	0.04
	x6	−0.00

Final Coefficients

FOR U1(X)	c	−4.9691958
	x	3.30613054
FOR U2(X)	c	−1.7771562
	x	−0.0507759
	x2	0.01692553
FOR U3(X)	c	−1.6906069
	x	1.19115212
	x2	0.02905249
	x3	−0.0054561
FOR U4(X)	c	0.25167832
	x	0.02571713
	x2	−0.0062811
	x3	−0.0001942
	x4	0.00003237
FOR U5(X)	c	−1.4983912
	x	0.92856629
	x2	0.06971681
	x3	−0.0147989
	x4	−0.0003468
	x5	0.00004825
FOR U6(X)	c	0.67673797
	x	0.16486089
	x2	−0.049805
	x3	−0.0033941
	x4	0.00053378
	x5	0.00001276
	x6	−1.41E−06

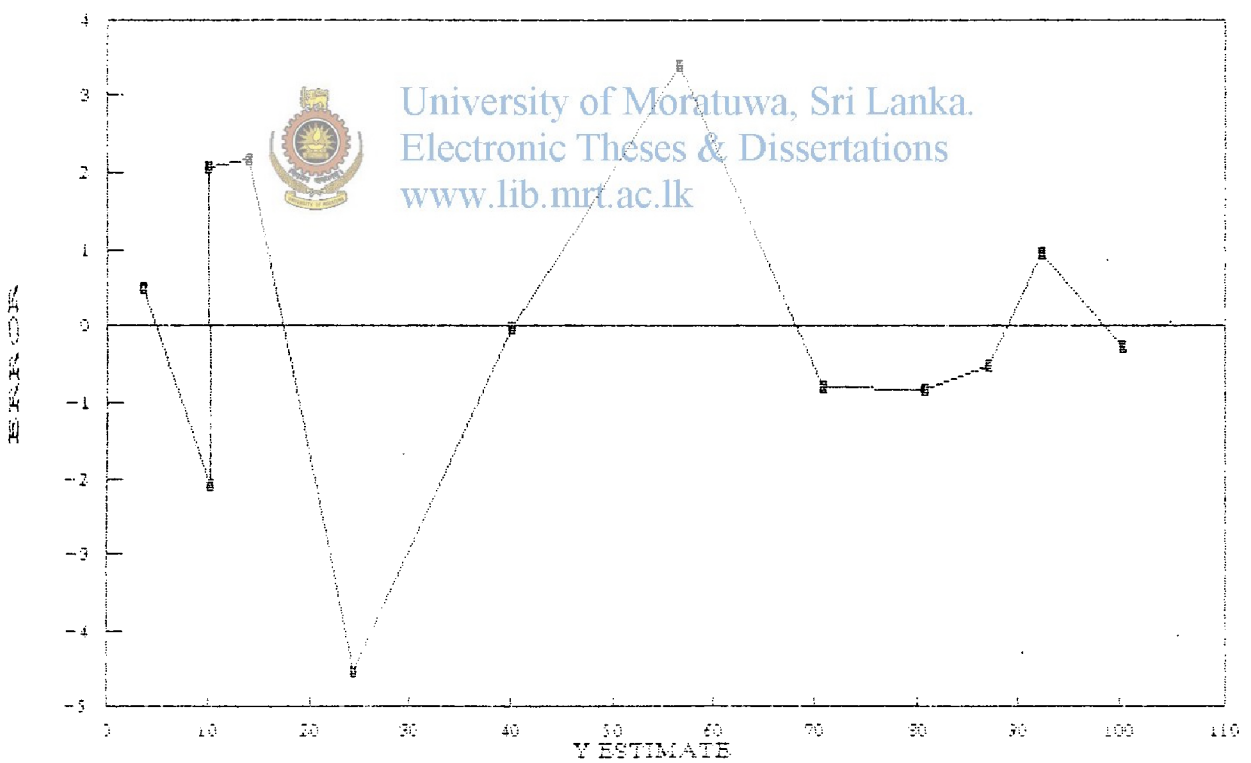
The Final equation would be:

A0	A1 (for x)	A2 (for x2)	A3 (for x3)	A4 (for x4)	A5 (for x5)	A6 (for x6)
40.030036	5.965671	0.057609	−0.024843	0.000219	0.000059	−0.000001



FOR RESIDUAL PLOT

x Value	Y Obs.value	Y Estimated	Err	Err ^ 2
1	4	3.488846	0.511154	0.2613
2	8	10.09555	−2.09555	4.3913
3	12	9.916635	2.083365	4.3404
4	16	13.83525	2.164753	4.6862
5	20	24.52466	−4.52466	20.473
6	40	40.03003	−0.03003	0.0009
7	60	56.60582	3.394179	11.52
8	70	70.8087	−0.8087	0.654
9	80	80.84616	−0.84616	0.716
10	86.67	87.1806	−0.5106	0.2607
11	93.33	92.38908	0.940917	0.8853
12	100	100.2787	−0.27867	0.0777
0	0		0	0
0	0		0	0
0	0		0	0
			SUM	48.267



APPENDIX 11

DATA MATRIX WITH DEPENDENT VARIABLE

	Productivity score	%Total rej/ total prod	Quality rejects	%Mat var/std usage	%Labour var /std usage	%No prod due to lab,serv & mat	%No prod due to mach. bkdwns	Asset utilisation	%Eng stores /CRV	Energy usage per tonne	%Maint cost direct OH	InventL of FP	%Raw mat inv /Prod cost	Prod. targe fulfilled	%Market share	Asset turn. ratio
	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
JC1	17.67983	99.74396	62.45152	66.03847	12.43912	15.71938	23.67860	27.66443	56.10764	14.10493	78.89264	63.42694	14.62452	19.72013	72.84808	44.81319
JC2	30.49494	99.74396	66.88648	59.40924	28.03689	32.74680	32.56375	26.98729	50.48744	56.07697	87.78030	19.43236	87.31141	56.23693	71.43177	56.60963
JC3	9.21163	99.74396	68.38194	56.61310	29.69782	29.66907	31.69028	30.51859	50.39177	36.34447	95.31027	19.43236	88.46530	34.72866	71.77530	56.32659
JC4	10.25179	99.74396	65.79519	54.44649	26.70386	29.95121	18.90607	24.49063	50.45157	24.20070	83.29503	32.00572	70.73946	54.69920	70.33307	48.62535
JC5	63.96248	99.74396	66.05350	44.83826	33.19508	62.63815	36.12553	24.57827	48.00961	61.23122	54.35853	34.28104	79.13744	78.10528	70.94672	63.69474
JC6	77.03377	99.74396	62.73483	47.05247	48.47299	49.24001	47.99923	36.14381	47.30702	64.86692	88.82415	52.53683	29.84859	74.30764	69.11576	69.42883
JC7	10.52376	99.74396	67.42992	55.34929	12.88620	26.36651	24.38565	21.07346	47.73124	26.20117	84.05392	73.70573	87.85125	14.37176	70.54694	58.99654
JC8	59.59063	99.74396	68.12281	56.75940	99.71702	23.61296	34.70185	25.63295	47.75546	45.38115	76.39261	74.27645	67.47918	61.74536	70.83283	60.18291
JC9	72.36838	99.74396	65.36031	59.69869	40.88369	53.81684	28.84586	29.27992	47.70702	50.97496	79.78437	27.99299	31.44454	61.40553	69.05266	66.30298
JC10	51.15153	99.74396	65.07679	54.55409	54.66599	47.83660	31.27441	30.03676	47.00356	41.05467	92.99699	72.34210	37.83345	63.74928	70.41257	60.14332
JC11	66.25076	99.74396	66.82991	45.92950	67.44477	34.87974	40.80788	38.63768	47.18568	30.79203	90.90325	72.93859	80.12080	88.03077	72.01192	65.26284
JC12	66.55710	99.74396	66.40186	54.06873	56.95352	54.06390	42.80398	33.55261	56.57999	58.73890	81.21776	74.52994	54.82168	85.26957	72.78319	72.33273
JC13	24.84227	99.74396	69.65481	51.51521	60.53592	19.53143	43.72444	26.20861	55.86507	52.35082	78.98165	76.00536	88.55066	44.85635	73.45753	69.14697
JC14	28.62150	99.74396	68.14263	50.28307	71.96815	46.78190	44.40071	36.37569	56.13072	69.82006	69.76413	74.14939	33.33573	67.20225	74.15477	70.42572
JC15	10.25242	99.74396	66.79288	47.86241	87.14685	30.03876	33.94005	10.03726	54.90218	40.23210	83.83264	19.43276	68.96231	26.80029	72.11339	64.82700
JC16	54.28885	99.74396	63.04755	37.96218	67.80651	64.16383	49.51704	33.87017	53.75701	57.91469	69.76413	19.43276	40.75810	75.73821	72.65355	68.57777
JC17	54.16199	99.74396	64.66796	37.42652	56.75738	68.96323	50.21568	38.62390	53.97971	57.70967	82.83492	19.43276	33.59347	74.25755	71.20915	72.99562
JC18	65.09959	99.74396	68.08292	59.62230	63.50003	46.49985	57.55195	35.26327	55.50621	58.73242	88.01447	72.79076	26.55661	81.62783	71.30536	78.68461
JC19	59.37037	99.74396	68.50210	40.57747	56.16157	83.86415	41.99599	34.10438	56.25759	52.18610	88.39428	32.21740	38.14905	87.44357	71.80345	72.20344
JC20	55.43870	99.74396	64.59601	54.43875	49.45378	48.92091	37.81964	37.76415	55.83038	57.25333	86.91756	72.01593	44.93701	75.33039	71.61887	70.45806
JC21	66.28939	99.74396	61.70781	55.82031	58.44279	89.46915	40.09737	31.42449	54.97201	48.27925	93.12129	41.57057	51.91301	81.88867	71.44478	77.19200
JC22	57.97697	99.74396	66.02446	55.85717	52.42805	22.49163	52.31671	34.30460	54.34238	49.37562	85.74639	41.39175	45.71252	75.18897	72.66709	73.01264
JC23	38.86352	99.74396	68.38541	28.31310	56.94583	19.42415	41.05257	39.41720	49.72076	45.34515	84.94342	59.54492	41.15637	42.94943	71.38146	73.46178
JC24	45.05143	99.74396	66.37275	47.68341	45.28259	20.30764	42.63976	36.98656	58.25957	44.35234	77.92206	28.31738	32.78877	72.76305	72.00454	74.33098
JC25	47.02064	99.74396	61.33159	56.77024	44.00820	51.22306	35.75996	37.91132	58.78055	63.24348	70.00839	23.79198	27.16050	73.10324	72.25143	70.43866
JC26	47.32829	99.74396	67.11804	60.51424	65.90891	60.04813	46.27120	39.20744	59.08530	64.97708	89.08227	38.51108	22.36248	74.47996	75.75855	75.36062
JC27	25.75664	99.74396	66.91515	67.61270	76.12614	16.48350	38.00580	17.80874	56.72941	56.16446	92.51677	69.58815	70.93346	63.26894	72.23301	77.88826
JC28	39.39613	99.74396	65.61714	57.06096	51.37537	10.15021	33.75734	32.04838	56.01529	47.80819	77.80131	73.73202	67.48702	65.74974	70.18584	70.50324
JC29	47.81987	99.74396	61.08223	55.21180	38.73662	27.65748	37.50948	41.92918	55.45984	61.24310	72.19323	65.76650	49.45953	71.15653	73.48275	71.18058
JC30	76.62394	99.74396	65.90428	65.61884	57.43269	68.43438	32.23247	43.31233	55.69154	64.46953	80.15352	37.02590	13.55492	90.37434	71.75962	79.66330
JC31	55.49165	99.74396	65.95168	68.28012	57.20450	17.24989	38.08691	36.42636	54.24887	58.43597	81.42367	24.80591	24.14802	65.82383	72.19725	74.93916
JC32	49.29950	99.74396	66.43449	65.21253	43.33519	63.00785	16.79699	34.02427	52.48510	52.80814	61.68703	43.98854	71.85234	69.03575	73.07282	79.80576
JC33	78.25184	99.74396	64.13965	58.39058	74.25281	47.97775	37.87224	41.53624	50.28408	70.58892	71.38690	26.37644	36.70539	80.46051	74.11951	85.19352
JC34	71.28970	99.74396	65.07668	56.86922	66.06452	67.01118	49.87170	42.76375	50.48744	64.41198	63.25381	21.86779	50.99260	90.81920	72.42760	76.02414
JC35	49.17669	86.58506	64.59837	51.03445	70.70914	20.44573	35.80251	30.77011	51.13196	58.21419	79.99212	4.59669	28.44944	76.36208	74.55903	51.99618
A V E R A G E (Xbar)		99.36799	65.762047	53.848437	53.790870457	42.0196274446	38.0291885839	32.591852	53.0468854	51.59670423	80.672738	45.80725161	49.69134065	66.25859	71.99863	68.60085

MEAN CORRECTED DATA MATRIX

JC1	0.3759687	-3.310529	12.19003	-41.35175	-26.30025	-14.35058653	-4.9274175112	3.06075828042	-37.49177	-1.7800954	17.61968599	-35.06682	-46.5384649	0.849450051	-23.7877
JC2	0.3759687	1.1244352	5.560799	-25.75398	-9.2728291	-5.465442954	-5.6045601006	-2.5594437215	4.4802688	7.10756419	-26.3748925	37.620066	-10.0216654	-0.56685927	-11.9912
JC3	0.3759687	2.6198931	2.764665	-24.09305	-12.35056	-6.33890687	-2.07326199	-2.655114911	-15.25223	14.6375342	-26.3748925	38.773958	-31.5299313	-0.22333703	-12.2743
JC4	0.3759687	0.0331397	0.598048	-27.08701	-12.068414	-19.12311436	-8.10122341	-2.595314856	-27.39601	2.62229543	-13.8015267	21.048121	-11.5593926	-1.66556835	-19.9755
JC5	0.3759687	0.2914506	-9.01018	-20.59579	20.6185187	-1.903657165	-8.0135811402	-5.037270889	9.6345204	-26.314208	-11.526208	29.446095	11.84668702	-1.05191209	-4.90611
JC6	0.3759687	-3.027214	-6.79597	-5.317884	7.22038363	9.9700391146	3.55195861688	-5.7398694901	13.270212	8.15141261	6.729574451	-19.84275	8.049044727	-2.88287054	0.827979
JC7	0.3759687	1.667871	1.500856	-40.90467	-15.653113	-13.64353484	-11.518391812	-5.3156467366	-25.39554	3.38118671	27.89847674	38.159909	-51.8868327	-1.45169114	-9.60431
JC8	0.3759687	2.3607599	2.910968	45.926153	-18.406672	-3.327339836	-6.9589062743	-5.2914274032	-6.215559	-4.2801295	28.46919863	17.787841	-4.51323646	-1.16580012	-8.41794
JC9	0.3759687	-0.401739	5.850252	-12.90718	11.7972122	-9.183330122	-3.3119366839	-5.3398684742	-0.621742	-0.8883659	-17.8142616	-18.2468	-4.85306426	-2.94597411	-2.29787
JC10	0.3759687	-0.685256	0.705658	0.8751179	5.81697207	-6.754780414	-2.5550876079	-6.0433205779	-10.54204	12.3242548	26.53485078	-11.85789	-2.50931126	-1.58606703	-8.45753
JC11	0.3759687	1.0678601	-7.91894	13.653895	-7.1398914	2.778693532	6.04583315357	-5.8612072041	-20.80467	10.2305154	27.13133779	30.429456	21.77217579	0.013285172	-3.33801
JC12	0.3759687	0.6398115	0.22029	3.1626543	12.0442771	4.7747870695	0.96075859388	3.53310260914	7.1421951	0.54502524	28.72269139	5.1303438	19.01097348	0.784558796	3.731883
JC13	0.3759687	3.8927626	-2.33322	6.7450464	-22.488195	5.6952514707	-6.3832418615	2.81818651939	0.7541163	-1.6910892	30.19811054	38.859323	-21.4022403	1.458895185	0.546125
JC14	0.3759687	2.3805866	-3.56537	18.177279	4.76227456	6.3715187696	3.78383727678	3.08383788686	18.223352	-10.908604	28.34213691	-16.35561	0.943653029	2.156135054	1.824876
JC15	0.3759687	1.0308357	-5.98603	33.355981	-11.980866	-4.089135939	-22.554588834	1.85529824489	-11.36461	3.15990648	-26.3744906	19.270968	-39.4583085	0.114759821	-3.77384
JC16	0.3759687	-2.714494	-15.8863	14.015642	22.1441976	11.487847052	1.27832217942	0.7101214561	6.3179835	-10.908604	-26.3744906	-8.933243	9.479619247	0.654919309	-0.02307
JC17	0.3759687	-1.094091	-16.4219	2.9665086	26.943603	12.186490268	6.03204566439	0.9328272324	6.1129667	2.16218589	-26.3744906	-16.09787	7.998957903	-0.78948104	4.394772
JC18	0.3759687	2.3208771	5.773859	9.7091559	4.48022065	19.522765207	2.67141351594	2.45932308288	7.1357183	7.34173096	26.98350995	-23.13473	15.36923779	-0.6932739	10.08376
JC19	0.3759687	2.7400526	-13.271	2.3707013	41.8445257	3.9668039129	1.51252429316	3.21070555327	0.5893934	7.72153783	-13.5898469	-11.54229	21.18497278	-0.19518728	3.602593
JC20	0.3759687	-1.166033	0.590314	-4.337088	6.90128639	-0.209545329	5.17230192216	2.78349837412	5.6566269	6.24482267	26.2086742	-4.754328	9.071797727	-0.37976061	1.857213
JC21	0.3759687	-4.05424	1.97187	4.6519232	47.4495217	2.0681769585	-1.1673625543	1.92512364975	-3.317458	12.4485556	-4.23668139	2.2216678	15.63007432	-0.55385718	8.591154
JC22	0.3759687	0.2624103	2.00873	-1.362823	-19.527993	14.287521469	1.71275319407	1.29549108491	-2.221089	5.07365655	-4.41549916	-3.978822	8.930375754	0.66845551	4.41179
JC23	0.3759687	2.6233631	-25.5353	3.1549547	-22.595482	3.0233790726	6.82535003534	-3.3261206684	-6.251558	4.27068086	13.73766735	-8.534966	-23.3091631	-0.61717403	4.86093
JC24	0.3759687	0.6107023	-6.16502	-8.508283	-21.711989	4.6105691625	4.39471068279	5.21268835199	-7.244366	-2.750681	-17.4898697	-16.90257	6.504459788	0.005909327	5.730136
JC25	0.3759687	-4.43046	2.921808	-9.78267	9.20342953	-2.269226375	5.31947096231	5.73366870312	11.646771	-10.664345	-22.0152696	-22.53084	6.844644674	0.252796371	1.837818
JC26	0.3759687	1.3559891	6.665802	12.118036	18.0285031	8.2420116181	6.61558425092	6.03841482688	13.380372	8.40952897	-7.29616765	-27.32886	8.221361606	3.759916026	6.759776
JC27	0.3759687	1.153105	13.76426	22.335273	-25.536128	-0.023391915	-14.783107212	3.68252213416	4.5677594	11.8440369	23.78089784	21.242122	-2.98965626	0.234380349	9.287414
JC28	0.3759687	-0.144908	3.212518	-2.415502	-31.869422	-4.27184526	-0.5434751351	2.96840071261	-3.788518	-2.8714323	27.92476888	17.795678	-0.50885441	-1.81279135	1.90239
JC29	0.3759687	-4.679816	1.363361	-15.05425	-14.362145	-0.519705546	9.33732823311	2.41295081246	9.6463952	-8.4795082	19.95924968	-0.231815	4.897938796	1.484116325	2.579733
JC30	0.3759687	0.1422357	11.7704	3.6418159	26.4147512	-5.796721896	10.7204829802	2.64465864751	12.87283	-0.5192156	-8.78135362	-36.13642	24.11574468	-0.23901735	11.06246
JC31	0.3759687	0.1896319	14.43168	3.4136267	-24.769733	0.0577193431	3.83450404557	1.20198390128	6.8392675	0.75092975	-21.0013416	-25.54332	-0.43476406	0.198611805	6.33831
JC32	0.3759687	0.6724446	11.36409	-10.45568	20.9882232	-21.23219733	1.43241339088	-0.5617890089	1.2114314	-18.985706	-1.81870781	22.160995	2.777155058	1.074186849	11.20491
JC33	0.3759687	-1.622396	4.542145	20.461937	5.95812174	-0.156946664	8.94439054734	-2.7628015189	18.992211	-9.2858406	-19.4308155	-12.98596	14.20191953	2.120876593	16.59267
JC34	0.3759687	-0.685367	3.020786	12.273645	24.9915551	11.842515809	10.1718992001	-2.5594437215	12.815275	-17.418923	-23.9394654	1.3012572	24.56060191	0.428970179	7.423296
JC35	-12.782936	-1.163677	-2.81399	16.918269	-21.573897	-2.226680488	-1.8217406113	-1.914922883	6.6174892	-0.680615	-41.2105597	-21.2419	10.10348989	2.560399701	-16.6047

Final Eigen Vectors(In Descending order of Eigen values) of the Covariance matrix - Computed using Power Method

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	-0.0146157	0.0267365	0.01805	-0.068239	0.03477918	-0.060297684	-0.0257716221	0.11441035932	0.2072849	0.11083014	0.018183521	-0.111357	0.02657956	-0.03080547	0.383536
2	-0.0410218	0.0344353	0.024384	0.0424047	0.04243047	0.0112520767	-0.0203480497	0.07002928281	0.0311251	-0.0232181	0.021034806	0.0115211	0.037785426	1	-0.052
3	-0.0629475	-0.007795	-0.09818	-0.070515	-0.4237277	-0.473349107	1	0.37339947569	-0.0666	0.50733384	0.404213648	-0.113598	-0.02948489	0.012533815	-0.04939
4	0.50436023	0.5643988	0.013299	1	0.79194838	-0.175274754	0.23662719212	-0.269351578	0.0647047	-0.0652455	0.154241789	0.0514486	0.565545122	-0.03204334	-0.03091
5	0.94409375	-0.057162	0.537593	-0.750162	1	-0.264723376	0.08069349741	0.0589133767	-0.060403	0.07323965	0.123198937	0.0300458	-0.03017659	0.006033645	-0.02164
6	0.30455718	0.1806266	-0.0486	0.1513856	-0.013697	0.4189116828	-0.6031941386	0.52155760166	-0.132926	1	0.314228711	-0.180691	0.16617062	-0.01188585	-0.0314
7	0.29055043	0.0334465	-0.10324	-0.149832	-0.393649	0.1859601372	-0.1941124534	-0.0039093254	0.4576275	-0.4951872	1	0.2380686	-0.00577815	-0.02764449	-0.14337
8	0.05917623	0.0141183	-0.0657	0.0001846	-0.0486439	-0.08816195	0.01963916968	0.21113871389	0.1411397	0.37715266	-0.31736272	1	0.03522649	-0.02234334	-0.23748
9	0.61261825	0.159619	0.072769	0.1590619	-0.6678041	-0.722274944	-0.2815618966	0.61809567895	-0.722464	-0.4508551	-0.04921819	0.0476698	0.168535711	-0.00645337	0.009265
10	-0.1227688	0.0461325	-0.10468	0.0064397	0.53927522	1	0.32846062069	1	-0.209975	-0.4489025	-0.05420006	0.0549762	0.04360747	-0.03344809	0.038667
11	-0.5753311	1	-0.33813	-0.661048	0.10124355	-0.137469508	-0.0517997108	-0.1059597614	-0.11422	-0.0294243	-0.04053059	0.0175744	1	-0.00203917	0.000506
12	-0.9302724	0.2148032	1	0.1895971	-0.3052456	0.0920386616	-0.014525815	0.14012732506	0.0373747	0.00114198	0.122178032	0.0754489	0.270532831	-0.03920484	-0.02692
13	1	0.3114641	0.196984	-0.109095	-0.9167085	0.8228613175	0.29547059577	-0.4860196672	-0.041971	0.05628482	-0.27558713	-0.007206	0.338431836	0.031917663	0.04917
14	0.02133976	0.0047074	-0.01014	0.031732	-0.0286901	-0.056586678	0.00110858265	0.00991483281	0.0168544	0.05140861	0.125359795	0.3091274	0.003332563	0.052995453	1
15	0.35115546	0.2037945	0.033662	0.0153404	-0.2266839	-0.336495328	-0.0593498731	0.67603495593	1	-0.1104672	-0.42189747	-0.220769	0.221918883	-0.01724917	0.015563

Eigen values(Descending Order)-Computed by the Power method

		Proportion of variation	
ß1	1034.10013	36.945%	Accept
ß2	531.463323	18.987%	Accept
ß3	407.265581	14.550%	Accept
ß4	325.770636	11.639%	Accept
ß5	160.229994	5.724%	Accept
ß6	101.717706	3.634%	Accept
ß7	87.5105285	3.126%	Accept
ß8	71.3986945	2.551%	Accept
ß9	34.9477007	1.249%	Accept
ß10	23.2152146	0.829%	Accept
ß11	15.1277512	0.540%	Accept
ß12	9.13500192	0.326%	Accept
ß13	-7.6355775	-0.273%	Reject
ß14	3.117255	0.111%	Reject
ß15	1.68470338	0.060%	Reject

Total 2799.04864

Reject: All Eigen values which are -ve
All Eigen values contributing a small amount to the total variation

The dimensionality of the problem is reduced to 12

PRINCIPAL COMPONENTS USED FOR REGRESSION

JC1	-107.08279	-40.06632	-68.4977	-43.61335	22.2411854	-9.506359397	7.2435051002	-18.056150298	0.4776533	13.5144978	4.749163931	1.7265604
JC2	-57.784818	-38.02959	38.92141	7.0614399	-30.949775	8.0008691415	2.6630261719	19.9214102098	-15.45407	-3.4776052	3.463247879	0.3530793
JC3	-94.670469	-46.19351	31.96402	10.111993	3.81971208	14.430028944	1.49522804928	23.6243865161	0.1341991	-3.5669499	12.322609	1.4678171
JC4	-80.786014	-39.56458	15.55118	-10.10664	-3.1220002	21.896895585	13.0132505482	-21.438314315	-0.429574	-1.7875848	-2.96039897	1.2278869
JC5	4.89440143	-15.58766	51.93803	-21.36515	-28.920797	-16.96600104	-17.026867801	-22.660344821	-10.45539	7.47854889	-7.58866424	-4.351867
JC6	38.4044094	6.0069305	-16.4263	-16.4374	-0.6938258	9.8469757789	-13.02926215	12.6045855131	-13.22137	-6.0631729	-0.94908535	-7.48723
JC7	-166.20682	-10.98798	9.137533	-39.32133	16.1229633	-14.77076385	-7.6249268605	11.4088177641	2.546875	-0.4373273	1.059952163	-3.970333
JC8	-41.551453	54.106803	-1.28164	44.004364	25.2608428	-9.654933806	13.2651565137	-27.139635343	-4.893987	-0.2356869	5.930511855	-2.041098
JC9	21.4243306	-33.72113	-6.44679	-14.49457	9.53834269	-10.37248079	9.59411757461	-0.6991007441	-3.075884	-3.8203841	-2.16819723	-7.626335
JC10	-14.965485	19.112439	-19.6017	-25.5267	31.8425422	11.240555324	11.4108973336	-7.6022074621	-8.233963	-7.84653	-0.24287169	-4.199588
JC11	-34.467218	45.764164	19.6262	1.2665655	-1.3792633	49.40584246	5.74149214346	-20.827154754	10.192679	-2.2214588	5.331304363	-0.638487
JC12	18.2118944	39.746703	5.69781	-24.17371	-7.5493327	4.2582419977	0.92288115965	-0.8136829966	-5.552241	2.83996153	-4.21284514	3.9080945
JC13	-91.834103	38.149373	13.19592	15.641749	-4.4477836	-13.84112824	-14.03267304	11.6992064253	-1.848759	4.9844943	1.356436881	4.0990609
JC14	30.050323	39.338209	-20.9317	-3.684931	7.52477421	-29.08603034	-13.226844326	-5.921058493	-10.3042	-1.2081963	2.601029078	4.0921552
JC15	-52.731793	-18.8253	16.15809	69.096106	63.6376708	-20.36093008	1:6799087322	4.79479748796	3.0384206	4.41159593	-6.85826996	1.0061575
JC16	71.1727897	-16.0244	16.3008	15.593071	20.4291707	-0.761962444	-18.963882419	-12.490062951	-0.226313	7.25912552	0.818192244	0.7598196
JC17	76.6801732	-22.72291	9.610626	-0.679727	24.652218	11.269200967	-19.345820292	6.70710387188	2.5604149	0.02192954	1.214772555	0.4003465
JC18	43.8927198	39.249603	-28.486	-14.01585	1.02833461	8.4828012338	-0.5877985517	15.6929902461	-2.118794	14.121366	-0.78155481	-3.5479
JC19	83.6710223	-8.320862	19.92733	-22.94215	34.3549832	20.789930507	-2.7347640533	-0.1072582444	1.0747951	-1.9768803	-6.72854576	4.0650824
JC20	7.6956002	26.878068	-9.13896	-28.69696	-4.0200387	4.2267825849	1.05177008838	5.35534146478	-5.006609	-6.4086641	-0.96596607	4.0366641
JC21	63.0295518	3.0317224	30.66165	-29.60778	42.0383898	11.734951731	15.3090586124	12.8916969024	4.9935005	3.61709734	-1.91632343	1.0648245
JC22	0.41141761	1.2999048	-12.9342	15.995196	-26.586145	23.372109869	-3.8737825237	10.0066149957	5.0543438	12.5401955	-0.71201637	-2.838701
JC23	-41.473052	8.9303695	-28.6643	12.357435	19.038607	5.6825570443	-34.49009062	1.72253721354	13.241886	-17.83901	-0.95369731	-1.436691
JC24	8.76054988	-21.63857	-21.9324	14.82009	-28.36417	19.184616125	-9.6146680031	-4.7466907574	16.037039	4.99474303	-7.33030007	1.6119628
JC25	54.506568	-29.34402	-8.10132	-6.891058	-17.877372	-15.76847718	-1.5219497527	-2.3644677305	-0.846063	0.55183177	-0.97928766	4.2636664
JC26	74.9023518	0.9220715	-15.2011	-0.436658	15.8867606	-4.398107376	6.61550644601	20.2076922015	-2.987113	1.45029298	5.305146183	5.0265012
JC27	-49.669107	44.143414	-1.44724	32.342332	-8.0884598	-5.131020276	19.541143705	21.4240920782	-2.349994	3.12245205	-12.3656926	-0.109817
JC28	-67.25976	30.921385	-9.04794	4.9891696	-36.544741	1.8704469849	0.95638366943	-5.7565587792	5.075015	-1.5210988	-5.32949123	2.6388732
JC29	-16.835297	15.531413	-13.6141	-18.28369	-44.873936	-8.107824831	-9.9599226291	-1.6512229936	-0.660339	-4.5242374	1.671717873	3.4539971
JC30	102.14251	-4.930677	-14.9461	-20.97751	-3.2818413	-9.692135133	19.8719960118	1.57615521244	4.4958907	-7.6316048	0.63547265	0.8623903
JC31	20.3557105	-20.80231	-33.051	30.677723	-29.26454	-6.416311673	11.7470554225	11.457664074	5.4616837	0.38807943	1.61404653	-3.407029
JC32	-2.0521385	-5.538814	36.73734	-25.05037	-15.424364	-36.8132363	16.4301901586	-11.514881841	16.050003	-7.1134588	-1.08084476	0.8756993
JC33	74.2162616	-0.443539	1.535197	26.329414	-15.737082	-21.05819777	4.20374670969	2.79303829405	10.408141	-8.9050039	3.591784343	-3.986116
JC34	85.7563472	-5.348662	29.07017	8.9725572	-15.608778	-8.725768035	-2.5138458508	-8.8073887995	5.4411853	11.7917852	12.48688225	-3.640703
JC35	39.1913769	-35.04173	-16.2828	57.046315	-14.682252	15.738862283	5.79078472384	-21.291949146	-18.61906	-6.5031427	-0.02821713	2.3412549

Regression Output(PCA):

Constant	48.079671
Std Err of Y Est	8.4360459
R Squared	0.8912467
No. of Observations	35
Degrees of Freedom	22

PCA Coefficient(s)	0.244737	0.2028901	0.03268038	-0.114153244	-0.1414114393	0.14173086992	0.1040346	-0.1891546	0.09606692	-0.164415	0.152849873	-2.32227092			
Std Err of Coef.	0.022366	0.0511376	0.05910097	0.0549071107	0.0594662528	0.08422866975	0.1168879	0.10512797	0.178324196	0.2074853	0.284915655	0.42450637			
Significance at 5%(t test)	Yes	Yes	No	Yes	Yes	No	No	No	No	No	No	Yes			
X Coefficients															
X Coefficients	0.235513	-0.043598	0.24986846	-0.015996625	0.07219119888	0.28267375944	-0.120439	-2.4475626	-0.10110846	-0.196674	0.054206443	-0.29799518	0.657075	-0.70905	0.53938
Constant	138.847														

Fisher's test

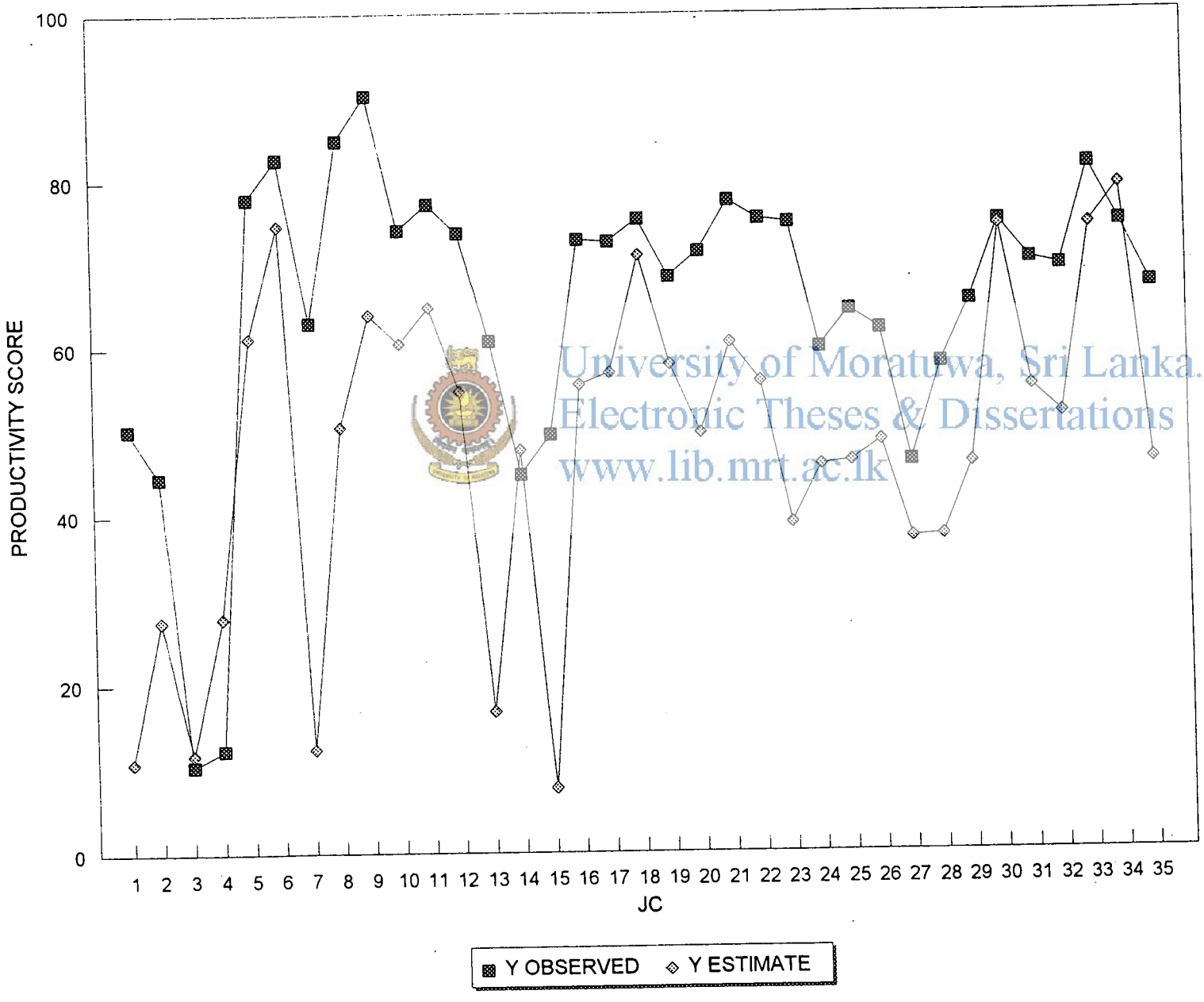
	Sum of squares	Mean square
Regression	23058.107	1921.5089
Residual	17066.904	775.76839

H0= Data is not significant H1= Data is significant

F statistic = 2.477

F ratio is = 2.226 @5%

Therefore the data is significant at 5% level of Significance



APPENDIX 12

DATA MATRIX WITH DEPENDENT VARIABLE

	Productivity score	%Mat var/s usage	%Labour var /std usage	%No prod du lab,serv & m	%No prod due t mach. bkdwns	Asset utilisation	InventL of FP	Prod. target fulfilled	Asset turn. ratio
	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
JC1	17.67983	66.03847	12.43912	15.71938	23.67860	27.66443	63.42694	19.72013	44.81319
JC2	30.49494	59.40924	28.03689	32.74680	32.56375	26.98729	19.43236	56.23693	56.60963
JC3	9.21163	56.61310	29.69782	29.66907	31.69028	30.51859	19.43236	34.72866	56.32659
JC4	10.25179	54.44649	26.70386	29.95121	18.90607	24.49063	32.00572	54.69920	48.62535
JC5	63.96248	44.83826	33.19508	62.63815	36.12553	24.57827	34.28104	78.10528	63.69474
JC6	77.03377	47.05251	48.47299	49.24001	47.99923	36.14381	52.53683	74.30764	69.42883
JC7	10.52376	55.34929	12.88620	26.36651	24.38565	21.07346	73.70573	14.37176	58.99654
JC8	59.59063	56.75940	99.71702	23.61296	34.70185	25.63295	74.27645	61.74536	60.18291
JC9	72.36838	59.69869	40.88369	53.81684	28.84586	29.27992	27.99299	61.40553	66.30298
JC10	51.15153	54.55409	54.66599	47.83660	31.27441	30.03676	72.34210	63.74928	60.14332
JC11	66.25076	45.92950	67.44477	34.87974	40.80788	38.63768	72.93859	88.03077	65.26284
JC12	66.55710	54.06873	56.95352	54.06390	42.80398	33.55261	74.52994	85.26957	72.33273
JC13	24.84227	51.51521	60.53592	19.53143	43.72444	26.20861	76.00536	44.85635	69.14697
JC14	28.62150	50.28307	71.96815	46.78190	44.40071	36.37569	74.14939	67.20225	70.42572
JC15	10.25242	47.86241	87.14685	30.03876	33.94005	10.08726	19.43276	26.80029	64.82700
JC16	54.28885	37.96218	67.80651	64.16383	49.51704	33.87017	19.43276	75.73821	68.57777
JC17	54.16199	37.42652	56.75738	68.96323	50.21568	38.62390	19.43276	74.25755	72.99562
JC18	65.09959	59.62230	63.50003	46.49985	57.55195	35.26327	72.79076	81.62783	78.68461
JC19	59.37037	40.57747	56.16157	63.86415	41.99599	34.10438	32.21740	87.44357	72.20344
JC20	55.43870	54.43875	49.45378	48.92091	37.81964	37.76415	72.01593	75.33039	70.45806
JC21	66.28939	55.82031	58.44279	89.46915	40.09737	31.42449	41.57057	81.88867	77.19200
JC22	57.97697	55.85717	52.42805	22.49163	52.31671	34.30460	41.39175	75.18897	73.01264
JC23	38.86352	28.31310	56.94583	19.42415	41.05257	39.41720	59.54492	42.94943	73.46178
JC24	45.05143	47.68341	45.28259	20.30764	42.63976	36.98656	28.31738	72.76305	74.33098
JC25	47.02064	56.77024	44.00820	51.22306	35.75996	37.91132	23.79198	73.10324	70.43866
JC26	47.32829	60.51424	65.90891	60.04813	46.27120	39.20744	38.51108	74.47996	75.36062
JC27	25.75664	67.61270	76.12614	16.48350	38.00580	17.80874	69.58815	63.26894	77.88826
JC28	39.39613	57.06096	51.37537	10.15021	33.75734	32.04838	73.73202	65.74974	70.50324
JC29	47.81987	55.21180	38.73662	27.65748	37.50948	41.92918	65.76650	71.15653	71.18058
JC30	76.62394	65.61884	57.43269	68.43438	32.23247	43.31233	37.02590	90.37434	79.66330
JC31	55.49165	68.28012	57.20450	17.24989	38.08691	36.42636	24.80591	65.82383	74.93916
JC32	49.29950	65.21253	43.33519	63.00785	16.79699	34.02427	43.98854	69.03575	79.80576
JC33	78.25184	58.39058	74.25281	47.97775	37.87224	41.53624	26.37644	80.46051	85.19352
JC34	71.28970	56.86922	66.06452	67.01118	49.87170	42.76375	21.86779	90.81920	76.02414
JC35	49.17669	51.03445	70.70914	20.44573	35.80251	30.77011	4.59669	76.36208	51.99618
AVERAGE (Xbar)		53.84844	53.79087	42.0196274	38.029188584	32.5918517701	45.8072516056	66.258594	68.6008468

MEAN CORRECTED DATA MATRIX

JC1	12.1900322	−41.35175	−26.3002	−14.35059	−4.9274175	17.619685994	−46.538464874	−23.787661377
JC2	5.56079818	−25.75398	−9.27283	−5.465443	−5.6045601	−26.37489245	−10.021665352	−11.991214729
JC3	2.76466332	−24.09305	−12.3506	−6.338907	−2.073262	−26.37489245	−31.529931304	−12.274260586
JC4	0.59804717	−27.08701	−12.0684	−19.12311	−8.1012234	−13.80152671	−11.55939263	−19.975498286
JC5	−9.0101782	−20.59579	20.61852	−1.903657	−8.0135811	−11.52620798	11.846687019	−4.9061062872
JC6	−6.7959277	−5.317884	7.220384	9.9700391	3.55195862	6.7295744507	8.04904472712	0.8279787833
JC7	1.50085455	−40.90467	−15.6531	−13.64353	−11.518392	27.898476745	−51.886832712	−9.6043098671
JC8	2.91096655	45.926153	−18.4067	−3.32734	−6.9589063	28.469198633	−4.5132364633	−8.4179404807
JC9	5.85025104	−12.90718	11.79721	−9.18333	−3.3119367	−17.81426155	−4.8530642634	−2.297868247
JC10	0.70565666	0.8751179	5.816972	−6.75478	−2.5550876	26.53485078	−2.5093112637	−8.4575314048
JC11	−7.9189372	13.653895	−7.13989	2.7786935	6.04583315	27.131337794	21.7721757911	−3.3380073814
JC12	0.22028841	3.1626543	12.04428	4.7747871	0.96075859	28.722691386	19.0109734813	3.73188327927
JC13	−2.3332253	6.7450464	−22.4882	5.6952515	−6.3832419	30.198110536	−21.402240303	0.54612478284
JC14	−3.565372	18.177279	4.762275	6.3715188	3.78383728	28.342136907	0.94365302941	1.82487642308
JC15	−5.9860324	33.355981	−11.9809	−4.089136	−22.554589	−26.37449062	−39.458308513	−3.7738445066
JC16	−15.886257	14.015642	22.1442	11.487847	1.27832218	−26.37449062	9.47961924657	−0.0230741788
JC17	−16.421923	2.9665086	26.9436	12.18649	6.03204566	−26.37449062	7.99895790283	4.3947715812
JC18	5.77385742	9.7091559	4.480221	19.522765	2.67141352	26.983509951	15.3692377916	10.0837583013
JC19	−13.270966	2.3707013	41.84453	3.9668039	1.51252429	−13.58984689	21.1849727824	3.60259291911
JC20	0.59031222	−4.337088	6.901286	−0.209545	5.17230192	26.208674202	9.07179772718	1.85721286899
JC21	1.97186918	4.6519232	47.44952	2.068177	−1.1673626	−4.236681386	15.6300743246	8.59115408037
JC22	2.00872882	−1.362823	−19.528	14.287521	1.71275319	−4.415499158	8.98037575446	4.41179006844
JC23	−25.535339	3.1549547	−22.5955	3.0233791	6.82585004	13.737667355	−23.309163107	4.86092989134
JC24	−6.1650236	−8.508283	−21.712	4.6105692	4.39471068	−17.48986973	6.50445978807	5.73013562697
JC25	2.92180642	−9.78267	9.20343	−2.269226	5.31947096	−22.01526963	6.84464467433	1.83781770394
JC26	6.66580085	12.118036	18.0285	8.2420116	6.61558425	−7.296167655	8.22136160572	6.7597756735
JC27	13.7642575	22.335273	−25.5361	−0.023392	−14.783107	23.780897841	−2.9896562592	9.2874141013
JC28	3.21251706	−2.415502	−31.8694	−4.271845	−0.5434751	27.924768881	−0.508854406	1.9023902656
JC29	1.36335983	−15.05425	−14.3621	−0.519706	9.33732823	19.959249683	4.89793879587	2.57973271139
JC30	11.7704034	3.6418159	26.41475	−5.796722	10.720483	−8.781353621	24.115744678	11.0624580411
JC31	14.4316795	3.4136267	−24.7697	0.0577193	3.83450405	−21.00134161	−0.4347640567	6.33830960324
JC32	11.3640909	−10.45568	20.98822	−21.2322	1.43241339	−1.818707809	2.77715505785	11.2049094674
JC33	4.5421433	20.461937	5.958122	−0.156947	8.94439055	−19.43081553	14.2019195263	16.5926736138
JC34	3.02078454	12.273645	24.99156	11.842516	10.1718992	−23.93946543	24.5606019118	7.42329606187
JC35	−2.8139876	16.918269	−21.5739	−2.22668	−1.8217406	−41.2105597	10.1034898912	−16.604668517

Final Eigen Vectors(In Descending order of Eigen values) of the Covariance matrix – Computed using Power Method

	1	2	3	4	5	6	7	8	9	10
1	−0.0954656	0.0055157	−0.06311	0.3428891	1	0.2826028173	0.59188090706	0.28896479405		
2	0.49679048	0.5202496	1	−0.607787	0.23223102	−0.11397886	−0.0978900768	0.19882337487		
3	1	−0.11399	−0.76775	−0.892553	0.12594445	0.0190461952	0.10322197968	0.12250313713		
4	0.26559643	0.1754146	0.163887	0.123505	−0.638282	0.4310816704	1	0.11947138076		
5	0.2244553	0.055046	−0.11923	0.4693742	−0.2130894	0.3079784208	−0.4699660281	1		
6	−0.5680743	1	−0.60033	−0.134737	−0.0147813	−0.079245089	−0.001152437	0.01052527516		
7	0.9679753	0.2742122	−0.10055	1	0.03453434	−0.500570263	−0.0077174616	−0.2741514735		
8	0.32045769	0.1838463	0.014599	0.1390415	0.09261807	1	−0.4723907777	−0.5570968438		
9										
10										
11										
12										
13										
14										
15										

	Eigen values(Descending Order) – Computed by the Power method	Proportion of variation	
β1	803.182322	40.716%	Accept
β2	519.859502	26.354%	Accept
β3	321.589122	16.303%	Accept
β4	153.393489	7.776%	Accept
β5	90.7957635	4.603%	Accept
β6	55.4563432	2.811%	Accept
β7	28.3082618	1.435%	Accept
β8	0.05111041	0.003%	Reject
β9		0.000%	
β10		0.000%	
β11		0.000%	
β12		0.000%	
β13		0.000%	
β14		0.000%	
β15		0.000%	
Total	1972.63591		

Reject: All Eigen values which are −ve
All Eigen values with small variations are rejected.

PRINCIPAL COMPONENTS USED FOR REGRESSION

JC1	−115.6049	−20.75158	−29.9387	−3.517878	5.41341948	−1.934733644	8.08926662577
JC2	−23.868106	−44.90555	−2.54694	14.395247	2.02799044	−4.63642755	7.79601616406
JC3	−46.20331	−49.61474	3.247761	−4.823971	−1.7340016	5.5198281685	3.42740226193
JC4	−42.229687	−37.15713	−10.8712	8.7983508	4.6745934	−20.80763356	−4.0146619155
JC5	25.3854372	−23.06966	−29.557	−0.253709	−8.1485962	−13.01756476	2.91336523893
JC6	12.9062601	7.4061941	−14.0592	4.6133067	−13.986937	0.4805072245	5.08322658461
JC7	−111.47783	−10.61063	−41.5155	−24.72548	−1.9008185	9.5172653818	−0.048268162
JC8	−21.553501	50.72457	43.39869	−23.68304	13.508548	−16.75488117	−0.7510533053
JC9	6.32991596	−29.38813	−12.295	−6.139889	10.7887863	−0.086510893	−0.5394889947
JC10	−16.396191	22.762444	−20.2386	−14.7759	5.23522014	−12.79250849	−0.6374917175
JC11	7.08687327	41.181705	0.844222	16.192162	−8.6675112	−17.25686353	−5.4457341367
JC12	18.3596786	35.785942	−24.5304	4.1036749	−0.2031118	−5.775184808	3.44456453282
JC13	−56.531291	31.137074	9.883348	−12.51552	−7.0089547	7.4991323516	4.2050029332
JC14	2.07228846	39.156545	−1.74373	−16.57942	−3.8347126	0.0298152896	0.29316442023
JC15	−25.408384	−21.16097	64.69695	−59.15329	6.3451595	3.6370458055	0.5834703442
JC16	58.1129968	−17.014	14.62703	−18.68178	−16.732249	−2.997570146	2.36621862634
JC17	58.7094802	−22.52193	−0.31196	−14.9825	−20.330268	5.1260646458	0.01520511151
JC18	17.3170438	41.195766	−8.81106	8.8805365	−3.3715433	10.101109211	16.2835720818
JC19	75.0633032	−9.948932	−22.3675	−18.62302	−9.0384219	−6.972847775	−2.3613203793
JC20	0.28356422	26.245884	−26.9427	4.8792882	−0.4182281	−2.465538277	−2.1315799674
JC21	70.1489637	−1.050455	−30.3267	−27.39953	9.35496068	2.5657382997	4.05224191124
JC22	−3.651137	2.9729894	17.45762	31.654083	−9.4693575	7.3290673032	10.6412825032
JC23	−45.064386	13.221896	15.96355	−11.41287	−31.590431	10.83923018	−20.071574825
JC24	−5.0713403	−15.58763	18.71116	34.726319	−13.74086	6.0151712576	−5.2489384948
JC25	24.3765436	−26.02816	−5.48418	11.01609	2.85597708	2.9322730758	−2.0278332875
JC26	41.3552869	2.2970293	2.070019	−6.903524	6.09798017	9.6589779201	6.50467900533
JC27	−32.505557	38.457387	28.99069	2.0927019	19.3055437	5.1941688445	5.85705406794
JC28	−50.378944	29.749558	4.529238	26.225278	1.2260937	−1.488494594	−6.0951000537
JC29	−25.783884	16.012104	−17.7491	29.322133	−5.4864508	3.0255693054	−5.3892564961
JC30	59.8439383	−1.61287	−16.6009	9.3989733	19.3456647	3.9038890652	−6.9000178913
JC31	−10.034959	−15.05506	33.81614	30.065141	12.1333414	12.643601852	0.93992621648
JC32	16.7034554	−10.41211	−29.9609	−5.851456	25.9867721	6.0502097016	−17.301673729
JC33	47.7582336	−2.029947	24.98785	7.1089338	10.5531026	12.775307989	−10.985545886
JC34	75.9813734	−9.649385	5.634008	6.3250535	1.18183802	5.1946313458	6.55956981787
JC35	13.9687737	−30.73824	56.9931	20.225517	−0.3725377	−23.05184502	0.89431079475

Regression Output(PCA):

Constant	48.079671
Std Err of Y Est	12.357655
R Squared	0.7135969
No. of Observations	35
Degrees of Freedom	27

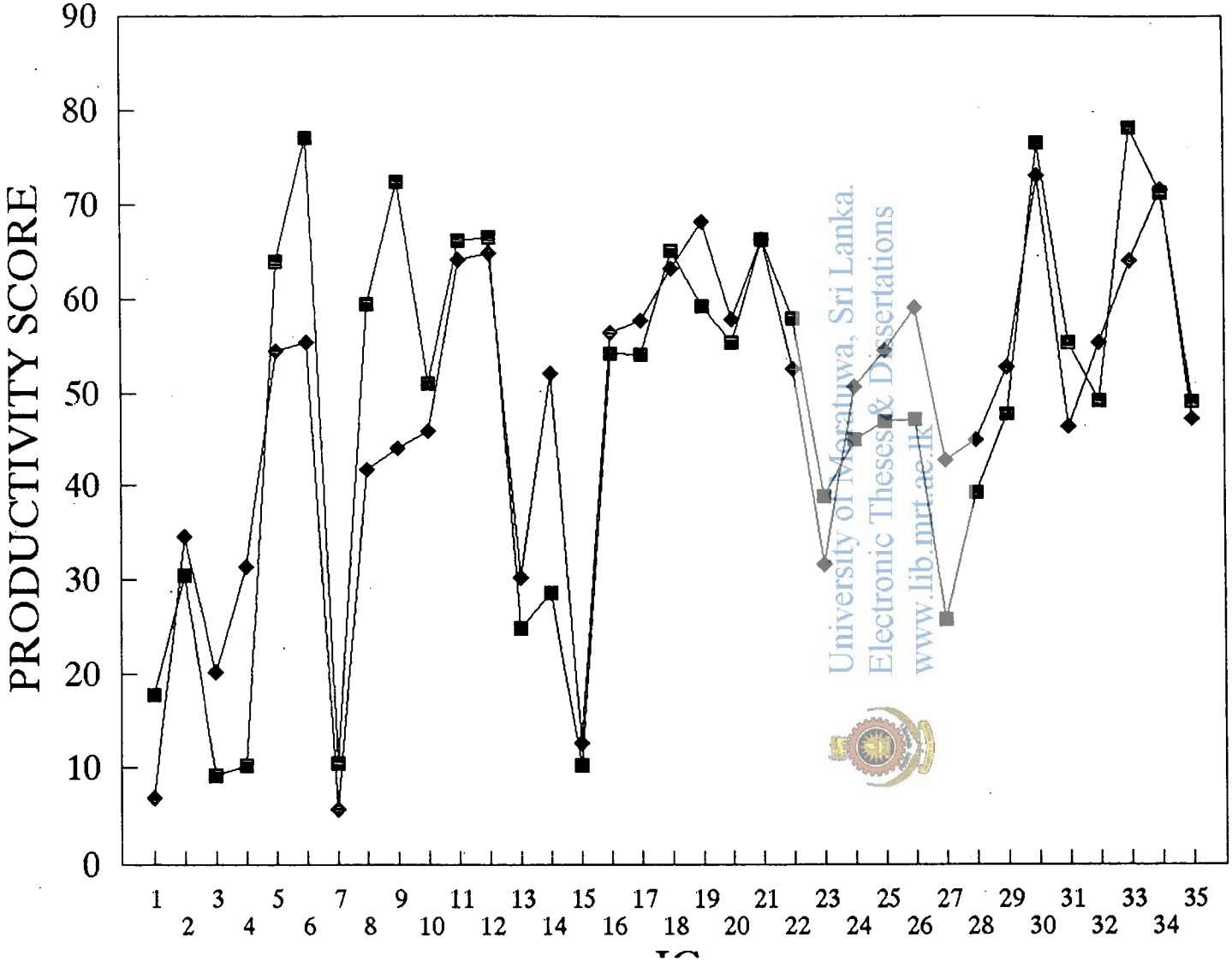
PCA Coefficient(s)	0.331641	0.2049717	−0.0977097	0.2773212367	0.03780007508	−0.0417918721	−0.110137	
Std Err of Coef.	0.045279	0.0778194	0.08343388	0.1070953443	0.1796693175	0.22291643771	0.2954453	
Significance at 5%(t test)	Yes	Yes	No	Yes	No	No	No	
X Coefficients								
X Coefficients	0.031529	0.0294537	0.12836567	−0.010004892	0.25837365741	0.04074735275	0.6874474	0.19482972
Constant	−29.418							

Fisher's test

H0= Data is not significant H1 = Data is significant

	Sum of squares			
Regression	10273.327	1467.6182	F statistic =	9.6104
Residual	4123.2141	152.71163	F ratio is @5% =	2.3732

Therefore the Regression is significant at 5% level of significance



APPENDIX 13

DATA MATRIX WITH DEPENDENT VARIABLE

	Productivity score	%Mat var/s usage	%Labour var /std usage	%No prod du lab,serv & ma	%No prod due t mach. bkdwns	Asset utilisation	InventL of FP	Prod. target fulfilled	Asset tum. ratio
	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
JC1	17.67983	66.03847	12.43912	15.71938	23.67860	27.66443	63.42694	19.72013	44.81319
JC2	30.49494	59.40924	28.03689	32.74680	32.56375	26.98729	19.43236	56.23693	56.60963
JC3	9.21163	56.61310	29.69782	29.66907	31.69028	30.51859	19.43236	34.72866	56.32659
JC4	10.25179	54.44649	26.70386	29.95121	18.90607	24.49063	32.00572	54.69920	48.62535
JC5	63.96248	44.83826	33.19508	62.63815	36.12553	24.57827	34.28104	78.10528	63.69474
JC6	77.03377	47.05251	48.47299	49.24001	47.99923	36.14381	52.53683	74.30764	69.42883
JC7	10.52376	55.34929	12.88620	26.36651	24.38565	21.07346	73.70573	14.37176	58.99654
JC8	59.59063	56.75940	99.71702	23.61296	34.70185	25.63295	74.27645	61.74536	60.18291
JC9	72.36838	59.69869	40.88369	53.81684	28.84586	29.27992	27.99299	61.40553	66.30298
JC10	51.15153	54.55409	54.66599	47.83660	31.27441	30.03676	72.34210	63.74928	60.14332
JC11	66.25076	45.92950	67.44477	34.87974	40.80788	38.63768	72.93859	88.03077	65.26284
JC12	66.55710	54.06873	56.95352	54.06390	42.80398	33.55261	74.52994	85.26957	72.33273
JC13	24.84227	51.51521	60.53592	19.53143	43.72444	26.20861	76.00536	44.85635	69.14697
JC14	28.62150	50.28307	71.96815	46.78190	44.40071	36.37569	74.14939	67.20225	70.42572
JC15	10.25242	47.86241	87.14685	30.03876	33.94005	10.03726	19.43276	26.80029	64.82700
JC16	54.28885	37.96218	67.80651	64.16383	49.51704	33.87017	19.43276	75.73821	68.57777
JC17	54.16199	37.42652	56.75738	68.96323	50.21568	38.62390	19.43276	74.25755	72.99562
JC18	65.09959	59.62230	63.50003	46.49985	57.55195	35.26327	72.79076	81.62783	78.68461
JC19	59.37037	40.57747	56.16157	83.86415	41.99599	34.10438	32.21740	87.44357	72.20344
JC20	55.43870	54.43875	49.45378	48.92091	37.81964	37.76415	72.01593	75.33039	70.45806
JC21	66.28939	55.82031	58.44279	89.46915	40.09737	31.42449	41.57057	81.88867	77.19200
JC22	57.97697	55.85717	52.42805	22.49163	52.31671	34.30460	41.39175	75.18897	73.01264
JC23	38.86352	28.31310	56.94583	19.42415	41.05257	39.41720	59.54492	42.94943	73.46178
JC24	45.05143	47.68341	45.28259	20.30764	42.63976	36.98656	28.31738	72.76305	74.33098
JC25	47.02064	56.77024	44.00820	51.22306	35.75996	37.91132	23.79198	73.10324	70.43866
JC26	47.32829	60.51424	65.90891	60.04813	46.27120	39.20744	38.51108	74.47996	75.36062
JC27	25.75664	67.61270	76.12614	16.48350	38.00580	17.80874	69.58815	63.26894	77.88826
JC28	39.39613	57.06096	51.37537	10.15021	33.75734	32.04838	73.73202	65.74974	70.50324
JC29	47.81987	55.21180	38.73662	27.65748	37.50948	41.92918	65.76650	71.15653	71.18058
JC30	76.62394	65.61884	57.43269	68.43438	32.23247	43.31233	37.02590	90.37434	79.66330
JC31	55.49165	68.28012	57.20450	17.24989	38.08691	36.42636	24.80591	65.82383	74.93916
JC32	49.29950	65.21253	43.33519	63.00785	16.79699	34.02427	43.98854	69.03575	79.80576
JC33	78.25184	58.39058	74.25281	47.97775	37.87224	41.53624	26.37644	80.46051	85.19352
JC34	71.28970	56.86922	66.06452	67.01118	49.87170	42.76375	21.86779	90.81920	76.02414
JC35	49.17669	51.03445	70.70914	20.44573	35.80251	30.77011	4.59669	76.36208	51.99618
AVERAGE (Xbar)		53.84844	53.79087	42.0196274	38.029188584	32.5918517701	45.8072516056	66.258594	68.6008468

MEAN CORRECTED DATA MATRIX

JC1	12.1900322	−41.35175	−26.3002	−14.35059	−4.9274175	17.619685994	−46.538464874	−23.787661377
JC2	5.56079818	−25.75398	−9.27283	−5.465443	−5.6045601	−26.37489245	−10.021665352	−11.991214729
JC3	2.76466332	−24.09305	−12.3506	−6.338907	−2.073262	−26.37489245	−31.529931304	−12.274260586
JC4	0.59804717	−27.08701	−12.0684	−19.12311	−8.1012234	−13.80152671	−11.55939263	−19.975498286
JC5	−9.0101782	−20.59579	20.61852	−1.903657	−8.0135811	−11.52620798	11.846687019	−4.9061062872
JC6	−6.7959277	−5.317884	7.220384	9.9700391	3.55195862	6.7295744507	8.04904472712	0.8279787833
JC7	1.50085455	−40.90467	−15.6531	−13.64353	−11.518392	27.898476745	−51.886832712	−9.6043098671
JC8	2.91096655	45.926153	−18.4067	−3.32734	−6.9589063	28.469198633	−4.5132364633	−8.4179404807
JC9	5.85025104	−12.90718	11.79721	−9.18333	−3.3119367	−17.81426155	−4.8530642634	−2.297868247
JC10	0.70565666	0.8751179	5.816972	−6.75478	−2.5550876	26.53485078	−2.5093112637	−8.4575314048
JC11	−7.9189372	13.653895	−7.13989	2.7786935	6.04583315	27.131337794	21.7721757911	−3.3380073814
JC12	0.22028841	3.1626543	12.04428	4.7747871	0.96075859	28.722691386	19.0109734813	3.73188327927
JC13	−2.3332253	6.7450464	−22.4882	5.6952515	−6.3832419	30.198110536	−21.402240303	0.54612478284
JC14	−3.565372	18.177279	4.762275	6.3715188	3.78383728	28.342136907	0.94365302941	1.82487642308
JC15	−5.9860324	33.355981	−11.9809	−4.089136	−22.554589	−26.37449062	−39.458308513	−3.7738445066
JC16	−15.886257	14.015642	22.1442	11.487847	1.27832218	−26.37449062	9.47961924657	−0.0230741788
JC17	−16.421923	2.9665086	26.9436	12.18649	6.03204566	−26.37449062	7.99895790283	4.3947715812
JC18	5.77385742	9.7091559	4.480221	19.522765	2.67141352	26.983509951	15.3692377916	10.0837583013
JC19	−13.270966	2.3707013	41.84453	3.9668039	1.51252429	−13.58984689	21.1849727824	3.6025929191
JC20	0.59031222	−4.337088	6.901286	−0.209545	5.17230192	26.208674202	9.07179772718	1.85721286899
JC21	1.97186918	4.6519232	47.44952	2.068177	−1.11673626	−4.236681386	15.6300743246	8.59115408037
JC22	2.00872882	−1.362823	−19.528	14.287521	1.71275319	−4.415499158	8.93037575446	4.41179006844
JC23	−25.535339	3.1549547	−22.5955	3.0233791	6.82535004	13.737667355	−23.309163107	4.86092989134
JC24	−6.1650236	−8.508283	−21.712	4.6105692	4.39471068	−17.48986973	6.50445978807	5.73013562697
JC25	2.92180642	−9.78267	9.20343	−2.269226	5.31947096	−22.01526963	6.84464467433	1.83781770394
JC26	6.66580085	12.118036	18.0285	8.2420116	6.61558425	−7.296167655	8.22136160572	6.7597756735
JC27	13.7642575	22.335273	−25.5361	−0.023392	−14.783107	23.780897841	−2.9896562592	9.2874141013
JC28	3.21251706	−2.415502	−31.8694	−4.271845	−0.5434751	27.924768881	−0.508854406	1.9023902656
JC29	1.36335983	−15.05425	−14.3621	−0.519706	9.33732823	19.959249683	4.89793879587	2.57973271139
JC30	11.7704034	3.6418159	26.41475	−5.796722	10.720483	−8.781353621	24.115744678	11.0624580411
JC31	14.4316795	3.4136267	−24.7697	0.0577193	3.83450405	−21.00134161	−0.4347640567	6.33830960324
JC32	11.3640909	−10.45568	20.98822	−21.2322	1.43241339	−1.818707809	2.77715505785	11.2049094674
JC33	4.5421433	20.461937	5.958122	−0.156947	8.94439055	−19.43081553	14.2019195263	16.5926736138
JC34	3.02078454	12.273645	24.99156	11.842516	10.1718992	−23.93946543	24.5606019118	7.42329606187
JC35	−2.8139876	16.918269	−21.5739	−2.22668	−1.8217406	−41.2105597	10.1034898912	−16.604668517

Final Eigen Vectors(In Descending order of Eigen values) of the Covariance matrix – Computed using Power Method

	1	2	4						9	10	11
1	−0.0954656	0.0055157	0.342889								
2	0.49679048	0.5202496	−0.60779								
3	1	−0.11399	−0.89255								
4	0.26559643	0.1754146	0.123505								
5	0.2244553	0.055046	0.469374								
6	−0.5680743	1	−0.13474								
7	0.9679753	0.2742122	1								
8	0.32045769	0.1838463	0.139041								
9											
10											
11											
12											
13											
14											
15											

	Eigen values(Descending Order) – Computed by the Power method	Proportion of variation	
β1	803.182322	40.716%	Accept
β2	519.859502	26.354%	Accept
β3	321.589122	16.303%	Reject
β4	153.393489	7.776%	Accept
β5	90.7957635	4.603%	Reject
β6	55.4563432	2.811%	Reject
β7	28.3082618	1.435%	Reject
β8	0.05111041	0.003%	Reject
β9		0.000%	
β10		0.000%	
β11		0.000%	
β12		0.000%	
β13		0.000%	
β14		0.000%	
β15		0.000%	

Reject: All Eigen values which are −ve
All Eigen value which do not explain the variations sufficiently
All Eigen value which are not significant in the Regression Equation.

PRINCIPAL COMPONENTS USED FOR REGRESSION

JC1	−115.6049	−20.75158	−3.51788
JC2	−23.868106	−44.90555	14.39525
JC3	−46.20331	−49.61474	−4.82397
JC4	−42.229687	−37.15713	8.798351
JC5	25.3854372	−23.06966	−0.25371
JC6	12.9062601	7.4061941	4.613307
JC7	−111.47783	−10.61063	−24.7255
JC8	−21.553501	50.72457	−23.683
JC9	6.32991596	−29.38813	−6.13989
JC10	−16.396191	22.762444	−14.7759
JC11	7.08687327	41.181705	16.19216
JC12	18.3596786	35.785942	4.103675
JC13	−56.531291	31.137074	−12.5155
JC14	2.07228846	39.156545	−16.5794
JC15	−25.408384	−21.16097	−59.1533
JC16	58.1129968	−17.014	−18.6818
JC17	58.7094802	−22.52193	−14.9825
JC18	17.3170438	41.195766	8.880537
JC19	75.0633032	−9.948932	−18.623
JC20	0.28356422	26.245884	4.879288
JC21	70.1489637	−1.050455	−27.3995
JC22	−3.651137	2.9729894	31.65408
JC23	−45.064386	13.221896	−11.4129
JC24	−5.0713403	−15.58763	34.72632
JC25	24.3765436	−26.02816	11.01609
JC26	41.3552869	2.2970293	−6.90352
JC27	−32.505557	38.457387	2.092702
JC28	−50.378944	29.749558	26.22528
JC29	−25.783884	16.012104	29.32213
JC30	59.8439383	−1.61287	9.398973
JC31	−10.034959	−15.05506	30.06514
JC32	16.7034554	−10.41211	−5.85146
JC33	47.7582336	−2.029947	7.108934
JC34	75.9813734	−9.649385	6.325053
JC35	13.9687737	−30.73824	20.22552

Regression Output(PCA):

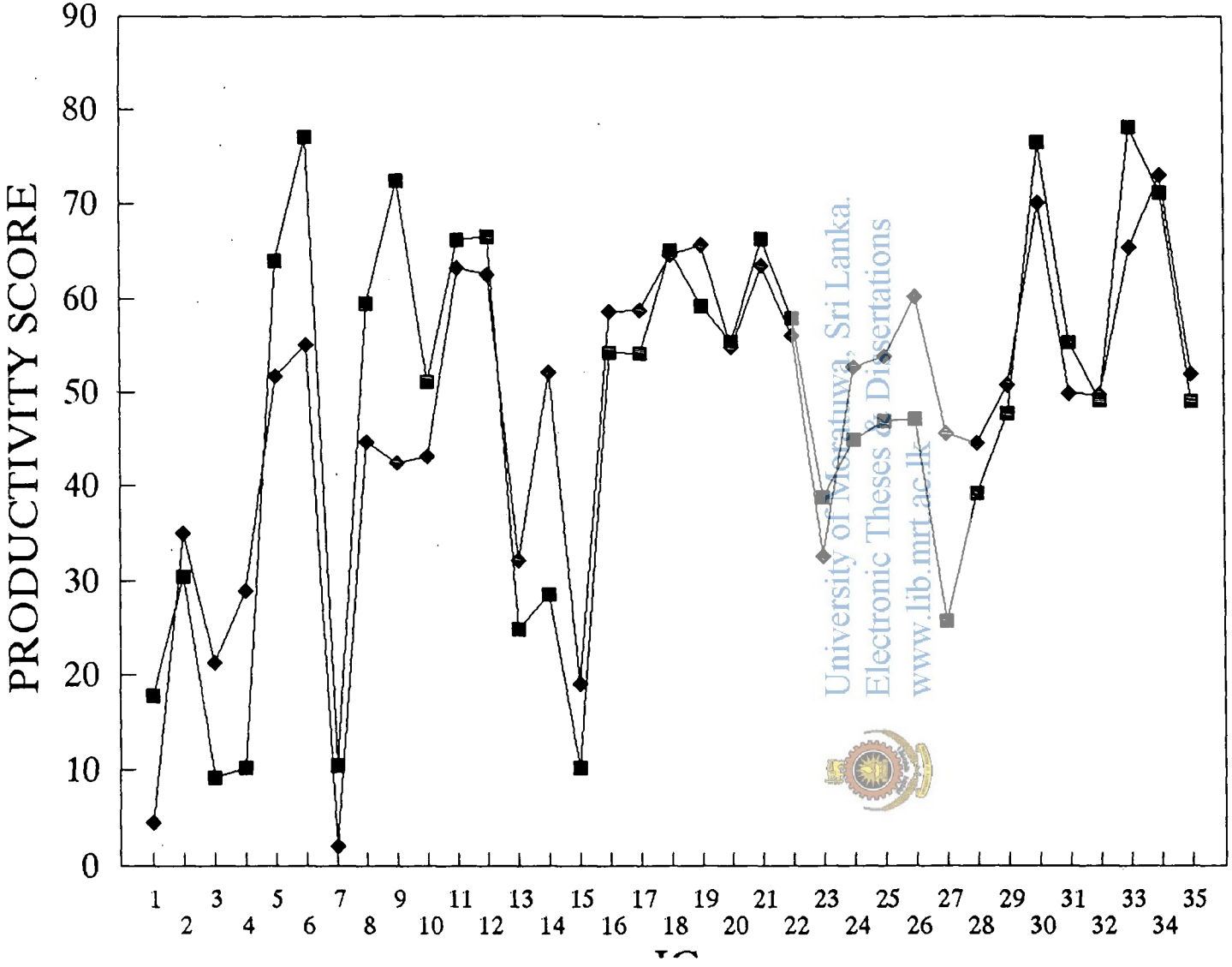
Constant		48.079671						
Std Err of Y Est		11.867613						
R Squared		0.6967294						
No. of Observations		35						
Degrees of Freedom		31						
PCA Coefficient(s)	0.331622	0.2044851	0.2761694					
Std Err of Coef.	0.043484	0.0747324	0.10275682					
Significant @ 5%(t test)	**Yes**	**Yes**	**Yes**					
X Coefficients								
X Coefficients	0.064165	0.1032777	0.06181665	0.1580555343	0.21531714829	−0.0211108582	0.6532434	0.18226356
Constant	−31.3761							

Fisher's test

	Sum of squares		
Regression	10030.494	3343.4978	F statistic = 23.7396
			F ratio is = 3.8710
Residual	4366.0477	140.84025	@5%

H0 = Data is not significant H1 = Data is significant

Therefore the Regression is significant at 5% level of significance



APPENDIX 14

DAILY DEPARTMENTAL BREAKDOWNS

LINE : No 1 DEPT. : HARD SOAPS [LOC. 535] DATE: 09 FEB 1994

SHIFT	DEFECT	Mc./ PLANT STOPPED AT	BREAKDOWN ATTEND. AT	BREAKDOWN COMPLTD. AT	Mc./ PLANT STARTED AT	DURATION OF B'DOWN	ENGINEER'S / ENG. ASSISTANT'S STATEMENT	INITIALS
G/C Pm	wrapper def:	8.20			9.00	40 Mts	check magazine due more damages →	

TOTAL BREAKDOWN TIME (MTS.)

Prod. Assistant ..... Plant Manager ..... Eng. Manager .....

DAILY DEPARTMENTAL BREAKDOWNS

LINE : No2 | DEPT. : HARD SOAPS [LOC. 535] | DATE: 0 9 FEB 1994

SHIFT	DEFECT	Mc./ PLANT STOPPED AT	BREAKDOWN ATTEND. AT	BREAKDOWN COMPLTD. AT	Mc./ PLANT STARTED AT	DURATION OF B'DOWN	ENGINEER'S / ENG. ASSISTANT'S STATEMENT	INITIALS
6/6	wrapper def:	6.00			8.00	120 mts	✓ off center wrapping	
	Stamper def	9.50			10.15	25 mts	gluet deft	
	Def: wrapper combing arm	12.50			1.40	50 mts	✓ Combing arm deft	[illegible]
	Def: wrapper combing arm	2.20			4.00	100 mts	✓ Replaced elevator arm	
6/6 pm	Air line [illegible] the gluet def	9.05			10.15	70 mts	Replace new hose and connectors	[illegible]
	Stamper Solenoid def (E)	1.45			2.15	30 mts	Electrical	[illegible]
	wrapper elevator finisher def	5.10			5.25	15 mts		[illegible]

TOTAL BREAKDOWN TIME (MTS.)

Prod. Assistant | Plant Manager | Eng. Manager

DAILY DEPARTMENTAL BREAKDOWNS

DEPT. : HARD SOAPS [LOC. 535]

DATE: 09 FEB 1994

LINE : 03

SHIFT	DEFECT	Mc./ PLANT STOPPED AT	BREAKDOWN ATTEND. AT	BREAKDOWN COMPLTD. AT	Mc./ PLANT STARTED AT	DURATION OF B'DOWN	ENGINEER'S / ENG. ASSISTANT'S STATEMENT	INITIALS
G/6 1	W/R Pusher	2.10			2.30	20	Off center wrapping	
2	W/R dy	2.30			2.45			
3	Stapler Dy	4.30			8.10			
G/6	wrapper motor belt dy	7.25			9.52		Started B/D at 9.20 (G/6 shift) on clean both pulleys and belt as item was greased and filters	
		12.05			12.20			

TOTAL BREAKDOWN TIME (MTS.)

Prod. Assistant

Plant Manager

Eng. Manager

DAILY DEPARTMENTAL BREAKDOWNS

09 FEB 1994

LINE : no. 8 DEPT. : HARD SOAPS [LOC. 535] DATE: .....

SHIFT	DEFECT	Mc./ PLANT STOPPED AT	BREAKDOWN ATTEND. AT	BREAKDOWN COMPLTD. AT	Mc./ PLANT STARTED AT	DURATION OF B'DOWN	ENGINEER'S / ENG. ASSISTANT'S STATEMENT	INITIALS
6	Def: Wrapper	6.30			6.50	20 m	Defn wrapper feed belt	
	Stamper Dies	7 a			7.45	45 mts	De blocked dies	
	Wrapper feed belt bearing	7.45			9.45	120 mts	Replaced bearings on wrapper feed belt	
	Stamper	9.45			10.25	40 m	attended to double stamping	
	- Eyeplate	11.40			12.a	15 mts		
	Def: Die compress	12.40			1a	20 mts		
	Defn Stamper Scrap belt	6.30					Replaced scrap belt with bed from p/m Stamper	

TOTAL BREAKDOWN TIME (MTS.)

..... Prod. Assistant

..... Plant Manager

..... Eng. Manager

DAILY DEPARTMENTAL BREAKDOWNS

DATE: 09 FEB 1994

LINE : No 9

DEPT. : HARD SOAPS [LOC. 535]

SHIFT	DEFECT	Mc./ PLANT STOPPED AT	BREAKDOWN ATTEND. AT	BREAKDOWN COMPLTD. AT	Mc./ PLANT STARTED AT	DURATION OF B'DOWN	ENGINEER'S / ENG. ASSISTANT'S STATEMENT	INITIALS
6/6	Def: wrapper (I/Drum problem)	6.45			7.10	25 mts		
	- do -	8.50			9.00	10 mts		
	- do -	10.00			10.20	20 mts		
	Eye plate change	1			2.05	15 mts		
6/6	Slower feed belt broken	8.50			11.00	130 mts	Started B/D at 9.00 pm (6/6 shift). replace divert. conveyor belt.	
	replace arm on wrapper				1.10	55 mts	Adjust Brakes of [illegible]	
	wrapper [illegible] seal def	12.15						
	wrapper on [illegible] photo cell [illegible]	1.45			2.00		[illegible] clean rubber roller adjust brake.	
	Biplan def	2.10			3.05		found the knife is not cutting properly connected biplam.	

TOTAL BREAKDOWN TIME (MTS.)

Prod. Assistant ....

Plant Manager ....

Eng. Manager ....

APPENDIX 15

HISTORICAL FAILURE DISTRIBUTION

MACHINE NUMBER: M12

TIME INTERVAL BETWEEN FAILURES(IN HOURS)	NO:OF FAILURES IN TIME INTERVAL	CUMULATIVE FREQUENCY	FAILURE DENSITY	HAZARD RATE	MACHINE RELIABILITY
FROM 0 TO 19	61	77	0.04146	0.04146	1.00000
FROM 19 TO 38	9	16	0.00812	0.02945	0.20779
FROM 38 TO 57	3	7	0.00204	0.02244	0.09091
FROM 57 TO 77	4	4	0.00272	0.05236	0.05195
FROM 77 TO 96		0	0.00000	ERR	0.00000

POPULATION SIZE : 77 OK

SIZE OF CLASS INTERVAL = 19.10

BARTLET'S TEST FOR EXPONENTIAL DISTRIBUTION

Ho:FAILURE DENSITY FUNCTION IS EXPONENTIAL H1:FAILURE DENSITY FUNCTION IS NOT EXPONENTIAL

K = 77 DEGREES OF FREEDOM = 76
X = 14.02 (CHI SQUARED DISTRIBUTION)
Y = 152.43

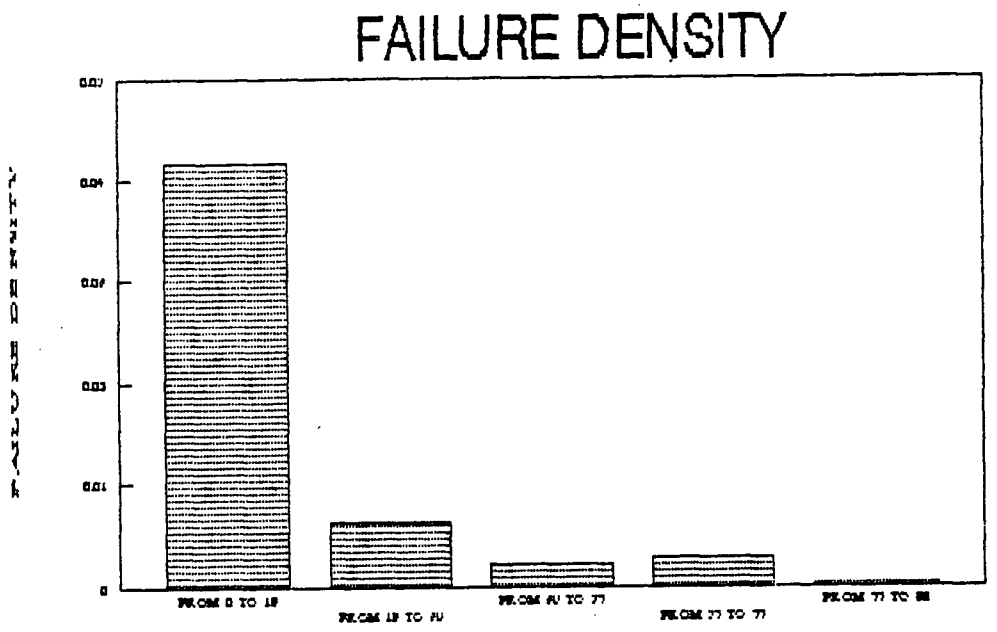
TEST STATISTIC,T = 87.08548

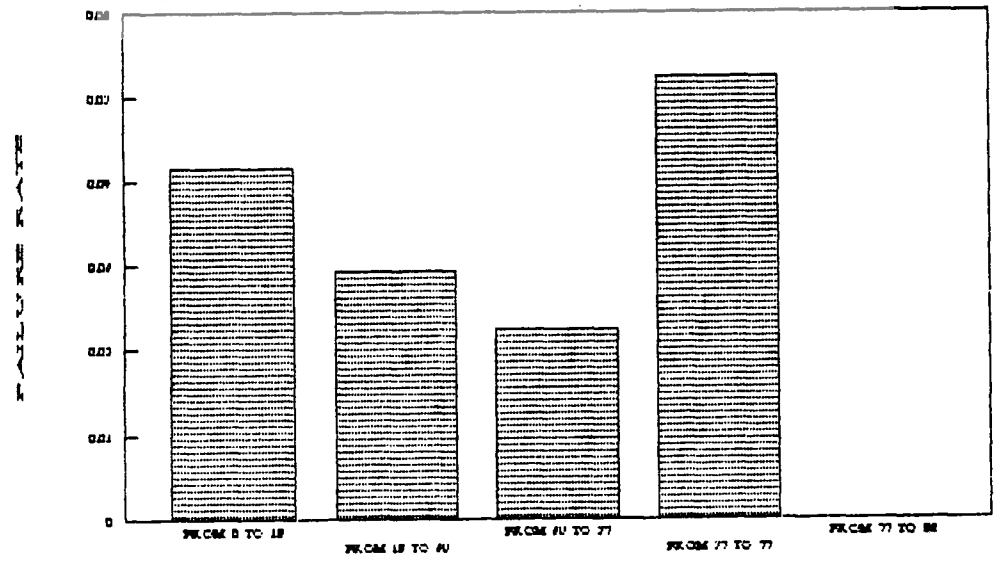
LEVELS OF SIGNIFICANCE	LEVEL(SMALLER TAIL)	LEVEL(LARGER TAIL)	STATUS
10% LEVEL OF SIGNIFICANCE	55.30	99.00	ACCEPTABLE
5% LEVEL OF SIGNIFICANCE	49.00	106.80	ACCEPTABLE
1% LEVEL OF SIGNIFICANCE	41.96	113.50	ACCEPTABLE

THE AVERAGE FAILURE RATE
(ACCORDING TO MAXIMUM LIKELIHOOD METHOD) 14.02174
AT 5% SIGNIFICANCE

THE COEFF. OF VARIATION OF FAILURE RATE 11.40%

HISTOGRAM OF FAILURE DENSITY AND BAR GRAPH OF FAILURE RATE





HISTORICAL FAILURE DISTRIBUTION

MACHINE NUMBER: M23

TIME INTERVAL BETWEEN FAILURES(IN HOURS)	NO;OF FAILURES IN TIME INTERVAL	CUMULATIVE FREQUENCY	FAILURE DENSITY	HAZARD RATE	MACHINE RELIABILITY
FROM 0 TO 27	24	37	0.02448	0.02448	1.00000
FROM 27 TO 53	8	13	0.00812	0.01742	0.35135
FROM 53 TO 80	2	7	0.00204	0.01078	0.18919
FROM 80 TO 106	4	5	0.00408	0.03019	0.13514
FROM 106 TO 133	1	1	0.00102	0.03774	0.02703

POPULATION SIZE : 37 OK

SIZE OF CLASS INTERVAL= 26.50

BARTLET'S TEST FOR EXPONENTIAL DISTRIBUTION

Ho:FAILURE DENSITY FUNCTION IS EXPONENTIAL H1:FAILURE DENSITY FUNCTION IS NOT EXPONENTIAL

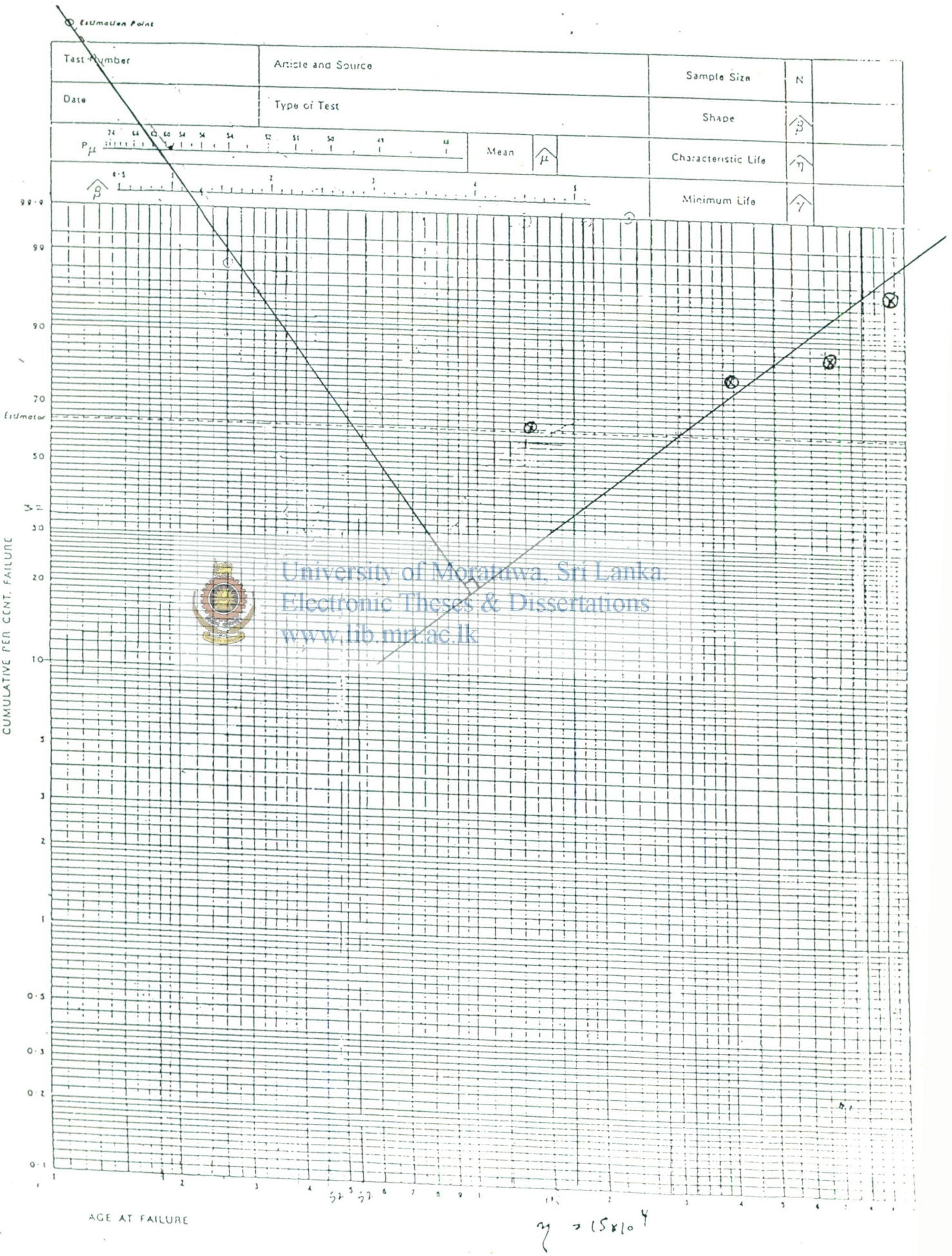
K = 37 DEGREES OF FREEDOM = 36
X = 27.49 (CHI SQUARED DISTRIBUTION)
Y = 78.55

TEST STATISTIC,T = 75.10986

LEVELS OF SIGNIFICANCE	LEVEL(SMALLER TAIL)	LEVEL(LARGER TAIL)	STATUS
10% LEVEL OF SIGNIFICANCE	23.30	51.00	NOT ACCEPTED
5% LEVEL OF SIGNIFICANCE	21.00	54.90	NOT ACCEPTED
1% LEVEL OF SIGNIFICANCE	17.46	61.50	NOT ACCEPTED

THE AVERAGE FAILURE RATE
(ACCORDING TO MAXIMUM LIKELIHOOD METHOD)DATA NOT EXPONENTIAL
AT 5% SIGNIFICANCE

Machine M23



$\eta = 15 \times 10^4$

APPENDIX 16

INPUT AREA

MACHINE NO: = M11 NO: OF CLASS INTERVALS 5

PRESS ~ONCE ALL DATA ARE ENTERED(MAX 768 DATA PTS)

TIME BETWEEN MACHINE BREAKDOWNS(IN HOURS)

6.6889	7.35847						
10.8111	5.2364						
11.9431	4.26582						
11.7133	2.3695						
17.5							
0.2333							
0.6222							
1.7111							
11.6667							
1.0111							
61.7223							
22.32226							
72.9178							
10.075							
14.2314							
9.4742							

Macro for EXPONENT.wk3

```
MACRO AREA                                                    \A
                                                              EXIT TO M PRESS "B" TO CONTINUE
                                                              /FS~R/FRM{WINDOWSON}{PANELON}{GOTO}INPUTAREA1~{\A}
                \0
                {WINDOWSON}{PANELON}{HOME}{LET FLAG1,1}{LET COUNTER,1}{LET COUNTCLASS,1}
                {MENUBRANCH "PETER"}~

                \A
                /RERAWDATA~/REDISTRIBUTION~{LET FLAG1,1}
          M11   ~/XL THE MACHINE NO:?~AA~
/CCOLUMN1~RAWDATA1~   5   ~/XN THE NO. OF CLASS INTERVALS(UPTO 20)?~BB~
          NEXT2 {GOTO}COLUMN1~/REDATAINPUT~
                /WTB{RIGHT}{RIGHT}~
          Y     ~/XL HAVE YOU TYPED IN CORRECTLY(Y/N)?~CC~
                ~{IF @LEFT(@UPPER(CC),1)="N"}/WTC{\A}
                ~{IF @LEFT(@UPPER(CC),1)="Y"}/WTC{BRANCH NEXT1}

          NEXT1 {IF FLAG1>48}~XL NOT PERMITTED("A" TO PROCESS)~EE~
FLAG1       1   {IF FLAG1>48}~{IF @LEFT(@UPPER(EE),1)="A"}{\B}
COUNTER     1   {IF FLAG1>48}~{BRANCH NEXT1}
                {FOR COUNTER,1,8,1,ROUTINE}
          N     ~/XL ARE THERE MORE DATA(Y/N)?~DD~
                ~{IF @LEFT(@UPPER(DD),1)="N"}{LET COUNTCLASS,1}{WINDOWSOFF}{PANELOFF}{\B}
                ~{IF @LEFT(@UPPER(DD),1)="Y"}{LET COUNTER,1}{GOTO}INPUTAREA1~{BRANCH NEXT2}

                \ROUTINE

                {RECALC LOC1}
                /RVLOC1~LOC2~
                /CCOLUMN8~RAWDATA8~
                {LET FLAG1,FLAG1+1}
                {RETURN}

                \B
{FOR COUNTCLASS,1,5,1,COUNTROUTINE}
                {CALC}
                /RVLOC3~LOC4~{GOTO}CLASS~
                {FOR COUNTCLASS,1,5,1,COUNTROUTINE}
          COUNTCLASS    1   {LET COUNTFREQ,1}{LET COUNTCLASS,1}{RECALC LOC6}
                /RVLOC6~LOC7~{GOTO}RAWDATA~
{FOR COUNTFREQ,1,20,1,FREQROUTINE}
                {FOR COUNTFREQ,1,20,1,FREQROUTINE}
                {LET COUNTCLASS,1}
          COUNTFREQ    21   {RECALC LOC12}
                /RVLOC12~LOC13~
{FOR COUNTCLASS,1,5,1,CALCULATION}
                {FOR COUNTCLASS,1,5,1,CALCULATION}
                {CALC}{CALC}
                {IF I874="NOT ACCEPTED"}{APP3}PRSPRINT1~LM10.1~R0.1~T1.0~B0.1~QQG{\0}
                /GRGQ{GOTO}CLASS~/GTBX.{END}{DOWN}~Q{GOTO}FAILDENS~
                /GA.{END}{DOWN}~Q/GOTFFAILURE DENSITY~TYFAILURE DENSITY~QSFAILDENS.CGM~RQ
                /GRGQ{GOTO}CLASS~/GTBX.{END}{DOWN}~Q{GOTO}FAILRATE~/GA.{END}{DOWN}~Q
                /GOTFFAILURE RATE~TYFAILURE RATE~QSFAILRATE.CGM~RQ
                {APP3}GAMFAILDENS.CGM~B888..J908~Q{APP3}GAMFAILRATE.CGM~B912..J932~Q
                {APP3}PRSPRINT2~G
                {\0}

                \COUNTROUTINE

                +FROM 0 TO 18
                {RECALC LOC5}
                /CLOC5~~
                /RVLOC5~~
                {DOWN}
                {RETURN}

                \FREQROUTINE
{FOR COUNTCLASS,1,5,1,SUBFREQROUTE}
                {RECALC LOC8}                {IF A67>=0}{IF A67<18}{LET FREQ1,FREQ1+1}
                /RVLOC8~LOC9~
                {FOR COUNTCLASS,1,5,1,SUBFREQROUTE}
                {LET COUNTCLASS,1}
                {RETURN}

                \SUBFREQROUTE

                {RECALC LOC10}
                /RVLOC10~LOC11~
                {IF A66>=73}{IF A66<91}{LET FREQ5,FREQ5+
                {RETURN}

                \CALCULATION

{LET G834,@SUM(E834..E853)}
{LET I834,(E834/(D823*E855))}
{LET M834,(G834/(E855))}
{LET K834,(I834/M834)}
                {RECALC LOC14}{RECALC LOC15}{RECALC LOC16}{RECALC LOC17}{CALC}
                /RVLOC14~LOC14A~
                /RVLOC15~LOC15A~
                /RVLOC16~LOC16A~
                /RVLOC17~LOC17A~
                {LET G838,@SUM(E838..E853)}
                {LET I838,(E838/(D823*E855))}
                {LET M838,(G838/(E855))}
                {LET K838,(I838/M838)}
                {CALC}{LET COUNTCLASS,1}
                {RETURN}
```

APPENDIX 17

A SAMPLE OF SIMULATION OUTPUT

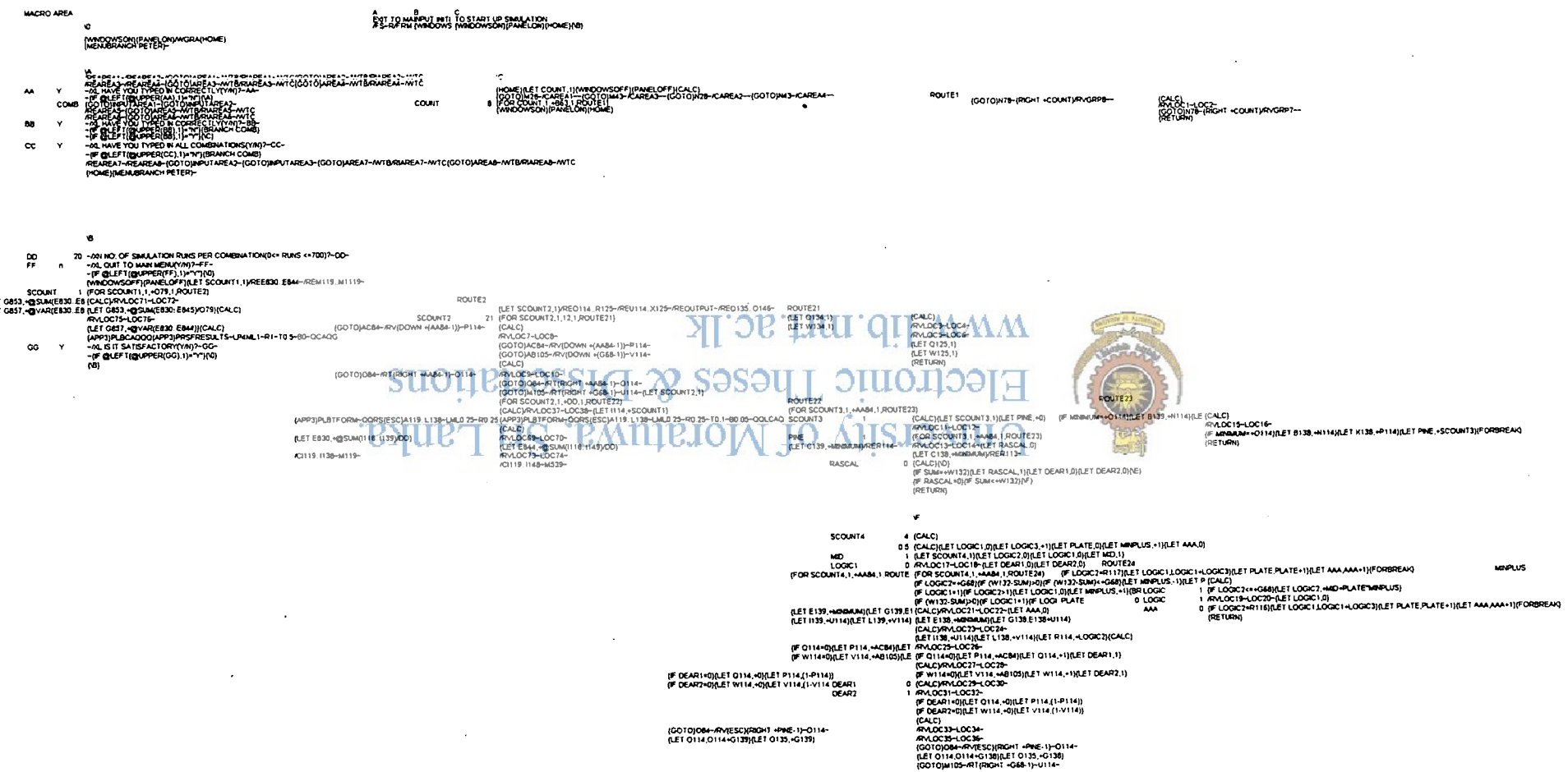
No: of combinations = 15
No: of gangs for repairs = 1

Combination no: presently simulated = 1

No: of simulation runs per combination = 20

Machine Group number	Time Machine broke down	Time entered for repair	Time repair completed	Total waiting time in the system	RND No: fail. time	RND No: Repair tim
GROUP 3	7.870959	7.870959	9.048234	1.177276	0.171416	0.628182
GROUP 1	16.05336	16.05336	16.359	0.305649	0.179974	0.371818
GROUP 2	75.2452	75.2452	76.33122	1.086017	0.826392	0.61157
GROUP 3	82.87248	82.87248	83.2103	0.337821	0.828584	0.38843
GROUP 2	84.52571	84.52571	84.77874	0.253028	0.173608	0.3418
GROUP 1	155.1083	155.1083	156.4704	1.36209	0.820026	0.6582
GROUP 2	158.6814	158.6814	159.3982	0.716739	0.820883	0.177307
GROUP 2	167.8801	167.8801	171.0732	3.193063	0.179117	0.822693
GROUP 3	170.4736	171.0732	173.1713	2.697632	0.875658	0.745218
GROUP 3	178.7292	178.7292	178.8641	0.134899	0.124342	0.254782
GROUP 3	186.7229	186.7229	187.448	0.725723	0.171175	0.1797
GROUP 2	196.3828	196.3828	199.5303	3.14755	0.445093	0.82022
GROUP 2	234.3164	234.3164	234.8712	0.554802	0.554907	0.127534
GROUP 2	236.0521	236.0521	240.4114	4.359344	0.027105	0.872466
GROUP 3	261.3318	261.3318	262.0307	0.698818	0.828825	0.522293
GROUP 3	308.3734	308.3734	308.9287	0.555306	0.669493	0.477707
GROUP 1	315.8365	315.8365	318.4598	2.623231	0.86051	0.78765
GROUP 3	325.7238	325.7238	325.8167	0.092935	0.330507	0.21234
GROUP 1	330.6143	330.6143	331.3213	0.707045	0.13949	0.17460
GROUP 1	336.1197	336.1197	339.3634	3.243786	0.057583	0.82539

Macro for SIMULA.wk3



\E

ROUTE4

\D

SCOUNT5 4 {CALC}
{LET SCOUNT5,+1}/RVLOC43~LOC44~
{FOR SCOUNT5,1,+AA84,1,ROUTED} {FOR SCOUNT5,1,+AA84,1,ROUTED}

ROUTED

{CALC}
/RVLOC41~LOC42~
{IF O138<=+MINIMUM}/RER117~ {IF O137<=+MINIMUM}/RER116~
{RETURN}

\E

ROUTE4

{CALC}
{FOR SCOUNT6,1,+AA84,1,ROUTE4} SCOU 2 /RVLOC45~LOC46~
{FOR SCOUNT6,1,+AA84,1,ROUTE4}
{CALC}{LET SCOUNT6,1}
/RVLOC67~LOC68~
{FOR SCOUNT6,1,+AA84,1,ROUTE5}
{CALC}
/RVLOC47~LOC48~
{LET E139,+LOGICMIN}{LET G139,E139+U113}{LET I139,G139-C139} {LET E127,+LOGICMIN}{LET G127,E127+U114}{LET I127,G127-C127}
/RVLOC49~LOC50~
{LET R114,+LOGGANG}{LET L139,+V113} {LET R116,+LOGGANG}{LET L127,+V114}
/RVLOC51~LOC52~
/RVLOC53~LOC54~
{IF Q114=0}{LET P114,+AC84}{LET Q114,+1}{LET DEAR1,1} {IF Q116=0}{LET P116,+AC86}{LET Q116,+1}{LET DEAR1,1}
{IF W113=0}{LET V113,+AB104}{LET W113,+1}{LET DEAR2,1} {IF W114=0}{LET V114,+AB105}{LET W114,+1}{LET DEAR2,1}
{CALC}
/RVLOC55~LOC56~
/RVLOC57~LOC58~
/RVLOC59~LOC60~
/RVLOC61~LOC62~
{IF DEAR1=0}{LET Q114,+0}{LET P114,(1-P114)} {IF DEAR1=0}{LET Q116,+0}{LET P116,(1-P116)}
{IF DEAR2=0}{LET W113,+0}{LET V113,(1-V113)} {IF DEAR2=0}{LET W114,+0}{LET V114,(1-V114)}
{GOTO}O84~/RV{ESC}{RIGHT +PINE-1}~O114~ {GOTO}O84~/RV{ESC}{RIGHT +PINE-1}~O116~
{LET O114,O114+G139}{LET O135,+G139}/RER115~ {LET O116,O116+G127}{LET O137,+G127}/RER115~
{CALC}
{GOTO}M105~/RT{RIGHT +G68-1}~U114~

ROUTE4

{IF R115=0}/REO136~ {CALC}
/RVLOC63~LOC64~
{IF R116=0}/REO137~
{RETURN}

ROUTE5

{IF O136=+LOGICMIN}{LET LOGMA{CALC}
/RVLOC65~LOC66~
{IF O136=+LOGICMIN}{LET LOGMACH,+N136}{FORBREAK
{RETURN}

APPENDIX 18

For Simulation 2 Lines 1a–3 incr by 10% , Lines 4–7 incr by 15% , Lines 8–9 incr by 13%

New values for series failure rate(Lamda)

	Base	New
Line 1a	0.22700	0.24970
Line 1	0.18486	0.20335
Line 2	0.11248	0.12373
Line 3	0.18991	0.20890
Line 4	0.24993	0.28742
Line 5	0.29140	0.33511
Line 6	0.14745	0.16957
Line 7	0.17640	0.20286
Line 8	0.16556	0.18708
Line 9	0.26530	0.29979

weights for machine failure rate

Line 1a		Line 1		Line 2		Line 3	
M1	0.08844	M1	0.10858	M2	0.16957	M2	0.10043
M11	0.31049	M13	0.38585	M21	0.32412	M23	0.48000
M12	0.60107	M14	0.50557	M22	0.50630	M24	0.41957

Line 4		Line 5		Line 6		Line 7	
M3	0.03956	M3	0.03393	M3	0.06706	M3	0.05606
M31	0.12662	M31	0.10860	M31	0.21461	M31	0.17940
M32	0.39073	M32	0.33513	M35	0.39133	M35	0.32712
M33	0.44308	M34	0.52234	M36	0.32699	M37	0.43742

Line 8		Line 9	
M3	0.05973	M3	0.03727
M38	0.39634	M38	0.24733
M39	0.24055	M311	0.12829
M310	0.30338	M312	0.58711

New machine failure rates

Line 1a		Line 1		Line 2		Line 3	
M1	0.02208	M1	0.02208	M2	0.02098	M2	0.02098
M11	0.07753	M13	0.07846	M21	0.04010	M23	0.10027
M12	0.15009	M14	0.10281	M22	0.06264	M24	0.08765

Line 4		Line 5		Line 6		Line 7	
M3	0.01137	M3	0.01137	M3	0.01137	M3	0.01137
M31	0.03639	M31	0.03639	M31	0.03639	M31	0.03639
M32	0.11230	M32	0.11231	M35	0.06636	M35	0.06636
M33	0.12735	M34	0.17504	M36	0.05545	M37	0.08874

Line 8		Line 9	
M3	0.01117	M3	0.01117
M38	0.07415	M38	0.07415
M39	0.04500	M311	0.03846
M310	0.05676	M312	0.17601

For Simulation 3 Lines 1a–3 incr by 20% , Lines 4–7 incr by 18% , Lines 8–9 incr by 15%

New values for series failure rate(Lamda)

	Base	New
Line 1a	0.22700	0.27240
Line 1	0.18486	0.22183
Line 2	0.11248	0.13498
Line 3	0.18991	0.22789
Line 4	0.24993	0.29492
Line 5	0.29140	0.34385
Line 6	0.14745	0.17399
Line 7	0.17640	0.20815
Line 8	0.16556	0.19039
Line 9	0.26530	0.30510

weights for machine failure rate

Line 1a		Line 1		Line 2		Line 3	
M1	0.08844	M1	0.10858	M2	0.16957	M2	0.10043
M11	0.31049	M13	0.38585	M21	0.32412	M23	0.48000
M12	0.60107	M14	0.50557	M22	0.50630	M24	0.41957

Line 4		Line 5		Line 6		Line 7	
M3	0.03956	M3	0.03393	M3	0.06706	M3	0.05606
M31	0.12662	M31	0.10860	M31	0.21461	M31	0.17940
M32	0.39073	M32	0.33513	M35	0.39133	M35	0.32712
M33	0.44308	M34	0.52234	M36	0.32699	M37	0.43742

Line 8		Line 9	
M3	0.05973	M3	0.03727
M38	0.39634	M38	0.24733
M39	0.24055	M311	0.12829
M310	0.30338	M312	0.58711

New machine failure rates

Line 1a		Line 1		Line 2		Line 3	
M1	0.02409	M1	0.02409	M2	0.02289	M2	0.02289
M11	0.08458	M13	0.08559	M21	0.04375	M23	0.10939
M12	0.16373	M14	0.11215	M22	0.06834	M24	0.09562

Line 4		Line 5		Line 6		Line 7	
M3	0.01167	M3	0.01167	M3	0.01167	M3	0.01167
M31	0.03734	M31	0.03734	M31	0.03734	M31	0.03734
M32	0.11523	M32	0.11524	M35	0.06809	M35	0.06809
M33	0.13067	M34	0.17961	M36	0.05689	M37	0.09105

Line 8		Line 9	
M3	0.01137	M3	0.01137
M38	0.07546	M38	0.07546
M39	0.04580	M311	0.03914
M310	0.05776	M312	0.17912

For Simulation 4 Lines 1a–3 decr by 5% , Lines 4–7 decr by 8% , Lines 8–9 decr by 3%

New values for series failure rate(Lamda)

	Base	New
Line 1a	0.22700	0.21565
Line 1	0.18486	0.17562
Line 2	0.11248	0.10686
Line 3	0.18991	0.18041
Line 4	0.24993	0.22994
Line 5	0.29140	0.26809
Line 6	0.14745	0.13565
Line 7	0.17640	0.16229
Line 8	0.16556	0.16059
Line 9	0.26530	0.25734

weights for machine failure rate

Line 1a		Line 1		Line 2		Line 3	
M1	0.08844	M1	0.10858	M2	0.16957	M2	0.10043
M11	0.31049	M13	0.38585	M21	0.32412	M23	0.48000
M12	0.60107	M14	0.50557	M22	0.50630	M24	0.41957

Line 4		Line 5		Line 6		Line 7	
M3	0.03956	M3	0.03393	M3	0.06706	M3	0.05606
M31	0.12662	M31	0.10860	M31	0.21461	M31	0.17940
M32	0.39073	M32	0.33513	M35	0.39133	M35	0.32712
M33	0.44308	M34	0.52234	M36	0.32699	M37	0.43742

Line 8		Line 9	
M3	0.05973	M3	0.03727
M38	0.39634	M38	0.24733
M39	0.24055	M311	0.12829
M310	0.30338	M312	0.58711

New machine failure rates

Line 1a		Line 1		Line 2		Line 3	
M1	0.01907	M1	0.01907	M2	0.01812	M2	0.01812
M11	0.06696	M13	0.06776	M21	0.03463	M23	0.08660
M12	0.12962	M14	0.08879	M22	0.05410	M24	0.07570

Line 4		Line 5		Line 6		Line 7	
M3	0.00910	M3	0.00910	M3	0.00910	M3	0.00910
M31	0.02911	M31	0.02911	M31	0.02911	M31	0.02911
M32	0.08984	M32	0.08984	M35	0.05309	M35	0.05309
M33	0.10188	M34	0.14003	M36	0.04436	M37	0.07099

Line 8		Line 9	
M3	0.00959	M3	0.00959
M38	0.06365	M38	0.06365
M39	0.03863	M311	0.03301
M310	0.04872	M312	0.15109

For Simulation 5 Lines 1a–3 decr by 9% , Lines 4–7 decr by 12% , Lines 8–9 decr by 5%

New values for series failure rate(Lamda)

	Base	New
Line 1a	0.22700	0.20657
Line 1	0.18486	0.16822
Line 2	0.11248	0.10236
Line 3	0.18991	0.17282
Line 4	0.24993	0.21994
Line 5	0.29140	0.25643
Line 6	0.14745	0.12976
Line 7	0.17640	0.15523
Line 8	0.16556	0.15728
Line 9	0.26530	0.25204

weights for machine failure rate

Line 1a		Line 1		Line 2		Line 3	
M1	0.08844	M1	0.10858	M2	0.16957	M2	0.10043
M11	0.31049	M13	0.38585	M21	0.32412	M23	0.48000
M12	0.60107	M14	0.50557	M22	0.50630	M24	0.41957

Line 4		Line 5		Line 6		Line 7	
M3	0.03956	M3	0.03393	M3	0.06706	M3	0.05606
M31	0.12662	M31	0.10860	M31	0.21461	M31	0.17940
M32	0.39073	M32	0.33513	M35	0.39133	M35	0.32712
M33	0.44308	M34	0.52234	M36	0.32699	M37	0.43742

Line 8		Line 9	
M3	0.05973	M3	0.03727
M38	0.39634	M38	0.24733
M39	0.24055	M311	0.12829
M310	0.30338	M312	0.58711

New machine failure rates

Line 1a		Line 1		Line 2		Line 3	
M1	0.01827	M1	0.01827	M2	0.01736	M2	0.01736
M11	0.06414	M13	0.06491	M21	0.03318	M23	0.08295
M12	0.12416	M14	0.08505	M22	0.05182	M24	0.07251

Line 4		Line 5		Line 6		Line 7	
M3	0.00870	M3	0.00870	M3	0.00870	M3	0.00870
M31	0.02785	M31	0.02785	M31	0.02785	M31	0.02785
M32	0.08594	M32	0.08594	M35	0.05078	M35	0.05078
M33	0.09745	M34	0.13394	M36	0.04243	M37	0.06790

Line 8		Line 9	
M3	0.00939	M3	0.00939
M38	0.06234	M38	0.06234
M39	0.03783	M311	0.03233
M310	0.04772	M312	0.14797

For Simulation 6 Lines 1a–3 decr by 15% , Lines 4–7 decr by 18% , Lines 8–9 decr by 13%

New values for series failure rate(Lamda)

	Base	New
Line 1a	0.22700	0.19295
Line 1	0.18486	0.15713
Line 2	0.11248	0.09561
Line 3	0.18991	0.16142
Line 4	0.24993	0.20494
Line 5	0.29140	0.23895
Line 6	0.14745	0.12091
Line 7	0.17640	0.14465
Line 8	0.16556	0.14404
Line 9	0.26530	0.23081

weights for machine failure rate

Line 1a		Line 1		Line 2		Line 3	
M1	0.08844	M1	0.10858	M2	0.16957	M2	0.10043
M11	0.31049	M13	0.38585	M21	0.32412	M23	0.48000
M12	0.60107	M14	0.50557	M22	0.50630	M24	0.41957

Line 4		Line 5		Line 6		Line 7	
M3	0.03956	M3	0.03393	M3	0.06706	M3	0.05606
M31	0.12662	M31	0.10860	M31	0.21461	M31	0.17940
M32	0.39073	M32	0.33513	M35	0.39133	M35	0.32712
M33	0.44308	M34	0.52234	M36	0.32699	M37	0.43742

Line 8		Line 9	
M3	0.05973	M3	0.03727
M38	0.39634	M38	0.24733
M39	0.24055	M311	0.12829
M310	0.30338	M312	0.58711

New machine failure rates

Line 1a		Line 1		Line 2		Line 3	
M1	0.01706	M1	0.01706	M2	0.01621	M2	0.01621
M11	0.05991	M13	0.06063	M21	0.03099	M23	0.07748
M12	0.11598	M14	0.07944	M22	0.04841	M24	0.06773

Line 4		Line 5		Line 6		Line 7	
M3	0.00811	M3	0.00811	M3	0.00811	M3	0.00811
M31	0.02595	M31	0.02595	M31	0.02595	M31	0.02595
M32	0.08008	M32	0.08008	M35	0.04732	M35	0.04732
M33	0.09081	M34	0.12481	M36	0.03954	M37	0.06327

Line 8		Line 9	
M3	0.00860	M3	0.00860
M38	0.05709	M38	0.05709
M39	0.03465	M311	0.02961
M310	0.04370	M312	0.13551

For Simulation 7 Lines 1a–3 decr by 22% , Lines 4–7 decr by 27% , Lines 8–9 decr by 20%

New values for series failure rate(Lamda)

	Base	New
Line 1a	0.22700	0.17706
Line 1	0.18486	0.14419
Line 2	0.11248	0.08773
Line 3	0.18991	0.14813
Line 4	0.24993	0.18245
Line 5	0.29140	0.21272
Line 6	0.14745	0.10764
Line 7	0.17640	0.12877
Line 8	0.16556	0.13245
Line 9	0.26530	0.21224

weights for machine failure rate

Line 1a		Line 1		Line 2		Line 3	
M1	0.08844	M1	0.10858	M2	0.16957	M2	0.10043
M11	0.31049	M13	0.38585	M21	0.32412	M23	0.48000
M12	0.60107	M14	0.50557	M22	0.50630	M24	0.41957

Line 4		Line 5		Line 6		Line 7	
M3	0.03956	M3	0.03393	M3	0.06706	M3	0.05606
M31	0.12662	M31	0.10860	M31	0.21461	M31	0.17940
M32	0.39073	M32	0.33513	M35	0.39133	M35	0.32712
M33	0.44308	M34	0.52234	M36	0.32699	M37	0.43742

Line 8		Line 9	
M3	0.05973	M3	0.03727
M38	0.39634	M38	0.24733
M39	0.24055	M311	0.12829
M310	0.30338	M312	0.58711

New machine failure rates

Line 1a		Line 1		Line 2		Line 3	
M1	0.01566	M1	0.01566	M2	0.01488	M2	0.01488
M11	0.05498	M13	0.05564	M21	0.02844	M23	0.07110
M12	0.10643	M14	0.07290	M22	0.04442	M24	0.06215

Line 4		Line 5		Line 6		Line 7	
M3	0.00722	M3	0.00722	M3	0.00722	M3	0.00722
M31	0.02310	M31	0.02310	M31	0.02310	M31	0.02310
M32	0.07129	M32	0.07129	M35	0.04212	M35	0.04212
M33	0.08084	M34	0.11111	M36	0.03520	M37	0.05633

Line 8		Line 9	
M3	0.00791	M3	0.00791
M38	0.05249	M38	0.05249
M39	0.03186	M311	0.02723
M310	0.04018	M312	0.12461

For Simulation 8 Lines 1a–3 decr by 60% , Lines 4–7 decr by 72% , Lines 8–9 decr by 64%

New values for series failure rate(Lamda)

	Base	New
Line 1a	0.22700	0.09080
Line 1	0.18486	0.07394
Line 2	0.11248	0.04499
Line 3	0.18991	0.07596
Line 4	0.24993	0.06998
Line 5	0.29140	0.08159
Line 6	0.14745	0.04129
Line 7	0.17640	0.04939
Line 8	0.16556	0.05960
Line 9	0.26530	0.09551

weights for machine failure rate

Line 1a		Line 1		Line 2		Line 3	
M1	0.08844	M1	0.10858	M2	0.16957	M2	0.10043
M11	0.31049	M13	0.38585	M21	0.32412	M23	0.48000
M12	0.60107	M14	0.50557	M22	0.50630	M24	0.41957

Line 4		Line 5		Line 6		Line 7	
M3	0.03956	M3	0.03393	M3	0.06706	M3	0.05606
M31	0.12662	M31	0.10860	M31	0.21461	M31	0.17940
M32	0.39073	M32	0.33513	M35	0.39133	M35	0.32712
M33	0.44308	M34	0.52234	M36	0.32699	M37	0.43742

Line 8		Line 9	
M3	0.05923	M3	0.03727
M38	0.39634	M38	0.24733
M39	0.24055	M311	0.12629
M310	0.30388	M312	0.58711

New machine failure rates

Line 1a		Line 1		Line 2		Line 3	
M1	0.00803	M1	0.00803	M2	0.00763	M2	0.00763
M11	0.02819	M13	0.02853	M21	0.01458	M23	0.03646
M12	0.05458	M14	0.03738	M22	0.02278	M24	0.03187

Line 4		Line 5		Line 6		Line 7	
M3	0.00277	M3	0.00277	M3	0.00277	M3	0.00277
M31	0.00886	M31	0.00886	M31	0.00886	M31	0.00886
M32	0.02734	M32	0.02734	M35	0.01616	M35	0.01616
M33	0.03101	M34	0.04262	M36	0.01350	M37	0.02161

Line 8		Line 9	
M3	0.00356	M3	0.00356
M38	0.02362	M38	0.02362
M39	0.01434	M311	0.01225
M310	0.01808	M312	0.05607

APPENDIX 19

SIMULATION 1

AVERAGE WAITING TIME

COMB 1	COMB 23	0.666649	0.565234
COMB 2	COMB 24	0.629665	0.500969
COMB 3	COMB 25	0.501047	0.636861
COMB 4	COMB 26	0.585629	0.605348
COMB 5	COMB 27	0.609939	0.653335
COMB 6	COMB 28	0.598068	0.678826
COMB 7	COMB 29	0.621001	0.566405
COMB 8	COMB 30	0.63739	0.62523
COMB 9	COMB 31	0.616233	0.605705
COMB 10	COMB 32	0.63268	0.599364
COMB 11	COMB 33	0.584388	0.626184
COMB 12	COMB 34	0.692521	0.643301
COMB 13	COMB 35	0.618867	0.621287
COMB 14	COMB 36	0.545991	0.636034
COMB 15	COMB 37	0.674489	0.608392
COMB 16	COMB 38	0.650322	0.604859
COMB 17	COMB 39	0.633592	0.611704
COMB 18	COMB 40	0.651149	0.47627
COMB 19	COMB 41	0.603162	0.641844
COMB 20	COMB 42	0.66309	0.600527
COMB 21	COMB 43	0.550281	0.707343
COMB 22	COMB 44	0.63319	0.688087

F I N A L R E S U L T S

AVERAGE WAITING TIME IN THE SYSTEM (ALL COMBINATIONS)	=	0.615965
VARIANCE FOR ALL COMBINATIONS	=	0.002341
NO: OF SIMULATED RUNS	=	14300
COEFFICIENT OF VARIATION	=	7.85%
NO OF RUNS FOR A 5% ERROR		3080.957
NO: OF SIMILAR REPAIR GANGS	=	2

AVERAGE WAITING TIME

COMB 1	COMB 23	0.571335	0.688177
COMB 2	COMB 24	0.659989	0.746093
COMB 3	COMB 25	0.606298	0.700588
COMB 4	COMB 26	0.682039	0.715508
COMB 5	COMB 27	0.600369	0.570873
COMB 6	COMB 28	0.606403	0.579419
COMB 7	COMB 29	0.596034	0.655427
COMB 8	COMB 30	0.619714	0.578279
COMB 9	COMB 31	0.599477	0.587804
COMB 10	COMB 32	0.628822	0.575926
COMB 11	COMB 33	0.565694	0.621779
COMB 12	COMB 34	0.559625	0.700747
COMB 13	COMB 35	0.713603	0.603416
COMB 14	COMB 36	0.571831	0.706763
COMB 15	COMB 37	0.56481	0.708861
COMB 16	COMB 38	0.587469	0.715724
COMB 17	COMB 39	0.581197	0.584077
COMB 18	COMB 40	0.664618	0.798119
COMB 19	COMB 41	0.555655	0.686211
COMB 20	COMB 42	0.595014	0.663637
COMB 21	COMB 43	0.645072	0.644415
COMB 22	COMB 44	0.708223	0.656951

F I N A L R E S U L T S

AVERAGE WAITING TIME IN THE SYSTEM (ALL COMBINATIONS)	=	0.635502
VARIANCE FOR ALL COMBINATIONS	=	0.003475
NO: OF SIMULATED RUNS	=	14300
COEFFICIENT OF VARIATION	=	9.28%
NO OF RUNS FOR A 5% ERROR		4297.548
NO: OF SIMILAR REPAIR GANGS	=	2

SIMULATION 3

AVERAGE WAITING TIME

COMB 1	COMB 23	0.71227	0.654599
COMB 2	COMB 24	0.604771	0.629645
COMB 3	COMB 25	0.720025	0.614936
COMB 4	COMB 26	0.595153	0.58511
COMB 5	COMB 27	0.596582	0.56831
COMB 6	COMB 28	0.614744	0.770646
COMB 7	COMB 29	0.6658	0.705211
COMB 8	COMB 30	0.678342	0.631974
COMB 9	COMB 31	0.723337	0.588355
COMB 10	COMB 32	0.647365	0.68331
COMB 11	COMB 33	0.555368	0.559381
COMB 12	COMB 34	0.669492	0.671082
COMB 13	COMB 35	0.695708	0.538552
COMB 14	COMB 36	0.545077	0.580459
COMB 15	COMB 37	0.644035	0.67073
COMB 16	COMB 38	0.573003	0.6738
COMB 17	COMB 39	0.658131	0.587937
COMB 18	COMB 40	0.683525	0.588582
COMB 19	COMB 41	0.600934	0.595749
COMB 20	COMB 42	0.650149	0.62815
COMB 21	COMB 43	0.602841	0.607572
COMB 22	COMB 44	0.556093	0.543223

F I N A L R E S U L T S

AVERAGE WAITING TIME IN THE SYSTEM (ALL COMBINATIONS)	=	0.628865
VARIANCE FOR ALL COMBINATIONS	=	0.003052
NO: OF SIMULATED RUNS	=	14300
COEFFICIENT OF VARIATION	=	8.79%
NO OF RUNS FOR A 5% ERROR		3854.317
NO: OF SIMILAR REPAIR GANGS	=	2

SIMULATION 4

AVERAGE WAITING TIME

COMB 1	COMB 23	0.689716	0.658046
COMB 2	COMB 24	0.608808	0.701382
COMB 3	COMB 25	0.576153	0.661289
COMB 4	COMB 26	0.632181	0.496674
COMB 5	COMB 27	0.609091	0.651735
COMB 6	COMB 28	0.578522	0.688006
COMB 7	COMB 29	0.686919	0.643056
COMB 8	COMB 30	0.615871	0.599136
COMB 9	COMB 31	0.694865	0.630361
COMB 10	COMB 32	0.590048	0.556044
COMB 11	COMB 33	0.542381	0.625061
COMB 12	COMB 34	0.747549	0.605038
COMB 13	COMB 35	0.552109	0.520776
COMB 14	COMB 36	0.623956	0.706115
COMB 15	COMB 37	0.645867	0.677568
COMB 16	COMB 38	0.629529	0.643687
COMB 17	COMB 39	0.615328	0.556202
COMB 18	COMB 40	0.651999	0.581477
COMB 19	COMB 41	0.583627	0.697215
COMB 20	COMB 42	0.657409	0.638209
COMB 21	COMB 43	0.626902	0.653305
COMB 22	COMB 44	0.608325	0.763122

F I N A L R E S U L T S

AVERAGE WAITING TIME IN THE SYSTEM (ALL COMBINATIONS)	=	0.630015
VARIANCE FOR ALL COMBINATIONS	=	0.00313
NO: OF SIMULATED RUNS	=	14300
COEFFICIENT OF VARIATION	=	8.88%
NO OF RUNS FOR A 5% ERROR		3938.152
NO: OF SIMILAR REPAIR GANGS	=	2

SIMULATION 6

AVERAGE WAITING TIME

COMB 1	COMB 23	0.548766	0.622045
COMB 2	COMB 24	0.677708	0.66465
COMB 3	COMB 25	0.608069	0.646291
COMB 4	COMB 26	0.629872	0.610627
COMB 5	COMB 27	0.592474	0.634636
COMB 6	COMB 28	0.594107	0.626148
COMB 7	COMB 29	0.604478	0.660635
COMB 8	COMB 30	0.619844	0.572717
COMB 9	COMB 31	0.651255	0.708759
COMB 10	COMB 32	0.635916	0.613272
COMB 11	COMB 33	0.618418	0.615194
COMB 12	COMB 34	0.627739	0.714988
COMB 13	COMB 35	0.641946	0.515375
COMB 14	COMB 36	0.512631	0.80712
COMB 15	COMB 37	0.592566	0.599829
COMB 16	COMB 38	0.52276	0.578383
COMB 17	COMB 39	0.67152	0.684235
COMB 18	COMB 40	0.547636	0.707551
COMB 19	COMB 41	0.567746	0.598128
COMB 20	COMB 42	0.677196	0.67725
COMB 21	COMB 43	0.645547	0.736184
COMB 22	COMB 44	0.612204	0.658175

F I N A L R E S U L T S

AVERAGE WAITING TIME IN THE SYSTEM = (ALL COMBINATIONS)		0.628468
VARIANCE FOR ALL COMBINATIONS	=	0.003358
NO: OF SIMULATED RUNS	=	14300
COEFFICIENT OF VARIATION	=	9.22%
NO OF RUNS FOR A 5% ERROR		4246.202
NO: OF SIMILAR REPAIR GANGS	=	2

SIMULATION 7

AVERAGE WAITING TIME

COMB 1	COMB 23	0.595461	0.63344
COMB 2	COMB 24	0.582271	0.643385
COMB 3	COMB 25	0.61176	0.618057
COMB 4	COMB 26	0.597123	0.600276
COMB 5	COMB 27	0.590718	0.558138
COMB 6	COMB 28	0.609317	0.608667
COMB 7	COMB 29	0.629003	0.614489
COMB 8	COMB 30	0.571554	0.616799
COMB 9	COMB 31	0.559632	0.60776
COMB 10	COMB 32	0.65355	0.584611
COMB 11	COMB 33	0.564155	0.459217
COMB 12	COMB 34	0.623725	0.634241
COMB 13	COMB 35	0.638094	0.624059
COMB 14	COMB 36	0.661637	0.56492
COMB 15	COMB 37	0.609395	0.577625
COMB 16	COMB 38	0.592794	0.59047
COMB 17	COMB 39	0.549259	0.566273
COMB 18	COMB 40	0.546735	0.609433
COMB 19	COMB 41	0.602261	0.65156
COMB 20	COMB 42	0.588168	0.579322
COMB 21	COMB 43	0.595326	0.573683
COMB 22	COMB 44	0.617982	0.684355

F I N A L R E S U L T S

AVERAGE WAITING TIME IN THE SYSTEM (ALL COMBINATIONS)	=	0.599789
VARIANCE FOR ALL COMBINATIONS	=	0.001395
NO: OF SIMULATED RUNS	=	14300
COEFFICIENT OF VARIATION	=	6.23%
NO OF RUNS FOR A 5% ERROR		1937.13
NO: OF SIMILAR REPAIR GANGS	=	2

SIMULATION 8

AVERAGE WAITING TIME

COMB 1	COMB 23	0.68624	0.604141
COMB 2	COMB 24	0.631348	0.591124
COMB 3	COMB 25	0.551079	0.553037
COMB 4	COMB 26	0.607378	0.608602
COMB 5	COMB 27	0.591887	0.700788
COMB 6	COMB 28	0.592931	0.658767
COMB 7	COMB 29	0.544571	0.639881
COMB 8	COMB 30	0.636424	0.62974
COMB 9	COMB 31	0.587427	0.627
COMB 10	COMB 32	0.579516	0.649788
COMB 11	COMB 33	0.663362	0.57666
COMB 12	COMB 34	0.725275	0.699446
COMB 13	COMB 35	0.659426	0.547185
COMB 14	COMB 36	0.736704	0.633469
COMB 15	COMB 37	0.590252	0.645755
COMB 16	COMB 38	0.511701	0.619625
COMB 17	COMB 39	0.65891	0.570727
COMB 18	COMB 40	0.631495	0.620796
COMB 19	COMB 41	0.645583	0.617141
COMB 20	COMB 42	0.54934	0.589256
COMB 21	COMB 43	0.641833	0.572256
COMB 22	COMB 44	0.590952	0.626617

F I N A L R E S U L T S

AVERAGE WAITING TIME IN THE SYSTEM (ALL COMBINATIONS)	=	0.618078
VARIANCE FOR ALL COMBINATIONS	=	0.002364
NO: OF SIMULATED RUNS	=	14300
COEFFICIENT OF VARIATION	=	7.87%
NO OF RUNS FOR A 5% ERROR		3090.171
NO: OF SIMILAR REPAIR GANGS	=	2

APPENDIX 20

DATA FOR 1994

Inventory level of Finished goods(cases)

	SL	LB
JC01	132	37
JC02	88	42
JC03	77	35
JC04	58	19
JC05	0	17
JC06	3	17
JC07	11	22
JC08	0	17

Effective assets utilisation

JC01	41.301%
JC02	31.470%
JC03	37.025%
JC04	32.654%
JC05	35.445%
JC06	42.875%
JC07	42.980%
JC08	33.273%

Production target fulfilled

	SL	LB
JC01	98.488%	112.630%
JC02	87.805%	104.375%
JC03	83.423%	69.232%
JC04	89.030%	82.831%
JC05	89.283%	93.270%
JC06	98.904%	93.295%
JC07	98.347%	94.950%
JC08	87.257%	84.638%

Labour variance

JC01	0.6204%
JC02	3.7099%
JC03	15.2720%
JC04	-2.6749%
JC05	-5.6129%
JC06	-1.9533%
JC07	-1.2350%
JC08	

Material variance

	SL- perfume	LB-Perfume	SL+LB-chemicals	SL-Wrap	LB-Wrap	SL-Corr boxes	LB-Corr boxes
JC01	-1.020%	-0.390%	0.396%	1.226%	4.430%	0.090%	0.610%
JC02	0.840%	2.950%	1.167%	-5.155%	3.720%	-2.910%	-2.400%
JC03	3.510%	3.620%	4.128%	-0.572%	3.630%	-4.220%	-1.510%
JC04	-2.410%	3.930%	-1.518%	1.185%	2.940%	0.040%	0.010%
JC05	-1.570%	-0.250%	0.581%	-25.497%	1.250%	-3.000%	-3.540%
JC06	-1.430%	3.290%	0.431%	16.958%	1.410%	-0.380%	0.660%
JC07	-2.660%	2.920%	-1.768%	6.270%	1.960%	0.120%	1.330%
JC08							

Asset turnover ratio

JC01	0.5155902
JC02	0.1173796
JC03	0.1159882
JC04	0.6663927
JC05	0.5420927
JC06	0.1238894
JC07	0.1497173
JC08	0.1280626

% machine breakdowns/available hours

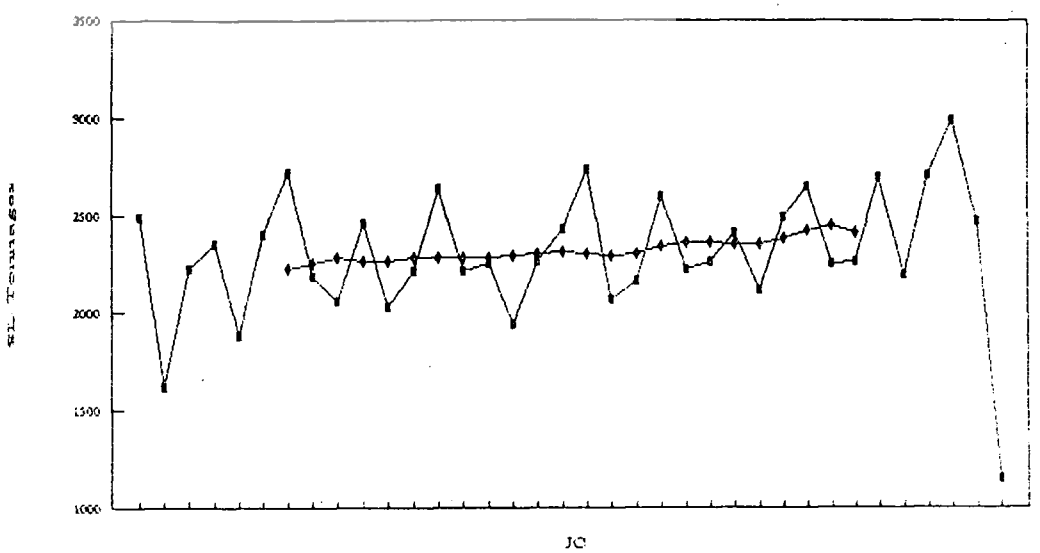
JC01	9.580%
JC02	14.163%
JC03	16.905%
JC04	14.489%
JC05	14.337%
JC06	11.917%
JC07	14.638%
JC08	

% No material,no services /available hours

JC01	11.574%
JC02	13.763%
JC03	15.560%
JC04	16.822%
JC05	7.764%
JC06	14.594%
JC07	10.539%
JC08	

SUNLIGHT

	Month	Tonnages (Y)	Sum of 12	Sum of 24	Trend (t)	Y/t = s x r
1991	JC 1	2490.473				
	JC 2	1617.847				
	JC 3	2225.167				
	JC 4	2352.067				
	JC 5	1881.208				
	JC 6	2404.263				
	JC 7	2716.058	26627.16	53407.26	2225.302	1.220534
	JC 8	2183.111	26780.1	54159.12	2256.63	0.967421
	JC 9	2057.238	27379.02	54789.38	2282.891	0.901155
	JC 10	2457.277	27410.36	54414.37	2267.266	1.083806
	JC 11	2025.926	27004.02	54389.39	2266.225	0.893965
	JC 12	2216.527	27385.37	54794	2283.083	0.970848
1992	JC 1	2643.407	27408.62	54842.96	2285.123	1.15679
	JC 2	2216.773	27434.34	54757.23	2281.551	0.971608
	JC 3	2256.501	27322.89	54762.51	2281.771	0.988925
	JC 4	1945.729	27439.62	55021.1	2292.546	0.84872
	JC 5	2262.561	27581.48	55364.25	2306.844	0.980804
	JC 6	2427.516	27782.77	55619.65	2317.485	1.047478
	JC 7	2741.772	27836.88	55444.18	2310.174	1.186525
	JC 8	2071.664	27607.3	55120.64	2296.693	0.90202
	JC 9	2173.963	27513.34	55261.47	2302.561	0.94415
	JC 10	2599.141	27748.13	56207.83	2341.993	1.109799
	JC 11	2227.218	28459.7	56918.25	2371.594	0.939123
	JC 12	2270.630	28458.55	56760.43	2365.018	0.96009
1993	JC 1	2413.835	28301.89	56562.82	2356.784	1.024207
	JC 2	2122.810	28260.94	56650.69	2360.454	0.899323
	JC 3	2491.286	28389.95	57316.73	2388.197	1.043166
	JC 4	2657.304	28926.78	58248.22	2427.009	1.094888
	JC 5	2261.407	29321.44	58891.65	2453.819	0.921587
	JC 6	2270.855	29570.21	58020.63	2417.526	0.93933
	JC 7	2700.824	28450.41			
	JC 8	2200.680				
	JC 9	2710.786				
	JC 10	2993.804				
	JC 11	2475.993				
	JC 12	2150.828				

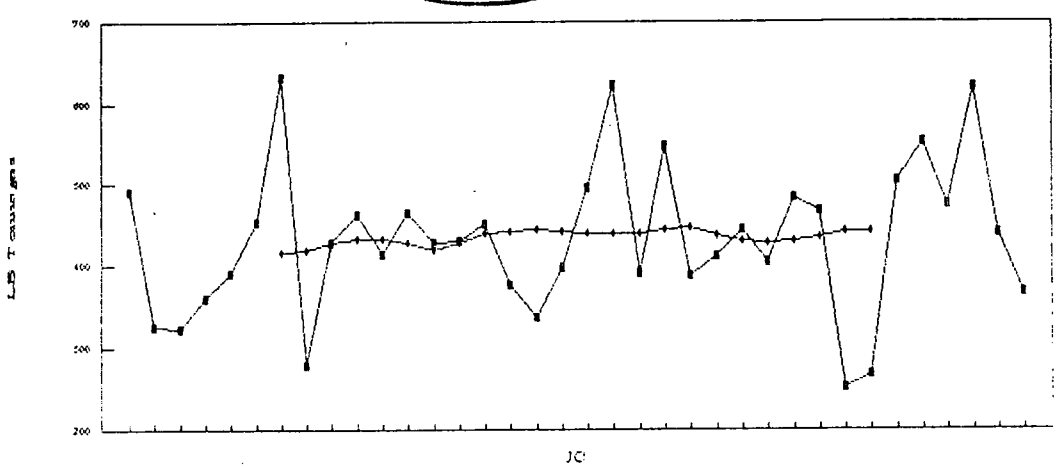


	1991	1992	1993	sum	Average	Rectified
JC1		1.15679	1.024207	2.180997	1.090498	1.0907
JC2		0.971608	0.899323	1.870931	0.935465	0.9356
JC3		0.988925	1.043166	2.032091	1.016046	1.0162
JC4		0.84872	1.094888	1.943608	0.971804	0.9719
JC5		0.980804	0.921587	1.90239	0.951195	0.9513
JC6		1.047478	0.93933	1.986809	0.993404	0.9935
JC7	1.220534	1.186825		2.407359	1.20368	1.2039
JC8	0.967421	0.90202		1.869441	0.934721	0.9349
JC9	0.901155	0.94415		1.845305	0.922652	0.9226
JC10	1.083806	1.109799		2.193605	1.096803	1.0970
JC11	0.893965	0.939123		1.833088	0.916544	0.9167
JC12	0.970848	0.96009		1.930938	0.965469	0.9656

Total	11.99828	12

LIFEBUOY

	Month	Tonnages (Y)	Sum of 12	Sum of 24	Trend (t)	Y/t = s x
1991	JC 1	493.035				
	JC 2	326.990				
	JC 3	324.867				
	JC 4	361.221				
	JC 5	391.369				
	JC 6	453.660				
	JC 7	630.927	5034.718	10004.34	416.8475	1.51356
	JC 8	280.700	4969.622	10044.02	418.5008	0.67072
	JC 9	429.063	5074.397	10277.21	428.2171	1.00197
	JC 10	463.283	5202.813	10422.16	434.2566	1.06684
	JC 11	414.137	5219.346	10385.27	432.7194	0.95705
	JC 12	465.466	5165.92	10276.49	428.1873	1.08706
1992	JC 1	427.939	5110.574	10086.36	420.2652	1.0182
	JC 2	431.765	4975.79	10293.27	428.8864	1.00671
	JC 3	453.283	5317.483	10596.98	441.5408	1.02659
	JC 4	3[illegible]7.754	5279.496	10643.29	443.4702	0.85181
	JC 5	337.943	5363.789	10703.82	445.9923	0.75773
	JC 6	398.314	5340.026	10627.24	442.8016	0.89953
	JC 7	496.143	5287.212	10590.91	441.2879	1.12430
	JC 8	622.393	5303.698	10582.35	440.9314	1.41154
	JC 9	391.076	5278.656	10588.19	441.1746	0.88644
	JC 10	547.576	5309.534	10709.33	446.2221	1.22713
	JC 11	390.374	5399.796	10712.47	446.3527	0.87468
	JC 12	412.652	5312.669	10495.41	437.3086	0.94361
1993	JC 1	444.425	5182.738	10375.82	432.3258	1.02798
	JC 2	406.723	5193.08	10316.02	429.8343	0.94623
	JC 3	484.161	5122.943	10330.31	430.4297	1.12483
	JC 4	468.016	5207.37	10487.78	436.9908	1.07099
	JC 5	250.816	5280.409	10609.94	442.081	0.56735
	JC 6	268.383	5329.534	10614.83	442.2844	0.60681
	JC 7	506.485	5285.291			
	JC 8	552.256				
	JC 9	475.508				
	JC 10	620.615				
	JC 11	439.496				
	JC 12	368.409				



	1991	1992	1993	sum	Average	Rectified
JC1		1.01826	1.027988	2.046246	1.023123	1.0374
JC2		1.008712	0.946232	1.952944	0.976472	0.9901
JC3		1.026594	1.124832	2.151425	1.075713	1.0907
JC4		0.861814	1.070997	1.932811	0.961408	0.9748
JC5		0.757733	0.567353	1.325086	0.662543	0.6718
JC6		0.899532	0.606811	1.506343	0.753171	0.7637
JC7	1.513588	1.124307		2.637875	1.318937	1.3373
JC8	0.670726	1.411542		2.082269	1.041135	1.0557
JC9	1.001875	0.838443		1.868416	0.944209	0.9574
JC10	1.066842	1.227136		2.293979	1.14699	1.1630
JC11	0.957057	0.874566		1.831843	0.915922	0.9286
JC12	1.087062	0.943817		2.030879	1.01594	1.0295

Total	11.83468	12