References

Barlow, R., Hunter, L. 1960. "Optimum Preventive Maintenance Policies" <u>Operations Research</u> Vol. 8, pp. 90-100.

Berger, D.L. 1987. "A Maintenance Management System for Decreased Downtime and Increased Mechanic Utilization" <u>Maintenance Management</u> (Ed. By Edward Hartmann). Industrial Engineering and Management Press. pp. 47-54.

Christer, A. H. ; and Whitelaw J. 1983. "An Operational Research Approach to Breakdown Maintenance: Problem Recognition" <u>Journal of Operational Research Society</u> Vol. 34, No. 11, pp. 1041-1052.

Duffuaa, S.O., ; Raouf, A. ; and Campbell, J.D. 1999. <u>Planning and Control of Maintenance Systems: Modeling and Analysis</u>. New York: John Wiley & Sons, Inc.

Kelly, A. 1984. <u>Maintenance Planning and Control</u>. Great Britain: Butterworths.

Lewis, E.E. 1996. <u>Introduction to Reliability Engineering</u>. New York: John Wiley & Sons, Inc.

Mann, L. 1982. <u>Maintenance Management</u>. Toronto: Lexington Books.

Nagarur, N., ; Keawplang, J. ; and Batanov, D. 1999. "Methodology for Developing Maintenance Management Systems Using Object Orientation" <u>Human Factors and Ergonomics in Manufacturing</u> Vol. 9, pp. 27-47.

Nelson, W. 1982. <u>Applied Life Data Analysis</u>. New York: Wiley.

Pintelon, L.M. ; and Gelders, L.F. 1992. "Maintenance management decision making" <u>European Journal of Operational Research</u> Vol. 58, pp. 301-317.

Sauter, V. 1997. <u>Decision Support Systems: An Applied Managerial Approach</u>. New York: John Wiley & Sons, Inc.

Sprague, R.H. and Watson, H.J. 1993. <u>Decision Support Systems: Putting Theory into Practice</u>. New Jersey: Prentice-Hall International.

Turban, E. 1988. <u>Decision Support and Expert Systems: Managerial Perspectives</u>. (n.p.): Macmillan Publishing Company.

Zijlstra, M. 1980. "Optimum Replacement and Maintenance Policies for Units with a Decreasing Performance Level" <u>European Journal of Operational Research</u> Vol. 5, pp. 267-275.
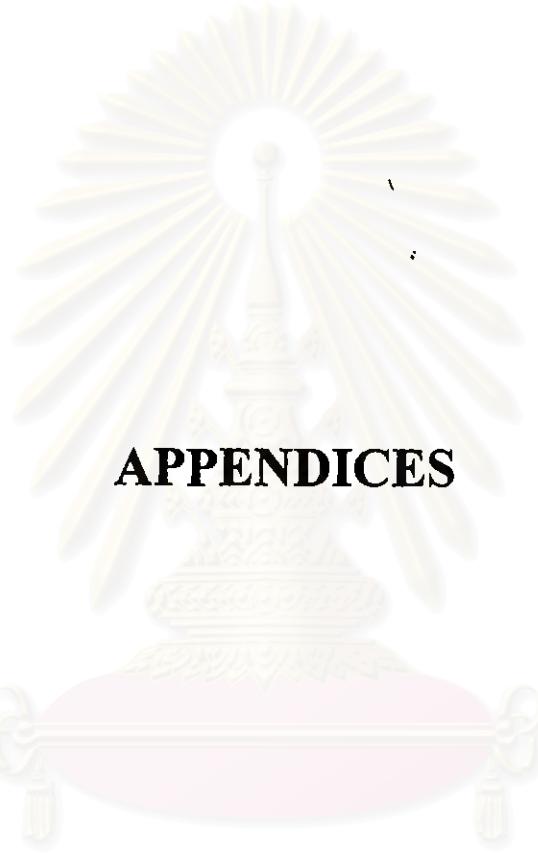
APPENDICES

Appendix A

DSMP Manual

A-1 System Requirement

- Operating System: Windows 95 or 98
- CPU Type & Speed: Pentium Celeron 266MHz
- Memory: 32 MB RAM
- Hard Drive Space: 6MB
- Application Development Software: Visual FoxPro 6.0

A-2 System Installation

(1) Select folder **d:\Dsmp**.

(2) Create folder **c:\Dsmp**.

(3) Copy files from **d:\Dsmp** to **c:\Dsmp**.

A-3 Starting the System

(1) Open the program Visual FoxPro.

(2) Open the project **c:\Dsmp\Dsmp.pjx**.

(3) Select the form **main menu** and click **run**.

A-4 Exploring the System

DSMP software composes of three major components as following:

- *Database*: for storing input and output data of the system.

- *Menus and Forms*: for interacting and directing the system.

- *Programs*: consist of knowledge base and model base for data analysis.

A-5 System Database

DSMP database composes of 39 table files for storing input, output, and in-process data. Figure A.1 presents the database in DSMP software.
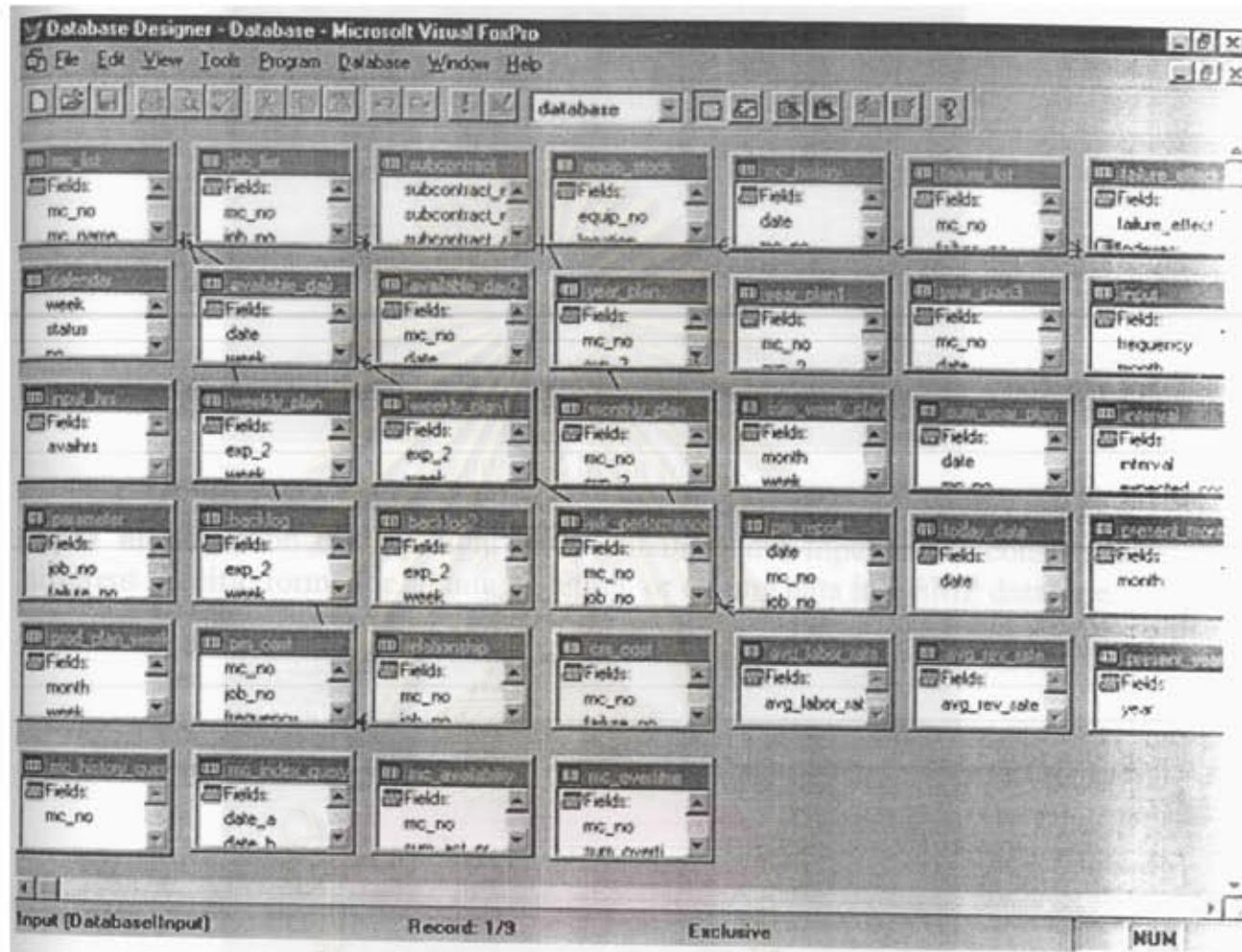

Figure A.1 DSMP Database.

A-6 System menus and forms

DSMP menu composes of main menu and 8 sub-menus for recording. browsing, and directing the system. Main menu of DSMP is presented in Figure A.2. From the main menu, users can select sub-menus or command buttons browsing into sub-menus or executing programs. Sub-menus in main menu are presented as follows:
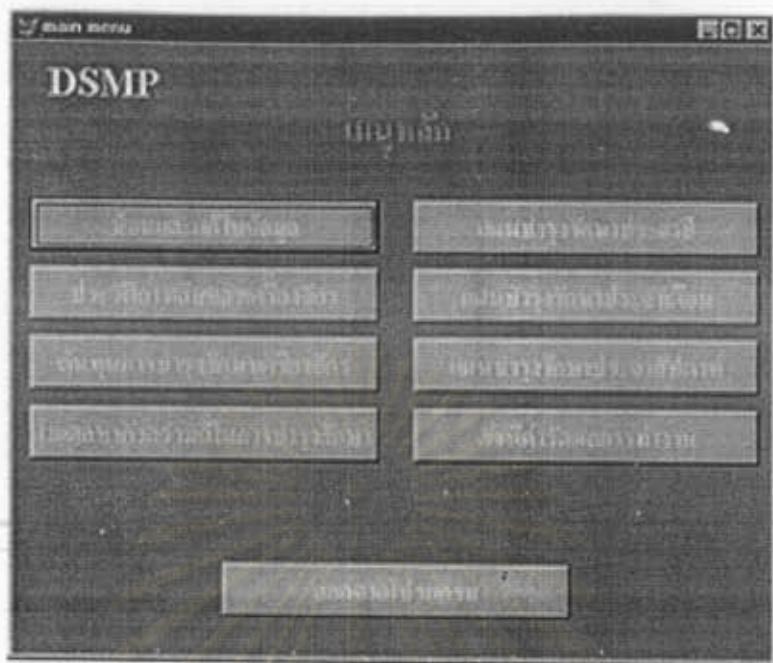
Figure A.2 Main Menu.

Input menu: is on the top right of the main menu. Input menu consists of different specific forms for adding, deleting, or editing data in DSMP database.
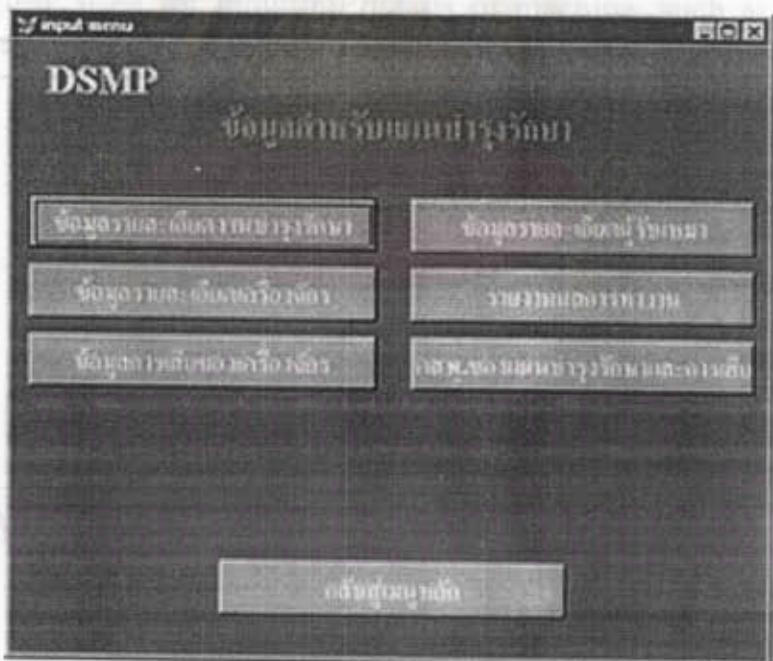
Figure A.3 Input Menu.

According to Figure A.3, input menu consists of 6 specific forms for recording data as following:

- *Preventive task form*: used for inputting details of preventive task, job no, frequency, and work hours into job list table file.

Figure A.4 Preventive Task Form.

- *Machine form*: used for inputting details of machine, such as machine no, machine name, and specific details into machine list table file.

Figure A.5 Machine Form.

- *Failure form*: used for inputting details of machine failure, such as failure no, failure effect, repair time, and failure details into failure list table file.

Figure A.6 Failure Form.

- *Subcontractor form*: used for inputting details of subcontractor, such as subcontractor no, address, and service rate into subcontractor list table file.

Figure A.7 Subcontractor Form.

- *Report form*: used for inputting summary of daily maintenance work and failure. Report form composes of 2 sub-forms and command for updating weekly plan.

Figure A.8 Report Form.

- *Work report sub-form*: used for inputting maintenance work report, such as date, job no, work hours, and workforces into weekly plan summary table file.

Figure A.9 Maintenance Work Report Sub-form.

- *Failure report sub-form*: used for inputting machine failure report, such as date, failure no., downtime, and repair time into machine failure history table

file.

Figure A.10 Machine Failure Report Sub-form.

After data of daily maintenance work report and machine failure is recorded. Weekly maintenance plan can be updated by using update command in report form.

- *Relationship form*: used for recording relationships between preventive task and machine failure into relationship table file.

Figure A.11 Relationship Form.

Machine failure history command: is on the second right of the main menu. Machine failure history command is used for browsing number of failures occurred to a specific machine. After selecting the command, DSMP software will ask users to identify machine no that users demand to see. Figure A.11 presents the request form for identifying machine no.

Figure A.12 Machine No Request Form.

After selecting machine no, list of failure history of specific machine is presented as in figure A.12.

Date	Mc_no	Failure_no	Downtime	Repairtime	Subcontract_no
10/14/1997	P01	P01-006	8.00	5.00	0001
12/23/97	P01	P01-035	4.00	1.00	0001
01/12/98	P01	P01-013	2.50	1.00	0001
04/03/98	P01	P01-012	5.00	3.50	0001
04/17/98	P01	P01-006	6.00	4.00	0001
04/20/98	P01	P01-030	5.00	2.00	0001
04/28/98	P01	P01-013	2.00	1.50	
07/10/98	P01	P01-028	2.00	1.50	
08/24/98	P01	P01-021	3.00	2.00	
09/04/98	P01	P01-003	2.00	0.67	0001
09/09/98	P01	P01-016	4.00	3.00	0001
02/12/99	P01	P01-003	1.00	0.83	
04/16/99	P01	P01-021	3.00	1.75	
05/10/99	P01	P01-036	1.50	1.50	
05/20/99	P01	P01-003	0.50	0.33	
05/31/99	P01	P01-027	8.00	3.00	0001

Figure A.13 Machine Failure History List.

Maintenance cost menu: is on the third right of the main menu. Maintenance cost menu consists of different commands for calculating, comparing and browsing different types of maintenance costs.
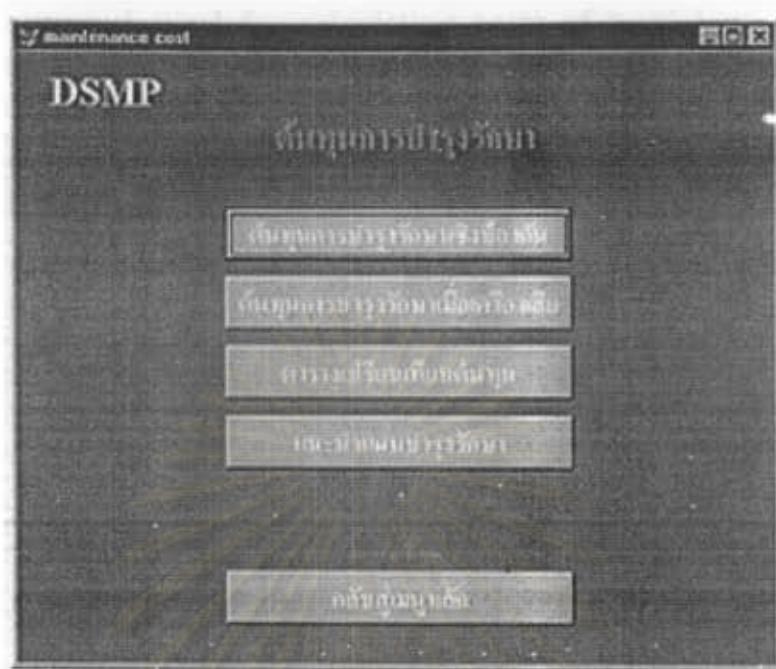
Figure A.14 Maintenance Cost Menu.

- *PM cost command*: used for calculating costs of preventive maintenance task. List of preventive maintenance costs for each job is presented after selecting this command.

Figure A.15 PM Costs Report.

- *CM cost command*: used for calculating costs of breakdown maintenance from each type of failure. List of breakdown maintenance costs is presented after selecting CM cost command.

Mc_no	Failure_no	M&f	Downtime_loss	Subcontract_cost	Overtime_cost	Mat_cost	Production_loss
P01	P01-001	0.00	0.00	0.00	0.00	0.00	0.00
P01	P01-002	0.00	0.00	0.00	0.00	0.00	0.00
P01	P01-003	1210.83	175.50	610.00	0.00	2366.67	1170.00
P01	P01-004	0.00	0.00	0.00	0.00	0.00	0.00
P01	P01-005	0.00	0.00	0.00	0.00	0.00	0.00
P01	P01-006	1206.67	799.50	3330.00	675.00	4333.33	5330.00
P01	P01-007	0.00	300.00	0.00	0.00	1500.00	2000.00
P01	P01-008	132.50	300.00	0.00	225.00	2800.00	2000.00
P01	P01-009	0.00	0.00	0.00	0.00	0.00	0.00
P01	P01-010	0.00	0.00	0.00	0.00	0.00	0.00
P01	P01-011	0.00	0.00	0.00	0.00	0.00	0.00
P01	P01-012	2418.25	862.50	3250.00	337.50	45130.00	3750.00
P01	P01-013	2421.75	337.50	1250.00	0.00	2790.00	2250.00
P01	P01-014	0.00	0.00	0.00	0.00	0.00	0.00
P01	P01-015	0.00	0.00	0.00	0.00	0.00	0.00
P01	P01-016	130.50	600.00	3000.00	0.00	0.00	4000.00
P01	P01-017	0.00	0.00	0.00	0.00	0.00	0.00
P01	P01-018	0.00	0.00	0.00	0.00	0.00	0.00
P01	P01-019	0.00	0.00	0.00	0.00	0.00	0.00
P01	P01-020	0.00	0.00	0.00	0.00	0.00	0.00
P01	P01-021	1209.17	424.50	0.00	300.00	2920.00	2030.00

Figure A.16 CM Costs Report.

- *Costs comparing command*: used for comparing PM and CM costs of maintenance task and machine failure that are related.

Mc_no	Job_no	Failure_no	Failure_effect	Pm_cost	Cm_cost
P01	P-P01-01	P01-002	PRODUCTION	0.83	0.00
P01	P-P01-01	P01-003	PRODUCTION	0.83	1.62
P01	P-P01-01	P01-007	PRODUCTION	0.83	0.00
P01	P-P01-02			0.28	0.00
P01	P-P01-03	P01-031	PRODUCTION	0.28	0.00
P01	P-P01-07	P01-001	SAFETY	0.28	0.00
P01	P-P01-07	P01-014	PRODUCTION	0.28	0.00
P01	P-P01-07	P01-015	PRODUCTION	0.28	0.00
P01	P-P01-08			1.33	0.00
P01	P-P01-09			0.28	0.00
P01	P-P01-10			0.28	0.00
P01	P-P01-11			0.28	0.00
P01	P-P01-12			1.33	0.00
P01	P-P01-13			1.33	0.00
P01	P-P01-14	P01-019	QUALITY	3.33	0.00
P01	P-P01-15			0.28	0.00
P01	P-P01-16	P01-018	QUALITY	3.33	0.00
P01	P-P01-19	P01-023	PRODUCTION	1.67	0.00
P01	P-P01-19	P01-024	QUALITY	1.67	19.06
P01	P-P01-20	P01-027	QUALITY	0.83	0.00
P01	P-P01-20	P01-028	QUALITY	0.83	17.36

Figure A.17 Costs Comparing Report.

- *Preventive task recommendation command*: used for recommending preventive maintenance tasks to perform for optimizing costs and machine performance.

Figure A.18 Recommended Preventive Task Report.

Frequency model menu: is on the bottom right of the main menu. Frequency model menu consists of form and command for recording model parameters and identifying optimal frequency to perform maintenance task.
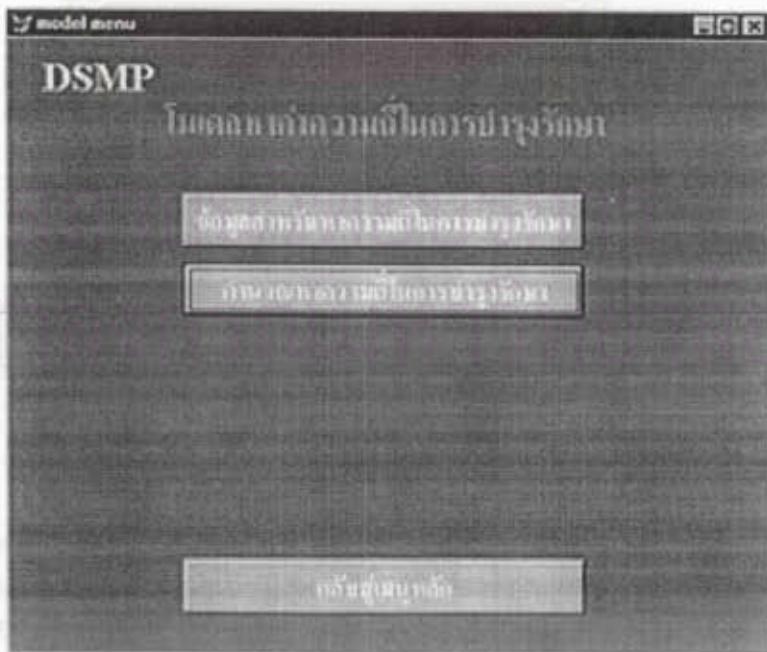
Figure A.19 Frequency Model Menu.

- *Parameter form*: used for recording data and parameters in optimal frequency model. These parameters are used to calculate and optimize frequency for performing maintenance task.
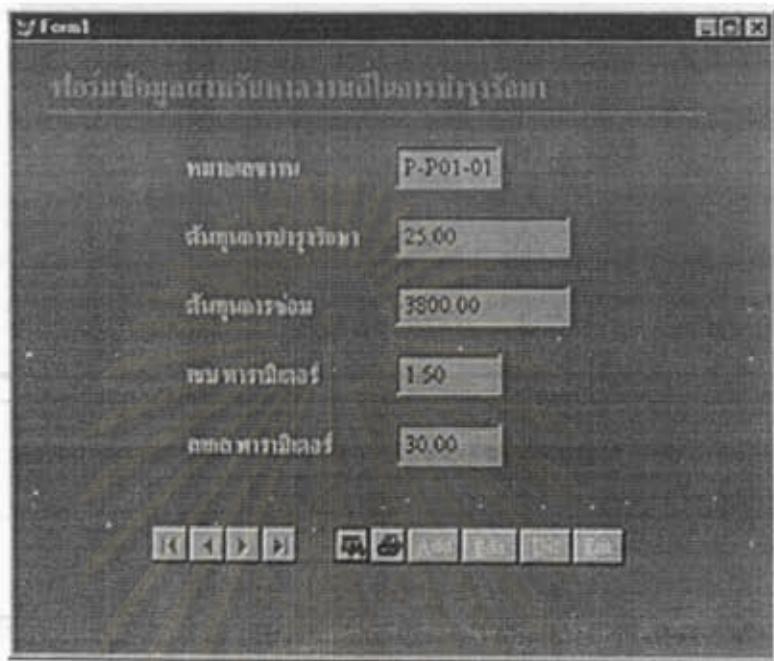
Figure A.20 Parameter Form.

- *Optimal frequency command*: used for calculating and optimizing frequency of specific maintenance task by executing optimal frequency model.

Figure A.21 Optimal Frequency Report.

Year plan menu: is on the top left of the main menu. Year plan menu consists of form and commands for setting yearly maintenance plan and reporting yearly maintenance summary.
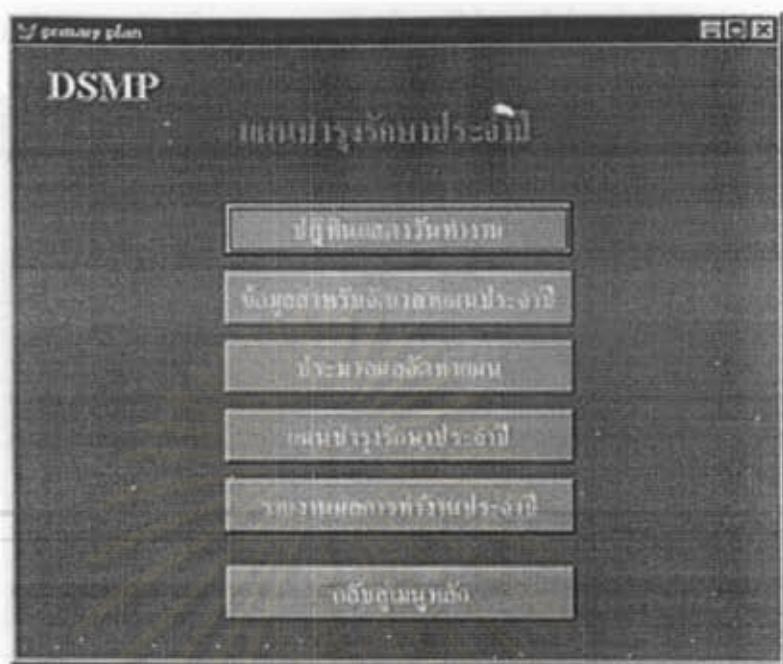
Figure A.22 Year Plan Menu.

- *Work calendar command*: used for browsing list of working days and setting available hours for maintenance task in each day of a specific year.
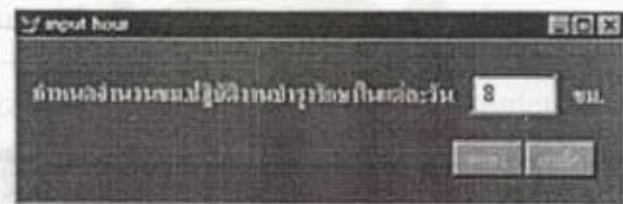
Figure A.23 Input Hours Form.

Figure A.24 Work Calendar Report.

- *Year plan parameter form*: used for identifying criteria for setting maintenance plan.
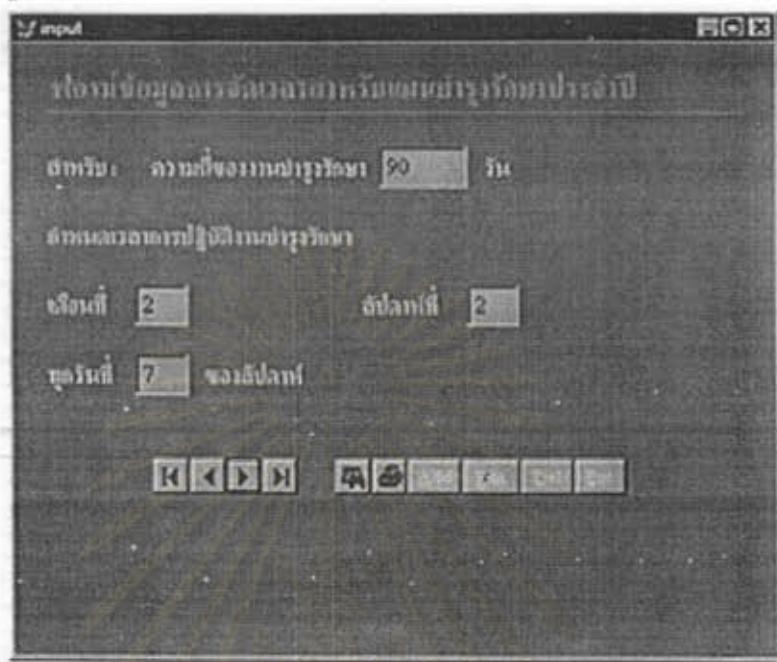
Figure A.25 Year Plan Parameter Form.

- *Setting plan command*: used for setting yearly maintenance plan.

- *Year plan command*: used for browsing yearly maintenance plan.

Figure A.26 Yearly Maintenance Plan.

- *Yearly report command*: used for browsing yearly maintenance summary report.

Figure A.27 Yearly Maintenance Summary Report.

Monthly plan command: is on the second left of the main menu. Monthly plan command is used for browsing preventive maintenance plan of a specific month.

Figure A.28 Input Month Form.

Figure A.29 Monthly Maintenance Plan.

Weekly plan menu: is on the third left of the main menu. Weekly plan menu consists of form and commands for setting weekly maintenance plan and reporting weekly maintenance summary.

Figure A.30 Weekly Plan Menu.

Production plan command: used for browsing weekly production plan.

Figure A.31 Weekly Production Plan.

Production plan form: used for recording production plan of each week for setting weekly maintenance plan.
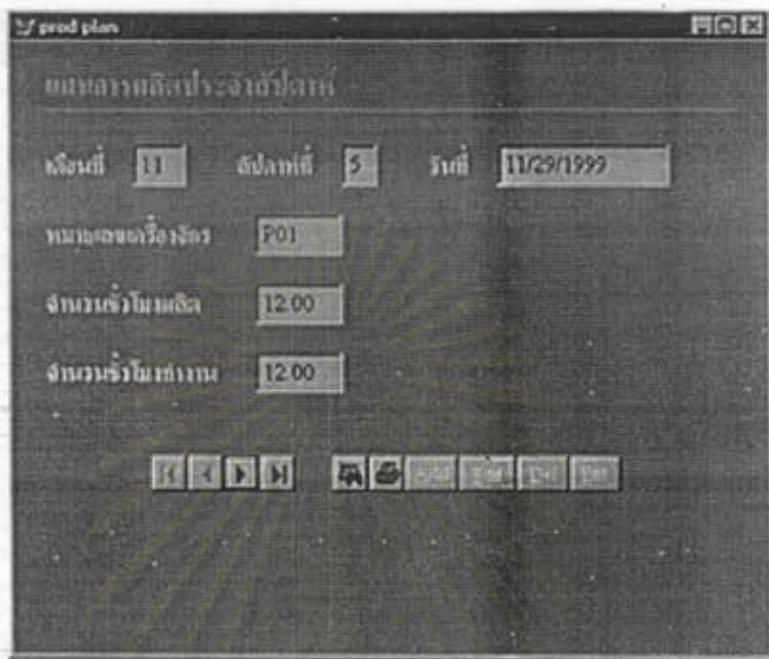
Figure A.32 Production Plan Form.

- *Setting plan command*: used for setting weekly maintenance plan.

- *Weekly plan command*: used for browsing weekly maintenance plan.

Figure A.33 Weekly Maintenance Plan.

- *Weekly report command*: used for browsing weekly maintenance summary report.

Date	Mc_no	Act_prod_hrs	Act_work_hrs	Downtime	Total_hrs	No_unfinish_job	Percentage	Expected_cost	Actual_cost
11/01/99	P01	6.50	1.50		8.00	0	100.0	100.00	150.00
11/02/99	P01	3.00	2.00		8.00	0	100.0	200.00	299.00
11/03/99	P01	12.00	0.00		12.00	0		0.00	0.00
11/04/99	P01	8.00	0.00		8.00	0		0.00	0.00
11/05/99	P01	8.00	0.00		8.00	0		0.00	0.00
11/06/99	P01	11.00	0.88		12.00	5	54.55	384.50	91.50

Figure A.34 Weekly Maintenance Summary Report.

Maintenance index menu: is on the bottom left of the main menu. Maintenance index menu composes of commands for calculating maintenance index to measure maintenance performance.

Figure A.35 Maintenance Index Menu.

- *MC availability command*: used for identifying availability of machine at specific range of time.
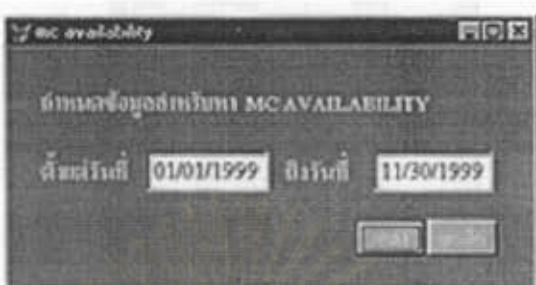
Figure A.36 Input Date Form.

Figure A.37 MC Availability.

- *Mean time between failure command*: used for identifying mean time between failure of machine for each type of failure.

Figure A.38 Mean Time between Failure.

- *Mean time to repair command*: used for identifying mean time to repair of machine for each type of failure.

Figure A.39 Mean Time to Repair.

- *Overtime hour command*: used for identifying number of overtime due to machine failure at specific range of time.
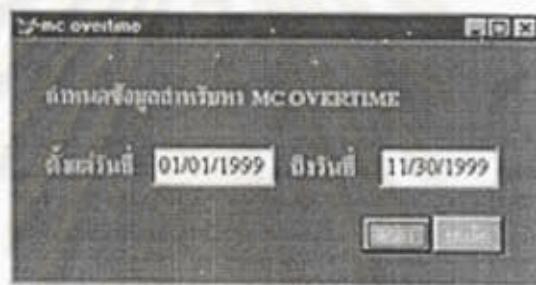
Figure A.40 Input Date Form.

Figure A.41 MC Overtime.

A-7 System Programs

DSMP programs consist of 14 programs for data processing and analysis. Code of each program is presented as the following.

- *Breakdown cost summary*

```
*Breakdown cost summary
*31/10/99
CLOSE DATABASES
OPEN DATABASE c:\Dsmp\Database
SET SAFETY OFF

SELECT a
USE avg_labor_rate
STORE avg_labor_rate TO lr

SELECT b
USE avg_rev_rate
STORE avg_rev_rate TO rr

SELECT c
USE mc_history
SCAN
        STORE date TO dt
        STORE mc_no TO mc
        STORE downtime TO dn
        STORE repairtime TO rp
        STORE overtime TO ot
        STORE mat_cost TO mt
        STORE subcontract_no TO sc
        w = dn*3*lr
        x = dn*rr
        y = 0
        z = ot*3*1.5*lr
        SELECT d
        USE subcontract
        SCAN
                STORE subcontract_no TO q
                STORE service_rate TO r
                IF       q = sc
                         x = r*rp
                ENDIF
        ENDSCAN
        SELECT c
        bd = w + x + y + z + mt
        REPLACE breakdown_cost WITH bd
ENDSCAN

SELECT c
SCAN
        STORE date TO x
        STORE mc_no TO y
        STORE breakdown_cost TO z
```

```
        SELECT e
        USE sum_year_plan
        SCAN
                STORE date TO dt
                STORE mc_no TO mc
                IF      dt = x AND mc = y
                        bd = z
                        REPLACE breakdown_cost WITH bd
                ENDIF
        ENDSCAN
ENDSCAN

SET SAFETY ON
```

- *Corrective maintenance cost*

```
*Corrective maintenance cost
*21/10/99
CLOSE DATABASES
OPEN DATABASE c:\Dsmp\Database
SET SAFETY OFF

SELECT a
USE avg_labor_rate
STORE avg_labor_rate TO lr

SELECT b
USE avg_rev_rate
STORE avg_rev_rate TO rr

SELECT c
USE cm_cost
SCAN
        STORE mc_no TO v
        STORE failure_no TO w
        SELECT d
        USE failure_list
        SCAN
                STORE mc_no TO mc
                STORE failure_no TO fn
                STORE avg_downtime TO dt
                STORE avg_repairtime TO rt
                STORE mtbf TO mf
                STORE subcontract_no TO sc
                IF      mc = v AND fn = w
                        s = mf
                        x = dt*3*lr
                        z = dt*rr
                        y = 0
                        SELECT e
                        USE subcontract
                        SCAN
                                STORE subcontract_no TO q
                                STORE service_rate TO r
                                IF      q = sc
                                        y = r*rt
```

```
                        ENDIF
                    ENDSCAN
                ENDIF
            ENDSCAN
            SELECT c
            REPLACE mtbf WITH s
            REPLACE downtime_loss WITH x
            REPLACE subcontract_cost WITH y
            REPLACE production_loss WITH z
ENDSCAN

SELECT c
SCAN
        STORE mc_no TO x
        STORE failure_no TO y
        n = 0
        z = 0
        w = 0
        SELECT f
        USE mc_history
        SCAN
                STORE mc_no TO mc
                STORE failure_no TO fn
                STORE mat_cost TO mt
                STORE overtime TO ot
                IF      mc = x AND fn = y
                        n = n + 1
                        z = (((n - 1)*z) + mt)/n
                        w = (((n - 1)*w) + (ot*3*1.5*lr))/n
                ENDIF
        ENDSCAN
        SELECT c
        REPLACE mat_cost WITH z
        REPLACE overtime_cost WITH w
ENDSCAN

SELECT g
USE relationship
SCAN
        STORE mc_no TO x
        STORE failure_no TO y
        SELECT c
        cc = 0
        SCAN
                STORE mc_no TO mc
                STORE failure_no TO fn
                STORE downtime_loss TO dt
                STORE subcontract_cost TO sb
                STORE overtime_cost TO ot
                STORE production_loss TO pl
                STORE mtbf TO mf
                IF      mc = x AND fn = y AND mf <> 0
                        cc = (dt + sb + + ot + pl)/mf
                ENDIF
        ENDSCAN
        SELECT g
        REPLACE cm_cost WITH cc
```

```
ENDSCAN

SELECT g
SCAN
        STORE failure_no TO x
        SELECT d
        y = 0
        SCAN
                STORE failure_no TO fn
                STORE failure_effect TO ef
                IF      fn = x
                        SELECT g
                        REPLACE failure_effect WITH ef
                ENDIF
        ENDSCAN
ENDSCAN

SET SAFETY ON
```

- *Interval model*

```
*Interval Model
*6/10/99
CLOSE DATABASES
OPEN DATABASE c:\Dsmp\Database
SET SAFETY OFF

SELECT d
USE calendar
SCAN
        STORE date TO dt
        STORE no TO n
        SELECT e
        USE mc_history
        SCAN
                STORE date TO x
                IF      x = dt
                        REPLACE no WITH n
                ENDIF
        ENDSCAN
ENDSCAN

SELECT f
USE failure_list
SCAN
        STORE failure_no TO fn
        SELECT e
        x = 0
        t = 0
        lt = 0
        SCAN
                STORE failure_no TO m
                STORE no TO n
                IF      m = fn AND x <> 0
                        t = n - x
                        lt = LOG(T)
```

```
                                x = n
                                REPLACE time WITH t
                                REPLACE ln_time WITH lt
                        ENDIF
                        IF      m = fn AND x = 0
                                t = 0
                                lt = 0
                                x = n
                                REPLACE time WITH t
                                REPLACE ln_time WITH lt
                        ENDIF
                ENDSCAN
        ENDSCAN
ENDSCAN

SELECT f
SCAN
        STORE failure_no TO x
        SELECT e
        sm1 = 0
        sm2 = 0
        n = 0
        m = 0
        s = 0
        s1 = 0
        sh = 0
        ch = 0
        SCAN
                STORE failure_no TO fn
                STORE ln_time TO lt
                IF      fn = x AND lt <> 0
                        sm1 = sm1 + lt
                        sm2 = sm2 + (lt^2)
                        n = n + 1
                ENDIF
        ENDSCAN
        SELECT f
        IF      n <> 0
                m = sm1/n
                s1 = (n/(n-1))*(sm2/n - (sm1^2/n^2))
                IF      s1 >= 0
                        s = SQRT(s1)
                ENDIF
        ENDIF
        IF      s <> 0
                sh = 3.141593/(SQRT(6)*s)
                ch = EXP(m + (0.5772157*SQRT(6)*s/3.141593))
        ENDIF
        REPLACE means WITH m
        REPLACE sigma WITH s
        REPLACE char_life WITH ch
        REPLACE shape WITH sh
ENDSCAN

SELECT f
SCAN
        STORE failure_no TO x
        STORE char_life TO n
```

```
        STORE shape TO b
        SELECT a
        USE parameter
        SCAN
                STORE failure_no TO fn
                IF      fn = x AND n <> 0 AND b <> 0
                        REPLACE char_life WITH n
                        REPLACE shape WITH b
                ENDIF
        ENDSCAN
ENDSCAN

SELECT a
SCAN
        STORE job_no TO x
        SELECT g
        USE pm_cost
        pc = 0
        SCAN
                STORE job_no TO jb
                STORE pm_labor_cost TO lc
                STORE pm_mat_cost TO mc
                IF      jb = x
                        pc = lc + mc
                ENDIF
        ENDSCAN
        SELECT a
        REPLACE preventive_cost WITH pc
ENDSCAN

SELECT a
SCAN
        STORE failure_no TO x
        SELECT h
        USE cm_cost
        cc = 0
        SCAN
                STORE failure_no TO fn
                STORE downtime_loss TO dt
                STORE subcontract_cost TO sb
                STORE overtime_cost TO ot
                STORE production_loss TO pl
                STORE mat_cost TO mt
                IF      fn = x
                        cc = dt + sb + ot + pl + mt
                ENDIF
        ENDSCAN
        SELECT a
        REPLACE repair_cost WITH cc
ENDSCAN

SELECT a
SCAN
        STORE preventive_cost TO cp
        STORE repair_cost TO cf
        STORE char_life TO n
        STORE shape TO b
```

```
SELECT b
use interval
y = 10000000
SCAN
        STORE interval TO tp
        UEC = (cp+(cf*((tp/n)^b)))/tp
        REPLACE expected_cost with UEC
        IF              UEC <= y
                        vexpected = UEC
                        vinterval = tp
                        y = UEC
        ENDIF
ENDSCAN

SELECT a
REPLACE expected_cost WITH vexpected
REPLACE interval WITH vinterval

ENDSCAN

SET SAFETY ON
```

- *MC availability*

```
*Machine Availability
*05/11/99
CLOSE DATABASES
OPEN DATABASE c:\Dsinp\Database
SET SAFETY OFF

SELECT a
USE mc_index_query
STORE date_a TO da
STORE date_b TO db

SELECT          sum_year_plan.mc_no,sum(sum_year_plan.downtime), ;
                sum(sum_year_plan.act_prod_hrs) ;
FROM            Database!sum_year_plan ;
WHERE           sum_year_plan.date >= da AND sum_year_plan.date <= db ;
GROUP BY        sum_year_plan.mc_no ;
ORDER BY        sum_year_plan.mc_no ;
INTO TABLE c:\Dsinp\mc_availability0.dbf

SELECT b
USE mc_availability
ZAP
APPEND FROM mc_availability0
av = 0
SCAN
        STORE sum_act_pr TO x
        STORE sum_downti TO y
        IF      x <> 0
                av = (x - y)*100/x
                REPLACE percent_availability WITH av
        ENDIF
```

```
ENDSCAN

SET SAFETY ON
```

- *MC overtime*

```
*Machine Overtime
*05/11/99
CLOSE DATABASES
OPEN DATABASE c:\Dsmp\Database
SET SAFETY OFF

SELECT a
USE mc_index_query
STORE date_a TO da
STORE date_b TO db

SELECT              mc_history.mc_no,sum(mc_history.overtime) ;
FROM            Database!mc_history ;
WHERE           mc_history.date >= da AND mc_history.date <= db ;
GROUP BY        mc_history.mc_no ;
ORDER BY        mc_history.mc_no ;
INTO TABLE c:\Dsmp\mc_overtime0.dbf

SELECT b
USE mc_overtime
ZAP
APPEND FROM mc_overtime0
SCAN
        STORE mc_no TO mc
        SELECT c
        USE available_day2
        ah = 0
        SCAN
                STORE date TO x
                STORE mc_no TO y
                STORE avaihrs TO z
                IF      x >= da AND x <= db AND y = mc
                        ah = ah + z
                ENDIF
        ENDSCAN
        SELECT b
        REPLACE total_hrs WITH ah
ENDSCAN

SELECT b
ot = 0
SCAN
        STORE sum_overti TO x
        STORE total_hrs TO y
        IF      y <> 0
                ot = x*100/y
                REPLACE percent_overtime WITH ot
        ENDIF
ENDSCAN
```

SET SAFETY ON

- *Monthly plan*

```
*Monthly Plan
*19/10/99
CLOSE DATABASES
OPEN DATABASE c:\Dsmp\Database
SET SAFETY OFF

SELECT a
USE present_month
STORE month TO mn

SELECT b
USE monthly_plan
ZAP
APPEND FROM year_plan FOR exp_2 = mn

SET SAFETY ON
```

- *PM cost*

```
*Preventive maintenance cost
*12/10/99
CLOSE DATABASES
OPEN DATABASE c:\Dsmp\Database
SET SAFETY OFF

SELECT a
USE avg_labor_rate
STORE avg_labor_rate TO lr

SELECT b
USE pm_cost
SCAN
        STORE mc_no TO x
        STORE job_no TO y
        SELECT c
        USE job_list
        SCAN
                STORE mc_no TO mc
                STORE job_no TO jb
                STORE workforces TO wf
                STORE workhrs TO wk
                STORE subcontract_no TO sb
                IF      mc = x AND jb = y AND wf <> 0
                        plc = lr*wf*wk
                ENDIF
                IF      mc = x AND jb = y AND wf = 0
                        SELECT d
                        USE subcontract
                        SCAN
                                STORE subcontract_no TO z
                                STORE service_rate TO sr
```

```
                        IF      z = sb
                                plc = sr*wk
                        ENDIF
                ENDSCAN
        ENDIF
ENDSCAN
SELECT b
REPLACE pm_labor_cost WITH plc
ENDSCAN

SELECT b
SCAN
        STORE mc_no TO x
        STORE job_no TO y
        SELECT e
        USE wk_performance
        SCAN
                STORE mc_no TO mc
                STORE job_no TO jb
                STORE avg_mat_cost TO avc
                IF      mc = x AND jb = y
                        z = avc
                ENDIF
        ENDSCAN
        SELECT b
        REPLACE pm_mat_cost WITH z
ENDSCAN

SELECT f
USE relationship
SCAN
        STORE mc_no TO x
        STORE job_no TO y
        SELECT b
        pc = 0
        SCAN
                STORE mc_no TO mc
                STORE job_no TO jb
                STORE pm_labor_cost TO plc
                STORE pm_mat_cost TO pmc
                STORE frequency TO fq
                IF      mc = x AND jb = y
                        pc = (plc + pmc)/fq
                ENDIF
        ENDSCAN
        SELECT f
        REPLACE pm_cost WITH pc
ENDSCAN

SET SAFETY ON
```

- *Primary plan*

```
*Primary Plan
*13/08/99
CLOSE DATABASES
```

```
OPEN DATABASE c:\Dsmp\Database
SET SAFETY OFF

SELECT i
USE present_year
STORE year TO x

SELECT a
USE calendar

SELECT b
USE available_day
ZAP
APPEND FROM calendar FIELDS date,day,week,status FOR YEAR(date) = x AND status = .T.

SELECT c
USE input_hrs
GO TOP
STORE avaihrs TO x
SELECT b
av = x
SCAN
        REPLACE avaihrs WITH av

        IF      day = "SUN"
                y = 1
                REPLACE day_no WITH y
        ENDIF

        IF      day = "MON"
                y = 2
                REPLACE day_no WITH y
        ENDIF

        IF      day = "TUE"
                y = 3
                REPLACE day_no WITH y
        ENDIF

        IF      day = "WED"
                y = 4
                REPLACE day_no WITH y
        ENDIF

        IF      day = "THU"
                y = 5
                REPLACE day_no WITH y
        ENDIF

        IF      day = "FRI"
                y = 6
                REPLACE day_no WITH y
        ENDIF

        IF      day = "SAT"
                y = 7
                REPLACE day_no WITH y
```

```
        ENDIF

ENDSCAN

SELECT          job_list.mc_no,month(available_day.date),available_day.week, ;
                available_day.date,available_day.day_no,available_day.avaihrs, ;
                job_list.job_no,job_list.frequency,job_list.workhrs, ;
                job_list.workforces,job_list.subcontract_no ;
FROM            Database!job_list,Database!available_day ;
ORDER BY        available_day.date ;
INTO TABLE      c:\Dsmp\year_plan0.dbf

SELECT e
USE year_plan1
ZAP
APPEND FROM year_plan0
x1 = 0
x2 = 0
x3 = 0
cm = 0
n = 1
GO TOP
STORE frequency TO y
STORE mc_no TO z
SCAN
        STORE mc_no TO mc
        STORE frequency TO fq
        STORE avaihrs TO av
        STORE workforces TO wf
        STORE workhrs TO wk
        IF      mc = z AND fq = y AND cm <= av
                IF      wf = 0
                        cm = cm + wk
                        x1 = cm
                        x2 = cm
                        x3 = cm
                ENDIF

                IF      wf = 1
                        cm = x1 + wk
                        IF      cm <= x2
                                x1 = cm
                        ENDIF
                        IF      cm > x2 AND cm <= x3
                                x1 = x2
                                x2 = cm
                        ENDIF
                        IF      cm > x3
                                x1 = x2
                                x2 = x3
                                x3 = cm
                        ENDIF
                ENDIF

                IF      wf = 2
                        cm = x2 + wk
                        IF      cm <= x3
```

```
                        x1 = cm
                        x2 = cm
            ENDIF
            IF      cm > x3
                    x1 = x3
                    x2 = cm
                    x3 = cm
            ENDIF
    ENDIF

    IF      wf = 3
            cm = x3 + wk
            x1 = cm
            x2 = cm
            x3 = cm
    ENDIF

ENDIF

IF      mc = z AND fq = y AND cm > av
        cm = wk
        n = n + 1
        IF      wf = 0 OR wf = 3
                x1 = wk
                x2 = wk
                x3 = wk
        ENDIF
        IF      wf = 1
                x1 = 0
                x2 = 0
                x3 = wk
        ENDIF
        IF      wf = 2
                x1 = 0
                x2 = wk
                x3 = wk
        ENDIF
ENDIF

IF      mc = z AND fq <> y
        n = 1
        cm = wk
        y = fq
        IF      wf = 0 OR wf = 3
                x1 = wk
                x2 = wk
                x3 = wk
        ENDIF
        IF      wf = 1
                x1 = 0
                x2 = 0
                x3 = wk
        ENDIF
        IF      wf = 2
                x1 = 0
                x2 = wk
                x3 = wk
```

```
                ENDIF
        ENDIF

        IF      mc <> z
                n = 1
                cm = wk
                y = fq
                z = mc
                IF      wf = 0 OR wf = 3
                        x1 = wk
                        x2 = wk
                        x3 = wk
                ENDIF
                IF      wf = 1
                        x1 = 0
                        x2 = 0
                        x3 = wk
                ENDIF
                IF      wf = 2
                        x1 = 0
                        x2 = wk
                        x3 = wk
                ENDIF
        ENDIF

        REPLACE cumhrs WITH cm
        REPLACE run_no WITH n
ENDSCAN

SELECT d
USE year_plan
ZAP

SELECT g
USE input
SCAN
        STORE frequency TO fr
        STORE month TO mn
        STORE week TO wk
        STORE day_no TO dn

        SELECT d

        IF      fr <= 7
            APPEND FROM year_plan1 FOR frequency = fr AND day_no = dn AND run_no = 1
            APPEND FROM year_plan1 FOR frequency = fr AND day_no = dn-1 AND run_no = 2
            APPEND FROM year_plan1 FOR frequency = fr AND day_no = dn-2 AND run_no = 3
            APPEND FROM year_plan1 FOR frequency = fr AND day_no = dn-3 AND run_no = 4
        ENDIF

        IF      fr > 7 AND fr <= 30
            APPEND FROM year_plan1 FOR frequency = fr AND week = wk AND day_no = dn
AND         run_no = 1
            APPEND FROM year_plan1 FOR frequency = fr AND week = wk+1 AND day_no = dn-2
            AND run_no = 2
            APPEND FROM year_plan1 FOR frequency = fr AND week = wk+1 AND day_no = dn-1
            AND run_no = 3
```

```
                 APPEND FROM year_plan1 FOR frequency = fr AND week = wk+2 AND day_no = dn-2
                 AND run_no = 4
                 APPEND FROM year_plan1 FOR frequency = fr AND week = wk+2 AND day_no = dn-1
                 AND run_no = 5
        ENDIF

        IF       fr > 30 AND fr <= 90
                 APPEND FROM year_plan1 FOR frequency = fr AND exp_2 = mn AND week = wk
AND              day_no = dn AND run_no = 1
                 APPEND FROM year_plan1 FOR frequency = fr AND exp_2 = mn-1 AND week = wk
AND              day_no = dn AND run_no = 2
                 APPEND FROM year_plan1 FOR frequency = fr AND exp_2 = mn+1 AND week = wk
AND              day_no = dn AND run_no = 3
        ENDIF

        IF       fr > 90 AND fr <= 180
                 APPEND FROM year_plan1 FOR frequency = fr AND exp_2 = mn AND week = wk
AND              day_no = dn AND run_no = 1
                 APPEND FROM year_plan1 FOR frequency = fr AND exp_2 = mn-1 AND week = wk
AND              day_no = dn AND run_no = 2
                 APPEND FROM year_plan1 FOR frequency = fr AND exp_2 = mn+1 AND week = wk
AND              day_no = dn AND run_no = 3
        ENDIF

        IF       fr > 180 AND fr <= 365
                 APPEND FROM year_plan1 FOR frequency = fr AND exp_2 = mn AND week = wk
AND              day_no = dn AND run_no = 1
                 APPEND FROM year_plan1 FOR frequency = fr AND exp_2 = mn-1 AND week = wk
AND              day_no = dn AND run_no = 2
                 APPEND FROM year_plan1 FOR frequency = fr AND exp_2 = mn+1 AND week = wk
AND              day_no = dn AND run_no = 3
        ENDIF

ENDSCAN

SELECT       year_plan.mc_no,year_plan.date,MAX(year_plan.cumhrs) ;
FROM         Database!year_plan ;
GROUP BY     year_plan.date ;
ORDER BY     year_plan.date ;
INTO TABLE   c:\Dsmp\year_plan2.dbf

SELECT       mc_list.mc_no,available_day.date,available_day.week, ;
             available_day.day_no,available_day.avaihrs ;
FROM         Database!mc_list,Database!available_day ;
ORDER BY     available_day.date ;
INTO TABLE   c:\Dsmp\available_day0.dbf

SELECT h
USE available_day2
ZAP
APPEND FROM available_day0

SELECT f
USE year_plan3
ZAP
APPEND FROM year_plan2
SCAN
```

```
        STORE mc_no TO x
        STORE date TO y            .
        STORE max_cumhrs TO mch

        SELECT h
        SCAN
                STORE mc_no TO mc
                STORE date TO dt
                STORE avaihrs TO av
                STORE mark TO mk
                IF      mc = x AND dt = y AND mk = 0
                        avt = av - mch
                        mk = 1
                        REPLACE avaihrs2 WITH avt
                        REPLACE mark WITH mk
                ENDIF
                IF      mc = x AND dt <> y AND mk = 0
                        REPLACE avaihrs2 WITH av
                ENDIF
        ENDSCAN
ENDSCAN

SET SAFETY ON


-   Report


*Report
*12/10/99
CLOSE DATABASES
OPEN DATABASE c:\Dsmp\Database
SET SAFETY OFF

SELECT a
USE today_date
STORE date TO x

SELECT c
USE backlog2
ZAP
APPEND FROM weekly_plan FIELDS exp_2,week,date,mc_no,job_no, ;
frequency,workforces,workhrs,mark FOR date = x

SELECT b
USE pm_report
SCAN
        IF      date = x
                STORE job_no TO y

                SELECT c
                GO TOP
                SCAN
                        STORE job_no TO jb
                        IF      jb = y
                                DELETE
                                PACK
                        ENDIF
```

```
            IF      jb <> y
                    mk = 1
                    REPLACE mark WITH mk
            ENDIF
        ENDSCAN
    ENDIF
ENDSCAN

SET SAFETY ON
```

- *Report2*

```
*Report2
*12/10/99
CLOSE DATABASES
OPEN DATABASE c:\Dsmp\Database
SET SAFETY OFF

SELECT a
USE today_date
STORE date TO dt

SELECT b
USE available_day2                      &&Arange New Schedule for Backlog
SCAN
        STORE mc_no TO w
        STORE week TO x
        STORE date TO y
        STORE avaihrs2 TO z
        IF      y > dt
            SELECT c
            USE backlog2
            GO TOP
            STORE date TO dt
            STORE mc_no TO m
            x1 = 0
            x2 = 0
            x3 = 0
            cm = 0
            IF      m = w
            SCAN
                    STORE mc_no TO mc
                    STORE exp_2 TO mn
                    STORE week TO we
                    STORE frequency TO fr
                    STORE workforces TO wf
                    STORE workhrs TO wk
                    STORE mark TO mk
                    IF      (m = mc AND mn = MONTH(y) AND x = we AND fr <= 7 AND z <>
0                               AND mk <> 2);
                            OR (m = mc AND mn = MONTH(y) AND x >= we AND x < we - 2
AND                         fr > 7 AND fr <= 30 AND z <> 0 AND mk <> 2);
                            OR (m = mc AND mn <= MONTH(y) AND mn > MONTH(y) - 2 AND
y                           >= dt AND fr > 30 AND fr <= 90 AND z <> 0 AND mk <> 2);
                            OR (m = mc AND mn <= MONTH(y) AND mn > MONTH(y) - 4 AND
y                           >= dt AND fr > 90 AND fr <= 180 AND z <> 0 AND mk <> 2);
```

y

```
        OR (m = mc AND mn <= MONTH(y) AND mn > MONTH(y) - 6 AND
        >= dt AND fr > 180 AND fr <= 365 AND z <> 0 AND mk <> 2)

IF      wf = 0
        cm = cm + wk
        x1 = cm
        x2 = cm
        x3 = cm
ENDIF

IF      wf = 1
        cm = x1 + wk
        IF      cm <= x2
                x1 = cm
        ENDIF
        IF      cm > x2 AND cm <= x3
                x1 = x2
                x2 = cm
        ENDIF
        IF      cm > x3
                x1 = x2
                x2 = x3
                x3 = cm
        ENDIF
ENDIF

IF      wf = 2
        cm = x2 + wk
        IF      cm <= x3
                x1 = cm
                x2 = cm
        ENDIF
        IF      cm > x3
                x1 = x3
                x2 = cm
                x3 = cm
        ENDIF
ENDIF

IF      wf = 3
        cm = x3 + wk
        x1 = cm
        x2 = cm
        x3 = cm
ENDIF

IF      cm <= z
        mk = 2
        mn = MONTH(y)
        REPLACE exp_2 WITH mn
        REPLACE week WITH x
        REPLACE date2 WITH y
        REPLACE mark WITH mk
        REPLACE cumhrs WITH cm
ENDIF
ENDIF
```

```
 <> 0                   IF        (m <> mc AND mn = MONTH(y) AND x = we AND fr <= 7 AND z
                                  AND mk <> 2);
                                  OR (m <> mc AND mn = MONTH(y) AND x >= we AND x < we + 2
                                  AND fr > 7 AND fr <= 30 AND z <> 0 AND mk <> 2);
 AND y                            OR (m <> mc AND mn <= MONTH(y) AND mn > MONTH(y) - 2
                                  >= dt AND fr > 30 AND fr <= 90 AND z <> 0 AND mk <> 2);
 AND y                            OR (m <> mc AND mn <= MONTH(y) AND mn > MONTH(y) - 4
                                  >= dt AND fr > 90 AND fr <= 180 AND z <> 0 AND mk <> 2);
 AND y                            OR (m <> mc AND mn <= MONTH(y) AND mn > MONTH(y) - 6
                                  >= dt AND fr > 180 AND fr <= 365 AND z <> 0 AND mk <> 2)

                        cm = wk

                        IF        wf = 0 OR wf = 3
                                  x1 = wk
                                  x2 = wk
                                  x3 = wk
                        ENDIF

                        IF        wf = 1
                                  x1 = 0
                                  x2 = 0
                                  x3 = wk
                        ENDIF

                        IF        wf = 2
                                  x1 = 0
                                  x2 = wk
                                  x3 = wk
                        ENDIF

                        IF        cm <= z
                                  mk = 2
                                  mn = MONTH(y)
                                  REPLACE exp_2 WITH mn
                                  REPLACE week WITH x
                                  REPLACE date2 WITH y
                                  REPLACE mark WITH mk
                                  REPLACE cumhrs WITH cm
                        ENDIF
                    ENDIF
                ENDSCAN
                ENDIF
            ENDIF
ENDSCAN

SELECT c                          &&Update Weekly Plan
SCAN
        STORE mc_no TO u
        STORE job_no TO v
        STORE exp_2 TO w
        STORE week TO x
        STORE date TO y
        STORE date2 TO z
        SELECT d
        USE weekly_plan
        SCAN
```

```
                STORE mc_no TO mc
                STORE job_no TO jb
                STORE exp_2 TO mn
                STORE week TO we
                STORE date TO dt
                IF      mc = u AND jb = v AND mn = w AND we = x AND dt = y
                        REPLACE date WITH z
                ENDIF
        ENDSCAN
ENDSCAN

SELECT c                        &&Update Year Plan
SCAN
        STORE mc_no TO u
        STORE job_no TO v
        STORE exp_2 TO w
        STORE week TO x
        STORE date TO y
        STORE date2 TO z
        SELECT e
        USE year_plan
        SCAN
                STORE mc_no TO mc
                STORE job_no TO jb
                STORE date TO dt
                IF      mc = u AND jb = v AND dt = y
                        dn = 0
                        REPLACE exp_2 WITH w
                        REPLACE week WITH x
                        REPLACE date WITH z
                        REPLACE day_no WITH dn
                ENDIF
        ENDSCAN
ENDSCAN

SELECT d
USE weekly_plan
SCAN
        STORE mark TO mk
        IF      mk = 2
                mk = 1
                REPLACE mark WITH mk
        ENDIF
ENDSCAN

SELECT a
STORE date TO dt

SELECT f                        &&Weekly Plan Summary1
USE sum_week_plan
SCAN
        STORE date TO x
        STORE mc_no TO m
        STORE avaihrs TO u
        STORE prod_hrs TO y
        IF      x > dt
                SELECT d
```

```
z = 0
x1 = 0
x2 = 0
x3 = 0
cm = 0
SCAN
        STORE date TO dt
        STORE mc_no TO mc
        STORE workforces TO wf
        STORE workhrs TO wk
        STORE mark TO mk
        IF      mc = m AND dt = x AND mk <= 1

                IF      wf = 0
                        cm = cm + wk
                        x1 = cm
                        x2 = cm
                        x3 = cm
                ENDIF

                IF      wf = 1
                        cm = x1 + wk
                        IF      cm <= x2
                                x1 = cm
                        ENDIF
                        IF      cm > x2 AND cm <= x3
                                x1 = x2
                                x2 = cm
                        ENDIF
                        IF      cm > x3
                                x1 = x2
                                x2 = x3
                                x3 = cm
                        ENDIF
                ENDIF

                IF      wf = 2
                        cm = x2 + wk
                        IF      cm <= x3
                                x1 = cm
                                x2 = cm
                        ENDIF
                        IF      cm > x3
                                x1 = x3
                                x2 = cm
                                x3 = cm
                        ENDIF
                ENDIF

                IF      wf = 3
                        cm = x3 + wk
                        x1 = cm
                        x2 = cm
                        x3 = cm
                ENDIF

                IF      cm > z
```

```
                                        mk = 2
                                        z = cm
                                    ENDIF
                            ENDIF
                    ENDSCAN
                    SELECT f
                    fh = u - (y + z)
                    REPLACE freehrs WITH fh
                    REPLACE workhrs WITH z
            ENDIF
ENDSCAN

SELECT a
STORE date TO dt

SELECT f                        &&Weekly Plan Summary2
SCAN
        STORE date TO x
        STORE mc_no TO y
        IF      x > dt
                SELECT d
                n = 0
                SCAN
                STORE date TO dt
                STORE mc_no TO mc
                    IF      dt = x AND mc = y
                            n = n + 1
                    ENDIF
                ENDSCAN
                SELECT f
                REPLACE no_job WITH n
        ENDIF
ENDSCAN

SELECT b                        &&Update Available Day2 1
SCAN
        STORE mc_no TO r
        STORE date TO x
        STORE avaihrs2 TO y
        SELECT c
        z = 0
        w = x
        q = r
        avt = y
        SCAN
                STORE mc_no TO mc
                STORE date2 TO dt
                STORE cumhrs TO cm
                IF      mc = r AND dt = x AND cm > z
                        z = cm
                        w = dt
                        q = mc
                ENDIF
        ENDSCAN
        SELECT b
        IF      r = q AND x = w AND y > z
                avt = y - z
```

```
                    REPLACE avaihrs2 WITH avt
        ENDIF
ENDSCAN

SELECT b                        &&UPdate Available Day2 2
SCAN
        STORE mc_no TO r
        STORE date TO x
        STORE avaihrs2 TO z
        y = x
        q = r
        avt = z
        SELECT f
        SCAN
                STORE mc_no TO l
                STORE date TO m
                STORE freehrs TO n
                IF      m = x
                        y = m
                        q = l
                        avt = n
                ENDIF
        ENDSCAN
        SELECT b
        IF      r = q AND x = y
                REPLACE avaihrs2 WITH avt
        ENDIF
ENDSCAN

SELECT f                        &&Calculate Expected Costs
SCAN
        STORE mc_no TO x
        STORE date TO y
        SELECT d
        ec = 0
        SCAN
                STORE mc_no TO mc
                STORE date TO dt
                STORE job_no TO jb
                IF      mc = x AND dt = y
                        SELECT g
                        USE pm_cost
                        s = 0
                        SCAN
                                STORE mc_no TO q
                                STORE job_no TO r
                                STORE pm_labor_cost TO plc
                                STORE pm_mat_cost TO pmc
                                IF      q = mc AND r = jb
                                        s = plc + pmc
                                ENDIF
                        ENDSCAN
                        ec = ec + s
                ENDIF
        ENDSCAN
        SELECT f
        REPLACE expected_cost WITH ec
```

ENDSCAN

SET SAFETY ON

- *Report3*

```
*Report3
*12/10/99
CLOSE DATABASES
OPEN DATABASE c:\Dsmp\Database
SET SAFETY OFF

SELECT a
USE pm_report
SCAN
        STORE mc_no TO w
        STORE job_no TO x
        STORE workhrs TO y
        STORE mat_cost TO z
        SELECT b
        USE wk_performance
        SCAN
                STORE mc_no TO mc
                STORE job_no TO jb
                STORE avg_workhrs TO avh
                STORE avg_mat_cost TO avc
                STORE times TO n
                IF      mc = w AND jb = x
                        avh = ((n*avh) + y)/(n + 1)
                        REPLACE avg_workhrs WITH avh
                        avc = ((n*avc) + z)/(n + 1)
                        REPLACE avg_mat_cost WITH avc
                        n = n + 1
                        REPLACE times WITH n
                ENDIF
        ENDSCAN
ENDSCAN

SELECT c
USE sum_week_plan
SCAN
        STORE no_job TO noj
        STORE no_unfinish_job TO nuj
        IF      noj <> 0
                p = ((noj-nuj)*100)/noj
                REPLACE percentage WITH p
        ENDIF
ENDSCAN


SELECT c                               &&Calculate Actual Costs
SCAN
        STORE mc_no TO x
        STORE date TO y
        SELECT d
        USE avg_labor_rate
```

```
STORE avg_labor_rate TO lr

SELECT e
USE avg_rev_rate
STORE avg_rev_rate TO rr

SELECT a
pc = 0
q = 0
w = 0
SCAN
        STORE mc_no TO mc
        STORE date TO dt
        STORE workhrs TO wk
        STORE workforces TO wf
        STORE mat_cost TO mt
        STORE subcontract_no TO sc
        IF      mc = x AND dt = y AND wf <> 0
                plc = lr*wf*wk
                q = plc + mt
                pc = pc + q
        ENDIF
        IF      mc = x AND dt = y AND wf = 0
                SELECT f
                USE subcontract
                SCAN
                        STORE subcontract_no TO z
                        STORE service_rate TO sr
                        IF      z = sc
                                plc = sr*wk
                        ENDIF
                ENDSCAN
                w = plc + mt
                pc = pc + w
        ENDIF
ENDSCAN

SELECT g
USE mc_history
cc = 0
v = 0
SCAN
        STORE mc_no TO l
        STORE date TO m
        STORE downtime TO n
        STORE repairtime TO o
        STORE overtime TO k
        STORE mat_cost TO p
        STORE subcontract_no TO r
        IF      l = x AND m = y
                dw = n*3*lr
                pd = n*rr
                ot = k*3*1.5*lr
                IF      sb <> 0
                        SELECT f
                        SCAN
                                STORE subcontract_no TO s
```

```
                                            STORE service_rate TO t
                                            IF        s = sc
                                                      u = o*rt
                                            ENDIF
                                    ENDSCAN
                            ENDIF
                            v = dw + pd + ot + u + p
                            cc = cc + v
                    ENDIF
            ENDSCAN
            SELECT c
            ac = pc + cc
            REPLACE actual_cost WITH ac
ENDSCAN

SET SAFETY ON
```

- *Update failure list*

```
*Update Failure List
*19/10/99
CLOSE DATABASES
OPEN DATABASE c:\Dsmp\Database
SET SAFETY OFF

SELECT a
USE failure_list
SCAN
        STORE mc_no TO x
        STORE failure_no TO y
        n = 0
        dt = 0
        rt = 0
        SELECT b
        USE mc_history
        SCAN
                STORE mc_no TO mc
                STORE failure_no TO fn
                STORE downtime TO q
                STORE repairtime TO r
                IF       mc = x AND fn = y
                         n = n + 1
                         dt = (((n - 1)*dt) + q)/n
                         rt = (((n - 1)*rt) + r)/n
                ENDIF
        ENDSCAN
        SELECT a
        REPLACE avg_downtime WITH dt
        REPLACE avg_repairtime WITH rt
        REPLACE times WITH n
ENDSCAN

SELECT b
USE mc_history
GO TOP
STORE date TO x
```

```
STORE time TO y
SCAN
        STORE date TO dt
        STORE time TO s
        IF      dt <> x
                y = y + s
                x = dt
        ENDIF
ENDSCAN
SELECT a
SCAN
        STORE avg_downtime TO dw
        STORE times TO n
        IF      y <> 0 AND n > 1
                mf = (8*y/(n-1)) - dw
                mt = dw/n
                REPLACE mtbf WITH mf
                REPLACE mttr WITH mt
        ENDIF
ENDSCAN

SET SAFETY ON
```

-   *Weekly plan*

```
*Weekly Plan
*19/08/99
CLOSE DATABASES
OPEN DATABASE c:\Dsmp\Database
SET SAFETY OFF

SELECT h
USE sum_year_plan
APPEND FROM sum_week_plan

SELECT      year_plan.exp_2,year_plan.week,year_plan.date, ;
            year_plan.mc_no,year_plan.job_no,year_plan.frequency, ;
            year_plan.workforces,year_plan.workhrs, ;
            prod_plan_week.prod_hrs,prod_plan_week.avaihrs ;
FROM        Database!year_plan,Database!prod_plan_week ;
WHERE       year_plan.date = prod_plan_week.date AND ;
            year_plan.mc_no = prod_plan_week.mc_no ;
ORDER BY    year_plan.date ;
INTO TABLE c:\Dsmp\weekly_plan0.dbf

CLOSE DATABASES
OPEN DATABASE c:\Dsmp\Database

SELECT g                        &&Update Year Plan
USE prod_plan_week
SCAN
        STORE date TO x
        STORE mc_no TO y
        STORE avaihrs TO z
        SELECT e
        USE available_day2
```

```
            IF      cm > x3
                    x1 = x3
                    x2 = cm
                    x3 = cm
            ENDIF
        ENDIF

        IF      wf = 3
                cm = x3 + wk
                x1 = cm
                x2 = cm
                x3 = cm
        ENDIF

    ENDIF

    IF      mc = z AND fq <> y
            cm = wk
            y = fq
            IF      wf = 0 OR wf = 3
                    x1 = wk
                    x2 = wk
                    x3 = wk
            ENDIF
            IF      wf = 1
                    x1 = 0
                    x2 = 0
                    x3 = wk
            ENDIF
            IF      wf = 2
                    x1 = 0
                    x2 = wk
                    x3 = wk
            ENDIF
    ENDIF

    IF      mc <> z
            cm = wk
            y = fq
            z = mc
            IF      wf = 0 OR wf = 3
                    x1 = wk
                    x2 = wk
                    x3 = wk
            ENDIF
            IF      wf = 1
                    x1 = 0
                    x2 = 0
                    x3 = wk
            ENDIF
            IF      wf = 2
                    x1 = 0
                    x2 = wk
                    x3 = wk
            ENDIF
    ENDIF
```

```
            fh = av - ph
            REPLACE freehrs WITH fh
            REPLACE cumhrs WITH cm
ENDSCAN

SELECT b                    &&Set Weekly Plan
USE weekly_plan
ZAP
APPEND FROM weekly_plan1 FIELDS exp_2,week,date,mc_no,job_no, ;
frequency,workforces,workhrs,cumhrs,freehrs FOR cumhrs <= freehrs

SELECT c                    &&Set Backlog
USE backlog
ZAP
APPEND FROM weekly_plan1 FIELDS exp_2,week,date,mc_no,job_no, ;
frequency,workforces,workhrs,cumhrs,freehrs FOR cumhrs > freehrs

SELECT d                    &&Weekly Plan Summary
USE sum_week_plan
ZAP
APPEND FROM prod_plan_week
SCAN
        STORE date TO y
        STORE mc_no TO z
        STORE prod_hrs TO ph
        STORE avaihrs TO av
        SELECT b
        x = 0
        SCAN
                STORE date TO dt
                STORE mc_no TO mc
                STORE cumhrs TO cm
                IF      dt = y AND mc = z AND cm > x
                        x = cm
                ENDIF
        ENDSCAN
        SELECT d
        fh = av - (ph + x)
        REPLACE workhrs WITH x .
        REPLACE freehrs WITH fh
ENDSCAN

SELECT c
x = 0
SCAN
        REPLACE freehrs WITH x
        REPLACE cumhrs WITH x
ENDSCAN

SELECT d                    &&Update Available Day2
SCAN
        STORE date TO x
        STORE mc_no TO y
        STORE freehrs TO z
        SELECT e
        SCAN
                STORE mc_no TO mc
```

```
                STORE date TO dt
                IF      dt = x AND mc = y
                        REPLACE avaihrs2 WITH z
                ENDIF
        ENDSCAN
ENDSCAN

SELECT d                              &&Calculate Expected Costs
SCAN
        STORE mc_no TO x
        STORE date TO y
        SELECT b
        ec = 0
        SCAN
                STORE mc_no TO mc
                STORE date TO dt
                STORE job_no TO jb
                IF      mc = x AND dt = y
                        SELECT f
                        USE pm_cost
                        s = 0
                        SCAN
                                STORE mc_no TO q
                                STORE job_no TO r
                                STORE pm_labor_cost TO plc
                                STORE pm_mat_cost TO pmc
                                IF      q = mc AND r = jb
                                        s = plc + pmc
                                ENDIF
                        ENDSCAN
                        ec = ec + s
                ENDIF
        ENDSCAN
        SELECT d
        REPLACE expected_cost WITH ec
ENDSCAN

SET SAFETY ON
```

-   *Weekly plan2*

```
*Weekly Plan2
*02/10/99
CLOSE DATABASES
OPEN DATABASE c:\Dsmp\Database
SET SAFETY OFF

SELECT b                              &&Arange Schedule for Backlog
USE available_day2
SCAN
        STORE mc_no TO w
        STORE week TO x
        STORE date TO y
        STORE avaihrs2 TO z
        SELECT c
        USE backlog
```

```
GO TOP
STORE date TO dt
STORE mc_no TO m
x1 = 0
x2 = 0
x3 = 0
cm = 0
IF        m = w
SCAN
          STORE mc_no TO mc
          STORE exp_2 TO mn
          STORE week TO we
          STORE frequency TO fr
          STORE workforces TO wf
          STORE workhrs TO wk
          STORE mark TO mk
          IF      (m = mc AND mn = MONTH(y) AND x = we AND fr <= 7 AND z <> 0 AND
                  0);
                  OR (m = mc AND mn = MONTH(y) AND x >= we AND x < we + 2 AND fr >
                  AND fr <= 30 AND z <> 0 AND mk = 0);
                  OR (m = mc AND mn <= MONTH(y) AND mn > MONTH(y) - 2 AND y >= dt
                  AND fr > 30 AND fr <= 90 AND z <> 0 AND mk = 0);
                  OR (m = mc AND mn <= MONTH(y) AND mn > MONTH(y) - 4 AND y >= dt
                  AND fr > 90 AND fr <= 180 AND z <> 0 AND mk = 0);
                  OR (m = mc AND mn <= MONTH(y) AND mn > MONTH(y) - 6 AND y >= dt
                  AND fr > 180 AND fr <= 365 AND z <> 0 AND mk = 0)

          IF      wf = 0
                  cm = cm + wk
                  x1 = cm
                  x2 = cm
                  x3 = cm
          ENDIF

          IF      wf = 1
                  cm = x1 + wk
                  IF      cm <= x2
                          x1 = cm
                  ENDIF
                  IF      cm > x2 AND cm <= x3
                          x1 = x2
                          x2 = cm
                  ENDIF
                  IF      cm > x3
                          x1 = x2
                          x2 = x3
                          x3 = cm
                  ENDIF
          ENDIF

          IF      wf = 2
                  cm = x2 + wk
                  IF      cm <= x3
                          x1 = cm
                          x2 = cm
                  ENDIF
                  IF      cm > x3
```

mk =

7

mk =

```
                                    x1 = x3
                                    x2 = cm
                                    x3 = cm
                            ENDIF
                    ENDIF

                    IF      wf = 3
                            cm = x3 + wk
                            x1 = cm
                            x2 = cm
                            x3 = cm
                    ENDIF

                    IF      cm <= z
                            mk = 1
                            mn = MONTH(y)
                            REPLACE exp_2 WITH mn
                            REPLACE week WITH x
                            REPLACE date2 WITH y
                            REPLACE mark WITH mk
                            REPLACE cumhrs WITH cm
                    ENDIF
            ENDIF

            IF      (m <> mc AND mn = MONTH(y) AND x = we AND fr <= 7 AND z <> 0 AND
mk              = 0);
                    OR (m <> mc AND mn = MONTH(y) AND x >= we AND x < we + 2 AND fr >
7               AND fr <= 30 AND z <> 0 AND mk = 0);
                    OR (m <> mc AND mn <= MONTH(y) AND mn > MONTH(y) - 2 AND y >=
dt              AND fr > 30 AND fr <= 90 AND z <> 0 AND mk = 0);
                    OR (m <> mc AND mn <= MONTH(y) AND mn > MONTH(y) - 4 AND y >=
dt              AND fr > 90 AND fr <= 180 AND z <> 0 AND mk = 0);
                    OR (m <> mc AND mn <= MONTH(y) AND mn > MONTH(y) - 6 AND y >=
dt              AND fr > 180 AND fr <= 365 AND z <> 0 AND mk = 0)

            cm = wk

            IF      wf = 0 OR wf = 3
                    x1 = wk
                    x2 = wk
                    x3 = wk
            ENDIF

            IF      wf = 1
                    x1 = 0
                    x2 = 0
                    x3 = wk
            ENDIF

            IF      wf = 2
                    x1 = 0
                    x2 = wk
                    x3 = wk
            ENDIF

            IF      cm <= z
                    mk = 1
```

```
                                        mn = MONTH(y)
                                        REPLACE exp_2 WITH mn
                                        REPLACE week WITH x
                                        REPLACE date2 WITH y
                                        REPLACE mark WITH mk
                                        REPLACE cumhrs WITH cm
                        ENDIF
                ENDIF
        ENDSCAN
        ENDIF
ENDSCAN

SELECT e                        &&Update Weekly Plan1
USE prod_plan_week
GO TOP
STORE month TO x
STORE week TO y
STORE date TO z

SELECT d
USE weekly_plan

APPEND FROM backlog FIELDS exp_2,week,date,mc_no,job_no,frequency, ;
workforces,workhrs,mark FOR exp_2 = x AND week = y AND mark = 1

SELECT c                        &&Update Weekly Plan2
SCAN
        STORE mc_no TO w
        STORE job_no TO x
        STORE date TO y
        STORE date2 TO z
        SELECT d
        SCAN
                STORE mc_no TO mc
                STORE job_no TO jb
                STORE date TO dt
                IF      mc = w AND jb = x AND dt = y
                        REPLACE date WITH z
                ENDIF
        ENDSCAN
ENDSCAN

SELECT c                        &&Update Year Plan
SCAN
        STORE mc_no TO u
        STORE job_no TO v
        STORE exp_2 TO w
        STORE week TO x
        STORE date TO y
        STORE date2 TO z
        SELECT e
        USE year_plan
        SCAN
                STORE mc_no TO mc
                STORE job_no TO jb
                STORE date TO dt
                IF      mc = u AND jb = v AND dt = y
```

```
                            dn = 0
                            REPLACE exp_2 WITH w
                            REPLACE week WITH x
                            REPLACE date WITH z
                            REPLACE day_no WITH dn
                    ENDIF
            ENDSCAN
ENDSCAN

SELECT a                              && Weekly Plan Summary1
USE sum_week_plan
SCAN
        STORE date TO x
        STORE mc_no TO m
        STORE avaihrs TO u
        STORE prod_hrs TO y
        SELECT d
        z = 0
        x1 = 0
        x2 = 0
        x3 = 0
        cm = 0
        SCAN
                STORE date TO dt
                STORE mc_no TO mc
                STORE workforces TO wf
                STORE workhrs TO wk
                STORE mark TO mk
                IF      mc = m AND dt = x AND mk <= 1

                        IF      wf = 0
                                cm = cm + wk
                                x1 = cm
                                x2 = cm
                                x3 = cm
                        ENDIF

                        IF      wf = 1
                                cm = x1 + wk
                                IF      cm <= x2
                                        x1 = cm
                                ENDIF
                                IF      cm > x2 AND cm <= x3
                                        x1 = x2
                                        x2 = cm
                                ENDIF
                                IF      cm > x3
                                        x1 = x2
                                        x2 = x3
                                        x3 = cm
                                ENDIF
                        ENDIF

                        IF      wf = 2
                                cm = x2 + wk
                                IF      cm <= x3
                                        x1 = cm
```

```
                                            x2 = cm
                            ENDIF
                            IF      cm > x3
                                    x1 = x3
                                    x2 = cm
                                    x3 = cm
                            ENDIF
                    ENDIF

                    IF      wf = 3
                            cm = x3 + wk
                            x1 = cm
                            x2 = cm
                            x3 = cm
                    ENDIF

                    IF      cm > z
                            mk = 2
                            z = cm
                    ENDIF
                ENDIF
        ENDSCAN
        SELECT a
        fh = u - (y + z)
        REPLACE freehrs WITH fh
        REPLACE workhrs WITH z
ENDSCAN

SELECT a                         &&Weekly Plan Summary2
SCAN
        STORE date TO x
        STORE mc_no TO y
        SELECT d
        n = 0
        SCAN
        STORE date TO dt
        STORE mc_no TO mc
                IF      dt = x AND mc = y
                        n = n + 1
                ENDIF
        ENDSCAN
        SELECT a
        REPLACE no_job WITH n
ENDSCAN

SELECT b                         &&Update Available Day1
SCAN
        STORE mc_no TO v
        STORE date TO x
        STORE avaihrs2 TO y
        SELECT c
        z = 0
        w = x
        q = v
        avt = y
        SCAN
                STORE mc_no TO mc
```

```
                STORE date2 TO dt
                STORE cumhrs TO cm
                IF        mc = v AND dt = x AND cm > z
                          z = cm
                          w = dt
                          q = mc
                ENDIF
        ENDSCAN
        SELECT b
        IF        v = q AND x = w AND y > z
                  avt = y - z
                  REPLACE avaihrs2 WITH avt
        ENDIF
ENDSCAN

SELECT b                          &&UPdate Available Day2
SCAN
        STORE mc_no TO w
        STORE date TO x
        STORE avaihrs2 TO z
        y = x
        q = w
        avt = z
        SELECT a
        SCAN
                STORE mc_no TO o
                STORE date TO m
                STORE freehrs TO n
                IF        o = w AND m = x
                          y = m
                          q = o
                          avt = n
                ENDIF
        ENDSCAN
        SELECT b
        IF        w = q AND x = y
                  REPLACE avaihrs2 WITH avt
        ENDIF
ENDSCAN

SELECT a                          &&Calculate Expected Costs
SCAN
        STORE mc_no TO x
        STORE date TO y
        SELECT d
        ec = 0
        SCAN
                STORE mc_no TO mc
                STORE date TO dt
                STORE job_no TO jb
                IF        mc = x AND dt = y
                          SELECT f
                          USE pm_cost
                          s = 0
                          SCAN
                                  STORE mc_no TO q
                                  STORE job_no TO r
```

```
                    STORE pm_labor_cost TO plc
                    STORE pm_mat_cost TO pmc
                    IF      q = mc AND r = jb
                            s = plc + pmc
                    ENDIF
                ENDSCAN
                ec = ec + s
          ENDIF
      ENDSCAN
      SELECT a
      REPLACE expected_cost WITH cc
ENDSCAN

SET SAFETY ON
```
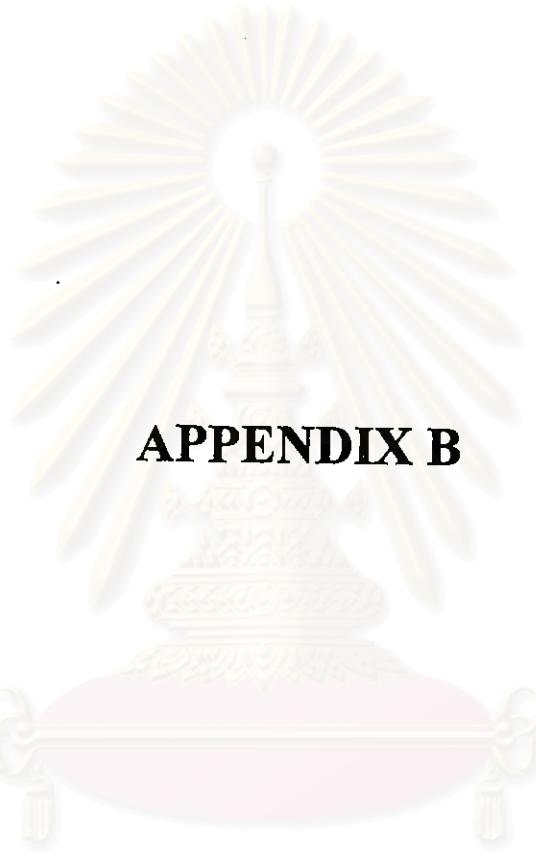
APPENDIX B

Appendix B

Table B-1: Maintenance Summary Report for Corrective Maintenance Test

date	mc_no	prod_hrs	workhrs	avaihrs	freehrs	no_job	act_prodhrs	act_hrs	downtime	total_hrs	unfinish_job	percent	expect_cost	act_cost	bd_cost
2/1/99	P01	6.00		8.00	2.00		5.50			5.50		100.00			0.00
4/1/99	P01	7.00		8.00	1.00		7.00			7.00		100.00			0.00
5/1/99	P01	5.00		8.00	3.00		6.00			6.00		60.00			0.00
6/1/99	P01	7.00		8.00	1.00		7.00			7.00		100.00			0.00
7/1/99	P01	6.00		8.00	2.00		6.00			6.00		100.00			0.00
8/1/99	P01	8.00		8.00	0.00		6.50			6.50		0.00			0.00
9/1/99	P01	8.00		8.00	0.00		8.00			8.00		0.00			0.00
11/1/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
12/1/99	P01	8.00		8.00	0.00		7.83			7.83		0.00			0.00
13/1/99	P01	8.00		8.00	0.00		7.67			7.67		0.00			0.00
14/1/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
15/1/99	P01	5.00		8.00	3.00		5.50			5.50		100.00			0.00
16/1/99	P01	6.00		8.00	2.00		6.00			6.00		0.00			0.00
18/1/99	P01	6.00		8.00	2.00		6.17			6.17		100.00			0.00
19/1/99	P01	7.00		8.00	1.00		7.00			7.00		100.00			0.00
20/1/99	P01	7.00		8.00	1.00		7.50			7.50		100.00			0.00
21/1/99	P01	8.00		8.00	0.00		7.67			7.67		0.00			0.00
22/1/99	P01	8.00		8.00	0.00		7.00			7.00		0.00			0.00
23/1/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
25/1/99	P01	8.00		8.00	0.00		8.00			8.00		0.00			0.00
26/1/99	P01	12.00		12.00	0.00		11.00			11.00		0.00			0.00
27/1/99	P01	10.00		10.00	0.00		9.50			9.50		0.00			0.00
28/1/99	P01	12.00		12.00	0.00		11.33			11.33		0.00			0.00
29/1/99	P01	13.00		13.00	0.00		12.17			12.17		0.00			0.00
30/1/99	P01	6.00		8.00	2.00		6.00			6.00		100.00			0.00
1/2/99	P01	5.00		8.00	3.00		5.00			5.00		100.00			0.00
2/2/99	P01	4.00		8.00	4.00		4.50			4.50		100.00			0.00

date	mc_no	prod_hrs	workhrs	avaihrs	freehrs	no_job	act_prodhrs	act_hrs	downtime	total_hrs	unfinish_job	percent	expect_cost	act_cost	bd_cost
3/2/99	P01	5.00		8.00	3.00		4.50			4.50		0.00			0.00
4/2/99	P01	5.00		8.00	3.00		5.00			5.00		0.00			0.00
5/2/99	P01	6.00		8.00	2.00		6.00			6.00		0.00			0.00
6/2/99	P01	5.00		8.00	3.00		3.00			3.00		100.00			0.00
8/2/99	P01	6.00		8.00	2.00		7.50			7.50		100.00			0.00
9/2/99	P01	8.00		8.00	0.00		7.67			7.67		0.00			0.00
10/2/99	P01	8.00		8.00	0.00		7.17			7.17		0.00			0.00
11/2/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
12/2/99	P01	8.00		8.00	0.00		6.50		1.00	7.50		0.00			1950.00
13/2/99	P01	8.00		8.00	0.00		7.00			7.00		0.00			0.00
15/2/99	P01	5.00		8.00	3.00		6.00			6.00		100.00			0.00
16/2/99	P01	6.00		8.00	2.00		6.00			6.00		100.00			0.00
17/2/99	P01	7.00		8.00	1.00		7.50			7.50		100.00			0.00
18/2/99	P01	6.00		8.00	2.00		4.50			4.50		100.00			0.00
19/2/99	P01	7.00		8.00	1.00		7.00			7.00		0.00			0.00
20/2/99	P01	8.00		8.00	0.00		7.67			7.67		0.00			0.00
22/2/99	P01	8.00		8.00	0.00		7.17			7.17		100.00			0.00
23/2/99	P01	12.00		12.00	0.00		11.00			11.00		0.00			0.00
24/2/99	P01	10.00		10.00	0.00		9.00			9.00		0.00			0.00
25/2/99	P01	8.00		8.00	0.00		7.50			7.50		100.00			0.00
26/2/99	P01	10.00		10.00	0.00		9.67			9.67		0.00			0.00
27/2/99	P01	9.00		9.00	0.00		8.17			8.17		100.00			0.00
1/3/99	P01	7.00		8.00	1.00		6.67			6.67		100.00			0.00
2/3/99	P01	5.00		8.00	3.00		5.50			5.50		80.00			0.00
3/3/99	P01	5.00		8.00	3.00		5.00			5.00		100.00			0.00
4/3/99	P01	4.00		8.00	4.00		4.00			4.00		0.00			0.00
5/3/99	P01	4.00		8.00	4.00		4.00			4.00		0.00			0.00
6/3/99	P01	6.00		8.00	2.00		5.50			5.50		100.00			0.00
8/3/99	P01	6.00		8.00	2.00		7.50			7.50		100.00			0.00
9/3/99	P01	8.00		8.00	0.00		7.67			7.67		0.00			0.00
10/3/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
11/3/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
12/3/99	P01	8.00		8.00	0.00		7.13			7.13		0.00			0.00

date	mc_no	prod_hrs	workhrs	avaihrs	freehrs	no_job	act_prodhrs	act_hrs	downtime	total_hrs	unfinish_job	percent	expect_cost	act_cost	bd_cost
13/3/99	P01	12.00		12.00	0.00		11.50			11.50		0.00			0.00
15/3/99	P01	12.00		12.00	0.00		11.17			11.17		0.00			0.00
16/3/99	P01	5.00		8.00	3.00		7.50			7.50		100.00			0.00
17/3/99	P01	6.00		8.00	2.00		6.00			6.00		100.00			0.00
18/3/99	P01	5.00		8.00	3.00		4.00			4.00		100.00			0.00
19/3/99	P01	5.00		8.00	3.00		5.00			5.00		100.00			0.00
20/3/99	P01	6.00		8.00	2.00		5.00			5.00		100.00			0.00
22/3/99	P01	7.00		8.00	1.00		7.00			7.00		0.00			0.00
23/3/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
24/3/99	P01	8.00		8.00	0.00		7.00			7.00		0.00			0.00
25/3/99	P01	8.00		8.00	0.00		7.00			7.00		0.00			0.00
26/3/99	P01	10.00		10.00	0.00		9.50			9.50		0.00			0.00
27/3/99	P01	10.00		10.00	0.00		9.00			9.00		0.00			0.00
29/3/99	P01	9.00		9.00	0.00		8.50			8.50		0.00			0.00
30/3/99	P01	8.00		8.00	0.00		7.00			7.00		0.00			0.00
31/3/99	P01	6.00		8.00	2.00		7.50			7.50		0.00			0.00
1/4/99	P01	5.00		8.00	3.00		7.00			7.00		50.00			0.00
2/4/99	P01	5.00		8.00	3.00		5.00			5.00		100.00			0.00
3/4/99	P01	6.00		8.00	2.00		6.00			6.00		100.00			0.00
5/4/99	P01	7.00		8.00	1.00		6.50			6.50		100.00			0.00
6/4/99	P01	7.00		8.00	1.00		7.00			7.00		0.00			0.00
7/4/99	P01	6.00		8.00	2.00		7.50			7.50		100.00			0.00
8/4/99	P01	8.00		8.00	0.00		7.67			7.67		0.00			0.00
9/4/99	P01	8.00		8.00	0.00		7.17			7.17		0.00			0.00
10/4/99	P01	8.00		8.00	0.00		7.00			7.00		0.00			0.00
12/4/99	P01	12.00		12.00	0.00		11.17			11.17		0.00			0.00
14/4/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
15/4/99	P01	6.00		8.00	2.00		7.50			7.50		0.00			0.00
16/4/99	P01	7.00		8.00	1.00		4.50		3.00	7.50		0.00			9130.00
17/4/99	P01	5.00		8.00	3.00		4.50			4.50		100.00			0.00
19/4/99	P01	8.00		8.00	0.00		7.00			7.00		100.00			0.00
20/4/99	P01	8.00		8.00	0.00		7.50			7.50		100.00			0.00
21/4/99	P01	10.00		10.00	0.00		9.33			9.33		0.00			0.00

date	mc_no	prod_hrs	workhrs	avaihrs	freehrs	no_job	act_prodhrs	act_hrs	downtime	total_hrs	unfinish_job	percent	expect_cost	act_cost	bd_cost
22/4/99	P01	12.00		12.00	0.00		11.50			11.50		0.00			0.00
23/4/99	P01	8.00		8.00	0.00		7.17			7.17		0.00			0.00
24/4/99	P01	7.00		8.00	1.00		7.00			7.00		100.00			0.00
26/4/99	P01	8.00		8.00	0.00		7.17			7.17		100.00			0.00
27/4/99	P01	8.00		8.00	0.00		7.50			7.50		100.00			0.00
28/4/99	P01	8.00		8.00	0.00		7.33			7.33		0.00			0.00
29/4/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
30/4/99	P01	8.00		8.00	0.00		7.33			7.33		0.00			0.00
1/5/99	P01	6.00		8.00	2.00		6.50			6.50		100.00			0.00
3/5/99	P01	7.00		8.00	1.00		7.00			7.00		100.00			0.00
4/5/99	P01	7.00		8.00	1.00		7.17			7.17		100.00			0.00
5/5/99	P01	6.00		8.00	2.00		6.83			6.83		100.00			0.00
6/5/99	P01	7.00		8.00	1.00		7.17			7.17		100.00			0.00
7/5/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
8/5/99	P01	8.00		8.00	0.00		7.00			7.00		0.00			0.00
10/5/99	P01	7.00		8.00	1.00		6.00		1.50	7.50		0.00			2225.00
11/5/99	P01	8.00		8.00	0.00		7.67			7.67		0.00			0.00
12/5/99	P01	8.00		8.00	0.00		7.33			7.33		0.00			0.00
13/5/99	P01	13.00		13.00	0.00		12.50			12.50		0.00			0.00
14/5/99	P01	12.00		12.00	0.00		11.33			11.33		0.00			0.00
15/5/99	P01	10.00		10.00	0.00		9.67			9.67		0.00			0.00
17/5/99	P01	7.00		8.00	1.00		7.00			7.00		0.00			0.00
18/5/99	P01	6.00		8.00	2.00		4.00			4.00		100.00			0.00
19/5/99	P01	6.00		8.00	2.00		6.00			6.00		100.00			0.00
20/5/99	P01	6.00		8.00	2.00		7.00		0.50	7.50		100.00			1375.00
21/5/99	P01	7.00		8.00	1.00		7.00			7.00		0.00			0.00
22/5/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
24/5/99	P01	8.00		8.00	0.00		7.50			7.50		100.00			0.00
25/5/99	P01	8.00		8.00	0.00		7.67			7.67		100.00			0.00
26/5/99	P01	8.00		8.00	0.00		7.33			7.33		100.00			0.00
27/5/99	P01	10.00		10.00	0.00		9.33			9.33		100.00			0.00
28/5/99	P01	12.00		12.00	0.00		11.17			11.17		0.00			0.00
29/5/99	P01	10.00		10.00	0.00		9.50			9.50		100.00			0.00

date	mc_no	prod_hrs	workhrs	avaihrs	freehrs	no_job	act_prodhrs	act_hrs	downtime	total_hrs	unfinish_job	percent	expect_cost	act_cost	bd_cost
31/5/99	P01	8.00		8.00	0.00		5.00		8.00	13.00		100.00			47825.00
1/6/99	P01	10.00		10.00	0.00		9.50			9.50		0.00			0.00
2/6/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
3/6/99	P01	7.00		8.00	1.00		7.33			7.33		100.00			0.00
4/6/99	P01	5.00		8.00	3.00		6.50			6.50		100.00			0.00
5/6/99	P01	6.00		8.00	2.00		6.00			6.00		100.00			0.00
7/6/99	P01	6.00		8.00	2.00		6.00			6.00		100.00			0.00
8/6/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
9/6/99	P01	7.00		8.00	1.00		7.00			7.00		0.00			0.00
10/6/99	P01	7.00		8.00	1.00		6.50			6.50		0.00			0.00
11/6/99	P01	8.00		8.00	0.00		7.17			7.17		0.00			0.00
12/6/99	P01	8.00		8.00	0.00		7.33			7.33		0.00			0.00
14/6/99	P01	8.00		8.00	0.00		7.67			7.67		0.00			0.00
15/6/99	P01	6.00		8.00	2.00		7.00		2.50	9.50		100.00			8412.50
16/6/99	P01	7.00		8.00	1.00		7.67			7.67		100.00			0.00
17/6/99	P01	6.00		8.00	2.00		7.50			7.50		0.00			0.00
18/6/99	P01	7.00		8.00	1.00		7.00			7.00		0.00			0.00
19/6/99	P01	7.00		8.00	1.00		6.50			6.50		100.00			0.00
21/6/99	P01	8.00		8.00	0.00		4.50		6.50	11.00		100.00			85610.00
22/6/99	P01	8.00		8.00	0.00		7.67			7.67		100.00			0.00
23/6/99	P01	8.00		8.00	0.00		7.17			7.17		100.00			0.00
24/6/99	P01	8.00		8.00	0.00		7.33			7.33		0.00			0.00
25/6/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
26/6/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
28/6/99	P01	8.00		8.00	0.00		7.67			7.67		100.00			0.00
29/6/99	P01	8.00		8.00	0.00		7.33			7.33		100.00			0.00
30/6/99	P01	7.00		8.00	1.00		7.50			7.50		0.00			0.00
1/7/99	P01	7.00		8.00	1.00		7.00			7.00		100.00			0.00
2/7/99	P01	6.00		8.00	2.00		6.00			6.00		100.00			0.00
3/7/99	P01	7.00		8.00	1.00		7.17			7.17		100.00			0.00
5/7/99	P01	5.00		8.00	3.00		4.50			4.50		100.00			0.00
6/7/99	P01	5.00		8.00	3.00		6.00			6.00		100.00			0.00
7/7/99	P01	7.00		8.00	1.00		7.00			7.00		0.00			0.00

date	mc_no	prod_hrs	workhrs	avaihrs	freehrs	no_job	act_prodhrs	act_hrs	downtime	total_hrs	unfinish_job	percent	expect_cost	act_cost	bd_cost
8/7/99	P01	6.00		8.00	2.00		7.00			7.00		0.00			0.00
9/7/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
10/7/99	P01	8.00		8.00	0.00		7.67			7.67		0.00			0.00
12/7/99	P01	8.00		8.00	0.00		7.33			7.33		0.00			0.00
13/7/99	P01	12.00		12.00	0.00		9.17		2.00	11.17		0.00			3800.00
14/7/99	P01	12.00		12.00	0.00		11.50			11.50		0.00			0.00
15/7/99	P01	7.00		8.00	1.00		5.33		2.00	7.33		0.00			5000.00
16/7/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
17/7/99	P01	8.00		8.00	0.00		7.67			7.67		0.00			0.00
19/7/99	P01	8.00		8.00	0.00		7.50			7.50		100.00			0.00
20/7/99	P01	7.00		8.00	1.00		7.17			7.17		100.00			0.00
21/7/99	P01	8.00		8.00	0.00		7.50			7.50		100.00			0.00
22/7/99	P01	8.00		8.00	0.00		7.00			7.00		0.00			0.00
23/7/99	P01	10.00		10.00	0.00		9.33			9.33		0.00			0.00
24/7/99	P01	10.00		10.00	0.00		9.50			9.50		0.00			0.00
26/7/99	P01	8.00		8.00	0.00		7.33			7.33		100.00			0.00
27/7/99	P01	8.00		8.00	0.00		7.50			7.50		100.00			0.00
28/7/99	P01	12.00		12.00	0.00		11.67			11.67		0.00			0.00
29/7/99	P01	11.00		11.00	0.00		13.00		2.00	15.00		0.00			5500.00
30/7/99	P01	9.00		9.00	0.00		8.67			8.67		100.00			0.00
31/7/99	P01	8.00		8.00	0.00		7.33			7.33		100.00			0.00
2/8/99	P01	7.00		8.00	1.00		7.50			7.50		0.00			0.00
3/8/99	P01	7.00		8.00	1.00		7.00			7.00		0.00			0.00
4/8/99	P01	6.00		8.00	2.00		6.50			6.50		100.00			0.00
5/8/99	P01	5.00		8.00	3.00		5.00			5.00		100.00			0.00
6/8/99	P01	7.00		8.00	1.00		7.00			7.00		100.00			0.00
7/8/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
9/8/99	P01	8.00		8.00	0.00		7.00			7.00		100.00			0.00
10/8/99	P01	8.00		8.00	0.00		7.33			7.33		100.00			0.00
11/8/99	P01	8.00		8.00	0.00		7.67			7.67		100.00			0.00
13/8/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
14/8/99	P01	8.00		8.00	0.00		7.00			7.00		0.00			0.00
16/8/99	P01	7.00		8.00	1.00		7.67			7.67		100.00			0.00

date	mc_no	prod_hrs	workhrs	avaihrs	freehrs	no_job	act_prodhrs	act_hrs	downtime	total_hrs	unfinish_job	percent	expect_cost	act_cost	bd_cost
17/8/99	P01	10.00		10.00	0.00		9.33			9.33		0.00			0.00
18/9/99	P01	12.00		12.00	0.00		11.50			11.50		0.00			0.00
19/8/99	P01	10.00		10.00	0.00		8.00		1.50	9.50		0.00			2225.00
20/8/99	P01	9.00		9.00	0.00		8.50			8.50		0.00			0.00
21/8/99	P01	8.00		8.00	0.00		7.33			7.33		100.00			0.00
23/8/99	P01	8.00		8.00	0.00		7.00		2.00	9.00		100.00			7525.00
24/8/99	P01	8.00		8.00	0.00		7.17			7.17		0.00			0.00
25/8/99	P01	8.00		8.00	0.00		7.33			7.33		0.00			0.00
26/8/99	P01	10.00		10.00	0.00		9.50			9.50		0.00			0.00
27/8/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
28/8/99	P01	8.00		8.00	0.00		7.00			7.00		0.00			0.00
30/8/99	P01	8.00		8.00	0.00		7.17			7.17		0.00			0.00
31/8/99	P01	7.00		8.00	1.00		7.17			7.17		0.00			0.00
1/9/99	P01	6.00		8.00	2.00		7.00			7.00		100.00			0.00
2/9/99	P01	5.00		8.00	3.00		5.00			5.00		100.00			0.00
3/9/99	P01	6.00		8.00	2.00		5.50			5.50		100.00			0.00
4/9/99	P01	7.00		8.00	1.00		7.33			7.33		100.00			0.00
6/9/99	P01	8.00		8.00	0.00		7.50			7.50		100.00			0.00
7/9/99	P01	7.00		8.00	1.00		7.00			7.00		0.00			0.00
8/9/99	P01	7.00		8.00	1.00		6.67			6.67		0.00			0.00
9/9/99	P01	8.00		8.00	0.00		7.67			7.67		0.00			0.00
10/9/99	P01	8.00		8.00	0.00		7.17			7.17		0.00			0.00
11/9/99	P01	10.00		10.00	0.00		9.33			9.33		0.00			0.00
13/9/99	P01	10.00		10.00	0.00		9.50			9.50		0.00			0.00
14/9/99	P01	8.00		8.00	0.00		7.50			7.50		100.00			0.00
15/9/99	P01	8.00		8.00	0.00		7.67			7.67		0.00			0.00
16/9/99	P01	7.00		8.00	1.00		6.50			6.50		100.00			0.00
17/9/99	P01	5.00		8.00	3.00		5.00			5.00		100.00			0.00
18/9/99	P01	5.00		8.00	3.00		4.50			4.50		100.00			0.00
20/9/99	P01	8.00		8.00	0.00		7.33			7.33		100.00			0.00
21/9/99	P01	10.00		10.00	0.00		9.17			9.17		0.00			0.00
22/9/99	P01	12.00		12.00	0.00		11.50			11.50		0.00			0.00
23/9/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00

date	mc_no	prod_hrs	workhrs	avaihrs	freehrs	no_job	act_prodhrs	act_hrs	downtime	total_hrs	unfinish_job	percent	expect_cost	act_cost	bd_cost
24/9/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
25/9/99	P01	8.00		8.00	0.00		7.33			7.33		0.00			0.00
27/9/99	P01	10.00		10.00	0.00		9.50			9.50		0.00			0.00
28/9/99	P01	11.00		11.00	0.00		10.67			10.67		0.00			0.00
29/9/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
30/9/99	P01	8.00		8.00	0.00		7.33			7.33		0.00			0.00
1/10/99	P01	8.00		8.00	0.00		7.33			7.33		0.00			0.00
2/10/99	P01	8.00		8.00	0.00		7.50			7.50		100.00			0.00
4/10/99	P01	7.00		8.00	1.00		7.00			7.00		100.00			0.00
5/10/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
6/10/99	P01	7.00		8.00	1.00		7.00			7.00		0.00			0.00
7/10/99	P01	6.00		8.00	2.00		5.00			5.00		0.00			0.00
8/10/99	P01	8.00		8.00	0.00		7.00			7.00		0.00			0.00
9/10/99	P01	8.00		8.00	0.00		7.17			7.17		0.00			0.00
11/10/99	P01	7.00		8.00	1.00		7.00			7.00		100.00			0.00
12/10/99	P01	8.00		8.00	0.00		7.67			7.67		100.00			0.00
13/10/99	P01	9.00		9.00	0.00		8.33			8.33		0.00			0.00
14/10/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
15/10/99	P01	8.00		8.00	0.00		7.00			7.00		0.00			0.00
16/10/99	P01	9.00		9.00	0.00		8.50			8.50		0.00			0.00
18/10/99	P01	10.00		10.00	0.00		9.33			9.33		100.00			0.00
19/10/99	P01	8.00		8.00	0.00		7.17			7.17		100.00			0.00
20/10/99	P01	12.00		12.00	0.00		11.50			11.50		0.00			0.00
21/10/99	P01	10.00		10.00	0.00		9.33			9.33		0.00			0.00
22/10/99	P01	10.00		10.00	0.00		9.50			9.50		0.00			0.00
23/10/99	P01	8.00		8.00	0.00		7.33			7.33		100.00			0.00
25/10/99	P01	8.00		8.00	0.00		7.00		2.00	9.00		100.00			5325.00
26/10/99	P01	12.00		12.00	0.00		11.50			11.50		0.00			0.00
27/10/99	P01	12.00		12.00	0.00		11.00			11.00		0.00			0.00
28/10/99	P01	12.00		12.00	0.00		11.67			11.67		0.00			0.00
29/10/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
30/10/99	P01	8.00		8.00	0.00		7.00			7.00		0.00			0.00
1/11/99	P01	6.00		8.00	2.00		6.33			6.33		100.00			0.00

date	mc_no	prod_hrs	workhrs	avaihrs	freehrs	no_job	act_prodhrs	act_hrs	downtime	total_hrs	unfinish_job	percent	expect_cost	act_cost	bd_cost
2/11/99	P01	7.00		8.00	1.00		7.00			7.00		100.00			0.00
3/11/99	P01	8.00		8.00	0.00		7.17			7.17		0.00			0.00
4/11/99	P01	8.00		8.00	0.00		7.00			7.00		0.00			0.00
5/11/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
6/11/99	P01	8.00		8.00	0.00		7.50			7.50		0.00			0.00
8/11/99	P01	8.00		8.00	0.00		7.33			7.33		0.00			0.00
9/11/99	P01	8.00		8.00	0.00		7.17			7.17		0.00			0.00
10/11/99	P01	13.00		13.00	0.00		12.50			12.50		0.00			0.00
11/11/99	P01	10.00		10.00	0.00		9.50			9.50		0.00			0.00
12/11/99	P01	14.00		14.00	0.00		13.17			13.17		0.00			0.00
13/11/99	P01	14.00		14.00	0.00		13.33			13.33		0.00			0.00
15/11/99	P01	12.00		12.00	0.00		11.50			11.50		0.00			0.00
16/11/99	P01	6.00		10.00	4.00		7.50			7.50		100.00			0.00
17/11/99	P01	7.00		10.00	3.00		7.17			7.17		100.00			0.00
18/11/99	P01	6.00		9.00	3.00		7.00			7.00		100.00			0.00
19/11/99	P01	8.00		8.00	0.00		7.67			7.67		100.00			0.00
20/11/99	P01	8.00		13.00	5.00		7.50			7.50		100.00			0.00
22/11/99	P01	13.00		13.00	0.00		12.17			12.17		0.00			0.00
23/11/99	P01	12.00		12.00	0.00		11.00			11.00		0.00			0.00
24/11/99	P01	10.00		10.00	0.00		9.33			9.33		100.00			0.00
25/11/99	P01	12.00		12.00	0.00		11.50			11.50		0.00			0.00
26/11/99	P01	12.00		12.00	0.00		11.33			11.33		0.00			0.00
27/11/99	P01	12.00		12.00	0.00		11.00			11.00		0.00			0.00
29/11/99	P01	12.00		12.00	0.00		11.50			11.50		0.00			0.00
30/11/99	P01	10.00		10.00	0.00		9.50			9.50		0.00			0.00
											Total		0.00	0.00	185902.50

Table B-2: Maintenance Plan for Preventive Maintenance Test

mc_no	month	week	date	avaihrs	job_no	frequency	workforces	workhrs
P01	1	1	2/1/99	8.00	P-P01-01	30	1	0.50
P01	1	1	2/1/99	8.00	P-P01-07	30	1	0.17
P01	1	1	2/1/99	8.00	P-P01-19	30	1	1.00
P01	1	1	2/1/99	8.00	P-P01-20	30	1	0.50
P01	1	1	2/1/99	8.00	P-P01-21	30	1	0.17
P01	1	1	2/1/99	8.00	P-P01-22	30	1	0.17
P01	1	1	2/1/99	8.00	P-P01-39	30	1	0.17
P01	1	4	18/1/99	8.00	P-P01-28	30	2	4.00
P01	2	1	2/2/99	8.00	P-P01-28	30	2	4.00
P01	2	1	6/2/99	8.00	P-P01-01	30	1	0.50
P01	2	1	6/2/99	8.00	P-P01-07	30	1	0.17
P01	2	1	6/2/99	8.00	P-P01-19	30	1	1.00
P01	2	1	6/2/99	8.00	P-P01-20	30	1	0.50
P01	2	1	6/2/99	8.00	P-P01-21	30	1	0.17
P01	2	1	6/2/99	8.00	P-P01-22	30	1	0.17
P01	2	1	6/2/99	8.00	P-P01-39	30	1	0.17
P01	2	3	15/2/99	8.00	P-P01-47	90	2	1.00
P01	2	3	15/2/99	8.00	P-P01-56	90	1	0.17
P01	3	1	4/3/99	8.00	P-P01-28	30	2	4.00
P01	3	1	6/3/99	8.00	P-P01-01	30	1	0.50
P01	3	1	6/3/99	8.00	P-P01-07	30	1	0.17
P01	3	1	6/3/99	8.00	P-P01-19	30	1	1.00
P01	3	1	6/3/99	8.00	P-P01-20	30	1	0.50
P01	3	1	6/3/99	8.00	P-P01-21	30	1	0.17
P01	3	1	6/3/99	8.00	P-P01-22	30	1	0.17
P01	3	1	6/3/99	8.00	P-P01-39	30	1	0.17
P01	4	1	3/4/99	8.00	P-P01-01	30	1	0.50
P01	4	1	3/4/99	8.00	P-P01-07	30	1	0.17
P01	4	1	3/4/99	8.00	P-P01-19	30	1	1.00
P01	4	1	3/4/99	8.00	P-P01-20	30	1	0.50
P01	4	1	3/4/99	8.00	P-P01-21	30	1	0.17
P01	4	1	3/4/99	8.00	P-P01-22	30	1	0.17
P01	4	1	3/4/99	8.00	P-P01-39	30	1	0.17
P01	4	3	17/4/99	8.00	P-P01-71	180	1	0.17
P01	4	4	19/4/99	8.00	P-P01-28	30	2	4.00
P01	5	1	1/5/99	8.00	P-P01-01	30	1	0.50
P01	5	1	1/5/99	8.00	P-P01-07	30	1	0.17
P01	5	1	1/5/99	8.00	P-P01-19	30	1	1.00
P01	5	1	1/5/99	8.00	P-P01-20	30	1	0.50
P01	5	1	1/5/99	8.00	P-P01-21	30	1	0.17
P01	5	1	1/5/99	8.00	P-P01-22	30	1	0.17

mc_no	month	week	date	avaihrs	job_no	frequency	workforces	workhrs
P01	5	1	1/5/99	8.00	P-P01-39	30	1	0.17
P01	5	3	10/5/99	8.00	P-P01-56	90	1	0.17
P01	5	4	17/5/99	8.00	P-P01-47	90	2	1.00
P01	5	5	24/5/99	8.00	P-P01-28	30	2	4.00
P01	6	1	4/6/99	8.00	P-P01-28	30	2	4.00
P01	6	1	5/6/99	8.00	P-P01-01	30	1	0.50
P01	6	1	5/6/99	8.00	P-P01-07	30	1	0.17
P01	6	1	5/6/99	8.00	P-P01-19	30	1	1.00
P01	6	1	5/6/99	8.00	P-P01-20	30	1	0.50
P01	6	1	5/6/99	8.00	P-P01-21	30	1	0.17
P01	6	1	5/6/99	8.00	P-P01-22	30	1	0.17
P01	6	1	5/6/99	8.00	P-P01-39	30	1	0.17
P01	7	1	1/7/99	8.00	P-P01-39	30	1	0.17
P01	7	1	3/7/99	8.00	P-P01-01	30	1	0.50
P01	7	1	3/7/99	8.00	P-P01-07	30	1	0.17
P01	7	1	3/7/99	8.00	P-P01-20	30	1	0.50
P01	7	1	3/7/99	8.00	P-P01-21	30	1	0.17
P01	7	1	3/7/99	8.00	P-P01-22	30	1	0.17
P01	7	2	5/7/99	8.00	P-P01-19	30	1	1.00
P01	7	5	26/7/99	8.00	P-P01-28	30	2	4.00
P01	8	1	2/8/99	8.00	P-P01-01	30	1	0.50
P01	8	1	2/8/99	8.00	P-P01-07	30	1	0.17
P01	8	1	2/8/99	8.00	P-P01-20	30	1	0.50
P01	8	1	2/8/99	8.00	P-P01-21	30	1	0.17
P01	8	1	3/8/99	8.00	P-P01-22	30	1	0.17
P01	8	1	3/8/99	8.00	P-P01-39	30	1	0.17
P01	8	1	4/8/99	8.00	P-P01-19	30	1	1.00
P01	8	3	16/8/99	8.00	P-P01-28	30	2	4.00
P01	8	3	16/8/99	8.00	P-P01-56	90	1	0.17
P01	8	4	23/8/99	8.00	P-P01-47	90	2	1.00
P01	9	1	1/9/99	8.00	P-P01-39	30	1	0.17
P01	9	1	4/9/99	8.00	P-P01-01	30	1	0.50
P01	9	1	4/9/99	8.00	P-P01-07	30	1	0.17
P01	9	1	4/9/99	8.00	P-P01-20	30	1	0.50
P01	9	1	4/9/99	8.00	P-P01-21	30	1	0.17
P01	9	1	4/9/99	8.00	P-P01-22	30	1	0.17
P01	9	2	6/9/99	8.00	P-P01-19	30	1	1.00
P01	9	3	14/9/99	8.00	P-P01-28	30	2	4.00
P01	10	1	2/10/99	8.00	P-P01-01	30	1	0.50
P01	10	1	2/10/99	8.00	P-P01-07	30	1	0.17
P01	10	1	2/10/99	8.00	P-P01-19	30	1	1.00
P01	10	1	2/10/99	8.00	P-P01-20	30	1	0.50
P01	10	1	2/10/99	8.00	P-P01-21	30	1	0.17
P01	10	1	2/10/99	8.00	P-P01-22	30	1	0.17

mc_no	month	week	date	avaihrs	job_no	frequency	workforces	workhrs
P01	10	1	2/10/99	8.00	P-P01-39	30	1	0.17
P01	10	2	4/10/99	8.00	P-P01-28	30	2	4.00
P01	10	4	18/10/99	8.00	P-P01-71	180	1	0.17
P01	11	1	1/11/99	8.00	P-P01-01	30	1	0.50
P01	11	1	1/11/99	8.00	P-P01-07	30	1	0.17
P01	11	1	1/11/99	8.00	P-P01-19	30	1	1.00
P01	11	1	1/11/99	8.00	P-P01-20	30	1	0.50
P01	11	1	1/11/99	8.00	P-P01-21	30	1	0.17
P01	11	1	1/11/99	8.00	P-P01-22	30	1	0.17
P01	11	1	1/11/99	8.00	P-P01-39	30	1	0.17
P01	11	5	2/11/99	8.00	P-P01-28	30	2	4.00
P01	11	3	17/11/99	8.00	P-P01-56	90	1	0.17
P01	11	3	18/11/99	8.00	P-P01-47	90	2	1.00
P01	12	1	4/12/99	8.00	P-P01-01	30	1	0.50
P01	12	1	4/12/99	8.00	P-P01-07	30	1	0.17
P01	12	1	4/12/99	8.00	P-P01-19	30	1	1.00
P01	12	1	4/12/99	8.00	P-P01-20	30	1	0.50
P01	12	1	4/12/99	8.00	P-P01-21	30	1	0.17
P01	12	1	4/12/99	8.00	P-P01-22	30	1	0.17
P01	12	1	4/12/99	8.00	P-P01-28	30	2	4.00
P01	12	1	4/12/99	8.00	P-P01-39	30	1	0.17

Table B-3: Maintenance Summary Report for Preventive Maintenance Test

date	mc_no	prod_hrs	workhrs	avaihrs	freehrs	no_job	act_prodhrs	act_hrs	downtime	total_hrs	unfinish_job	percent	expect_cost	act_cost	bd_cost
2/1/99	P01	6.00	1.00	8.00	1.00	7	5.50	1.00	0.00	6.50	0	100.00	134.00	134.00	0.00
4/1/99	P01	7.00	0.00	8.00	1.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
5/1/99	P01	5.00	0.00	8.00	3.00	0	6.00	0.00	0.00	6.00	0	0.00	0.00	0.00	0.00
6/1/99	P01	7.00	0.00	8.00	1.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
7/1/99	P01	6.00	0.00	8.00	2.00	0	6.00	0.00	0.00	6.00	0	0.00	0.00	0.00	0.00
8/1/99	P01	8.00	0.00	8.00	0.00	0	6.50	0.00	0.00	6.50	0	0.00	0.00	0.00	0.00
9/1/99	P01	8.00	0.00	8.00	0.00	0	8.00	0.00	0.00	8.00	0	0.00	0.00	0.00	0.00
11/1/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
12/1/99	P01	8.00	0.00	8.00	0.00	0	7.83	0.00	0.00	7.83	0	0.00	0.00	0.00	0.00
13/1/99	P01	8.00	0.00	8.00	0.00	0	7.67	0.00	0.00	7.67	0	0.00	0.00	0.00	0.00
14/1/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
15/1/99	P01	5.00	0.00	8.00	3.00	0	5.50	0.00	0.00	5.50	0	0.00	0.00	0.00	0.00
16/1/99	P01	6.00	0.00	8.00	2.00	0	6.00	0.00	0.00	6.00	0	0.00	0.00	0.00	0.00
18/1/99	P01	6.00	4.00	13.00	3.00	1	6.17	4.00	0.00	10.17	0	100.00	400.00	400.00	0.00
19/1/99	P01	7.00	0.00	13.00	6.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
20/1/99	P01	7.00	0.00	13.00	6.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
21/1/99	P01	8.00	0.00	8.00	0.00	0	7.67	0.00	0.00	7.67	0	0.00	0.00	0.00	0.00
22/1/99	P01	8.00	0.00	8.00	0.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
23/1/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
25/1/99	P01	8.00	0.00	8.00	0.00	0	8.00	0.00	0.00	8.00	0	0.00	0.00	0.00	0.00
26/1/99	P01	12.00	0.00	12.00	0.00	0	11.00	0.00	0.00	11.00	0	0.00	0.00	0.00	0.00
27/1/99	P01	10.00	0.00	10.00	0.00	0	9.50	0.00	0.00	9.50	0	0.00	0.00	0.00	0.00
28/1/99	P01	12.00	0.00	12.00	0.00	0	11.33	0.00	0.00	11.33	0	0.00	0.00	0.00	0.00
29/1/99	P01	13.00	0.00	13.00	0.00	0	12.17	0.00	0.00	12.17	0	0.00	0.00	0.00	0.00
30/1/99	P01	6.00	0.00	10.00	4.00	0	9.25	0.00	0.00	9.25	0	0.00	0.00	0.00	0.00
1/2/99	P01	5.00	0.00	8.00	3.00	0	5.00	0.00	0.00	5.00	0	0.00	0.00	0.00	0.00
2/2/99	P01	4.00	4.00	8.00	0.00	1	4.00	4.00	0.00	8.00	0	100.00	400.00	400.00	0.00
3/2/99	P01	5.00	0.00	8.00	3.00	0	4.50	0.00	0.00	4.50	0	0.00	0.00	0.00	0.00
4/2/99	P01	5.00	0.00	8.00	3.00	0	5.00	0.00	0.00	5.00	0	0.00	0.00	0.00	0.00
5/2/99	P01	6.00	0.00	8.00	2.00	0	6.00	0.00	0.00	6.00	0	0.00	0.00	0.00	0.00

date	mc_no	prod_hrs	workhrs	avaihrs	freehrs	no_job	act_prodhrs	act_hrs	downtime	total_hrs	unfinish_job	percent	expect_cost	act_cost	bd_cost
6/2/99	P01	5.00	1.00	8.00	2.00	7	3.00	1.00	0.00	4.00	0	100.00	134.00	134.00	0.00
8/2/99	P01	6.00	0.00	12.00	6.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
9/2/99	P01	8.00	0.00	8.00	0.00	0	7.67	0.00	0.00	7.67	0	0.00	0.00	0.00	0.00
10/2/99	P01	8.00	0.00	8.00	0.00	0	7.17	0.00	0.00	7.17	0	0.00	0.00	0.00	0.00
11/2/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
12/2/99	P01	8.00	0.00	8.00	0.00	0	6.50	0.00	0.00	6.50	0	0.00	0.00	0.00	0.00
13/2/99	P01	8.00	0.00	8.00	0.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
15/2/99	P01	5.00	1.00	8.00	2.00	2	6.00	1.00	0.00	7.00	0	100.00	108.50	108.50	0.00
16/2/99	P01	6.00	0.00	12.00	6.00	0	6.00	0.00	0.00	6.00	0	0.00	0.00	0.00	0.00
17/2/99	P01	7.00	0.00	10.00	3.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
18/2/99	P01	6.00	0.00	12.00	6.00	0	4.50	0.00	0.00	4.50	0	0.00	0.00	0.00	0.00
19/2/99	P01	7.00	0.00	8.00	1.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
20/2/99	P01	8.00	0.00	8.00	0.00	0	7.67	0.00	0.00	7.67	0	0.00	0.00	0.00	0.00
22/2/99	P01	8.00	0.00	12.00	4.00	0	7.17	0.00	0.00	7.17	0	0.00	0.00	0.00	0.00
23/2/99	P01	12.00	0.00	12.00	0.00	0	11.00	0.00	0.00	11.00	0	0.00	0.00	0.00	0.00
24/2/99	P01	10.00	0.00	10.00	0.00	0	9.00	0.00	0.00	9.00	0	0.00	0.00	0.00	0.00
25/2/99	P01	8.00	0.00	12.00	4.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
26/2/99	P01	10.00	0.00	10.00	0.00	0	9.67	0.00	0.00	9.67	0	0.00	0.00	0.00	0.00
27/2/99	P01	9.00	0.00	12.00	3.00	0	8.17	0.00	0.00	8.17	0	0.00	0.00	0.00	0.00
1/3/99	P01	7.00	0.00	8.00	1.00	0	6.67	0.00	0.00	6.67	0	0.00	0.00	0.00	0.00
2/3/99	P01	5.00	0.00	8.00	3.00	0	5.50	0.00	0.00	5.50	0	0.00	0.00	0.00	0.00
3/3/99	P01	5.00	0.00	8.00	3.00	0	5.00	0.00	0.00	5.00	0	0.00	0.00	0.00	0.00
4/3/99	P01	4.00	4.00	8.00	0.00	1	4.00	4.00	0.00	8.00	0	100.00	400.00	400.00	0.00
5/3/99	P01	4.00	0.00	8.00	4.00	0	4.00	0.00	0.00	4.00	0	0.00	0.00	0.00	0.00
6/3/99	P01	6.00	1.00	8.00	1.00	7	5.50	1.00	0.00	6.50	0	100.00	134.00	134.00	0.00
8/3/99	P01	6.00	0.00	8.00	2.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
9/3/99	P01	8.00	0.00	8.00	0.00	0	7.67	0.00	0.00	7.67	0	0.00	0.00	0.00	0.00
10/3/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
11/3/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
12/3/99	P01	8.00	0.00	8.00	0.00	0	7.13	0.00	0.00	7.13	0	0.00	0.00	0.00	0.00
13/3/99	P01	12.00	0.00	12.00	0.00	0	11.50	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
15/3/99	P01	12.00	0.00	12.00	0.00	0	11.17	0.00	0.00	11.17	0	0.00	0.00	0.00	0.00
16/3/99	P01	5.00	0.00	8.00	6.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00

date	mc_no	prod_hrs	workhrs	avaihrs	freehrs	no_job	act_prodhrs	act_hrs	downtime	total_hrs	unfinish_job	percent	expect_cost	act_cost	bd_cost
17/3/99	P01	6.00	0.00	8.00	4.00	0	6.00	0.00	0.00	6.00	0	0.00	0.00	0.00	0.00
18/3/99	P01	5.00	0.00	8.00	3.00	0	4.00	0.00	0.00	4.00	0	0.00	0.00	0.00	0.00
19/3/99	P01	5.00	0.00	8.00	3.00	0	5.00	0.00	0.00	5.00	0	0.00	0.00	0.00	0.00
20/3/99	P01	6.00	0.00	8.00	4.00	0	5.00	0.00	0.00	5.00	0	0.00	0.00	0.00	0.00
22/3/99	P01	7.00	0.00	8.00	1.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
23/3/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
24/3/99	P01	8.00	0.00	8.00	0.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
25/3/99	P01	8.00	0.00	8.00	0.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
26/3/99	P01	10.00	0.00	10.00	0.00	0	9.50	0.00	0.00	9.50	0	0.00	0.00	0.00	0.00
27/3/99	P01	10.00	0.00	10.00	0.00	0	9.00	0.00	0.00	9.00	0	0.00	0.00	0.00	0.00
29/3/99	P01	9.00	0.00	9.00	0.00	0	8.50	0.00	0.00	8.50	0	0.00	0.00	0.00	0.00
30/3/99	P01	8.00	0.00	8.00	0.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
31/3/99	P01	6.00	0.00	8.00	2.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
1/4/99	P01	5.00	0.00	8.00	3.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
2/4/99	P01	5.00	0.00	8.00	3.00	0	5.00	0.00	0.00	5.00	0	0.00	0.00	0.00	0.00
3/4/99	P01	6.00	1.00	8.00	1.00	7	6.00	1.00	0.00	7.00	0	100.00	134.00	134.00	0.00
5/4/99	P01	7.00	0.00	8.00	1.00	0	6.50	0.00	0.00	6.50	0	0.00	0.00	0.00	0.00
6/4/99	P01	7.00	0.00	8.00	1.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
7/4/99	P01	6.00	0.00	8.00	2.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
8/4/99	P01	8.00	0.00	8.00	0.00	0	7.67	0.00	0.00	7.67	0	0.00	0.00	0.00	0.00
9/4/99	P01	8.00	0.00	8.00	0.00	0	7.17	0.00	0.00	7.17	0	0.00	0.00	0.00	0.00
10/4/99	P01	8.00	0.00	8.00	0.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
12/4/99	P01	12.00	0.00	12.00	0.00	0	11.17	0.00	0.00	11.17	0	0.00	0.00	0.00	0.00
14/4/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
15/4/99	P01	6.00	0.00	8.00	2.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
16/4/99	P01	7.00	0.00	8.00	1.00	0	4.50	0.00	3.00	7.50	0	0.00	0.00	9130.00	9130.00
17/4/99	P01	5.00	0.17	8.00	2.83	1	4.50	0.17	0.00	4.67	0	100.00	8.50	8.50	0.00
19/4/99	P01	8.00	4.00	12.00	0.00	1	7.00	4.00	0.00	11.00	0	100.00	400.00	400.00	0.00
20/4/99	P01	8.00	0.00	12.00	4.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
21/4/99	P01	10.00	0.00	10.00	0.00	0	9.33	0.00	0.00	9.33	0	0.00	0.00	0.00	0.00
22/4/99	P01	12.00	0.00	12.00	0.00	0	11.50	0.00	0.00	11.50	0	0.00	0.00	0.00	0.00
23/4/99	P01	8.00	0.00	8.00	0.00	0	7.17	0.00	0.00	7.17	0	0.00	0.00	0.00	0.00
24/4/99	P01	7.00	0.00	8.00	1.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00

date	mc_no	prod_hrs	workhrs	avaihrs	freehrs	no_job	act_prodhrs	act_hrs	downtime	total_hrs	unfinish_job	percent	expect_cost	act_cost	bd_cost
26/4/99	P01	8.00	0.00	8.00	6.00	0	7.17	0.00	0.00	7.17	0	0.00	0.00	0.00	0.00
27/4/99	P01	8.00	0.00	8.00	4.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
28/4/99	P01	8.00	0.00	8.00	0.00	0	7.33	0.00	0.00	7.33	0	0.00	0.00	0.00	0.00
29/4/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
30/4/99	P01	8.00	0.00	8.00	0.00	0	7.33	0.00	0.00	7.33	0	0.00	0.00	0.00	0.00
1/5/99	P01	6.00	1.00	8.00	1.00	7	6.50	1.00	0.00	7.50	0	100.00	134.00	134.00	0.00
3/5/99	P01	7.00	0.00	8.00	1.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
4/5/99	P01	7.00	0.00	8.00	1.00	0	7.17	0.00	0.00	7.17	0	0.00	0.00	0.00	0.00
5/5/99	P01	6.00	0.00	9.00	3.00	0	6.83	0.00	0.00	6.83	0	0.00	0.00	0.00	0.00
6/5/99	P01	7.00	0.00	8.00	1.00	0	7.17	0.00	0.00	7.17	0	0.00	0.00	0.00	0.00
7/5/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
8/5/99	P01	8.00	0.00	8.00	0.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
10/5/99	P01	7.00	1.00	8.00	0.00	2	6.00	0.17	1.50	7.67	0	50.00	8.50	2233.50	2225.00
11/5/99	P01	8.00	0.00	8.00	0.00	0	7.67	0.00	0.00	7.67	0	0.00	0.00	0.00	0.00
12/5/99	P01	8.00	0.00	8.00	0.00	0	7.33	0.00	0.00	7.33	0	0.00	0.00	0.00	0.00
13/5/99	P01	13.00	0.00	13.00	0.00	0	12.50	0.00	0.00	12.50	0	0.00	0.00	0.00	0.00
14/5/99	P01	12.00	0.00	12.00	0.00	0	11.33	0.00	0.00	11.33	0	0.00	0.00	0.00	0.00
15/5/99	P01	10.00	0.00	10.00	0.00	0	9.67	0.00	0.00	9.67	0	0.00	0.00	0.00	0.00
17/5/99	P01	7.00	1.00	8.00	0.00	1	7.00	1.00	0.00	8.00	0	100.00	100.00	100.00	0.00
18/5/99	P01	6.00	0.00	8.00	2.00	0	4.00	0.00	0.00	4.00	0	0.00	0.00	0.00	0.00
19/5/99	P01	6.00	0.00	8.00	2.00	0	6.00	0.00	0.00	6.00	0	0.00	0.00	0.00	0.00
20/5/99	P01	6.00	0.00	9.00	3.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
21/5/99	P01	7.00	0.00	8.00	1.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
22/5/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
24/5/99	P01	8.00	4.00	12.00	0.00	1	7.50	4.00	0.00	11.50	0	100.00	400.00	400.00	0.00
25/5/99	P01	8.00	0.00	12.00	4.00	0	7.67	0.00	0.00	7.67	0	0.00	0.00	0.00	0.00
26/5/99	P01	8.00	0.00	12.00	4.00	0	7.33	0.00	0.00	7.33	0	0.00	0.00	0.00	0.00
27/5/99	P01	10.00	0.00	12.00	2.00	0	9.33	0.00	0.00	9.33	0	0.00	0.00	0.00	0.00
28/5/99	P01	12.00	0.00	12.00	0.00	0	11.17	0.00	0.00	11.17	0	0.00	0.00	0.00	0.00
29/5/99	P01	10.00	0.00	12.00	2.00	0	9.50	0.00	0.00	9.50	0	0.00	0.00	0.00	0.00
31/5/99	P01	8.00	0.00	8.00	4.00	0	5.00	0.00	0.00	5.00	0	0.00	0.00	0.00	0.00
1/6/99	P01	10.00	0.00	10.00	0.00	0	9.50	0.00	0.00	9.50	0	0.00	0.00	0.00	0.00
2/6/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00

date	mc_no	prod_hrs	workhrs	avaihrs	freehrs	no_job	act_prodhrs	act_hrs	downtime	total_hrs	unfinish_job	percent	expect_cost	act_cost	bd_cost
3/6/99	P01	7.00	0.00	8.00	1.00	0	7.33	0.00	0.00	7.33	0	0.00	0.00	0.00	0.00
4/6/99	P01	5.00	4.00	10.00	1.00	1	5.50	4.00	0.00	9.50	0	100.00	400.00	400.00	0.00
5/6/99	P01	6.00	1.00	8.00	1.00	7	6.00	1.00	0.00	7.00	0	100.00	134.00	134.00	0.00
7/6/99	P01	6.00	0.00	8.00	2.00	0	6.00	0.00	0.00	6.00	0	0.00	0.00	0.00	0.00
8/6/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
9/6/99	P01	7.00	0.00	8.00	1.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
10/6/99	P01	7.00	0.00	8.00	1.00	0	6.50	0.00	0.00	6.50	0	0.00	0.00	0.00	0.00
11/6/99	P01	8.00	0.00	8.00	0.00	0	7.17	0.00	0.00	7.17	0	0.00	0.00	0.00	0.00
12/6/99	P01	8.00	0.00	8.00	0.00	0	7.33	0.00	0.00	7.33	0	0.00	0.00	0.00	0.00
14/6/99	P01	8.00	0.00	8.00	0.00	0	7.67	0.00	0.00	7.67	0	0.00	0.00	0.00	0.00
15/6/99	P01	6.00	0.00	8.00	2.00	0	7.00	0.00	2.50	9.50	0	0.00	0.00	8412.50	8412.50
16/6/99	P01	7.00	0.00	8.00	1.00	0	7.67	0.00	0.00	7.67	0	0.00	0.00	0.00	0.00
17/6/99	P01	6.00	0.00	8.00	2.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
18/6/99	P01	7.00	0.00	8.00	1.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
19/6/99	P01	7.00	0.00	8.00	1.00	0	6.50	0.00	0.00	6.50	0	0.00	0.00	0.00	0.00
21/6/99	P01	8.00	0.00	12.00	4.00	0	4.50	0.00	6.50	11.00	0	0.00	0.00	89110.00	85610.00
22/6/99	P01	8.00	0.00	8.00	0.00	0	7.67	0.00	0.00	7.67	0	0.00	0.00	0.00	0.00
23/6/99	P01	8.00	0.00	8.00	0.00	0	7.17	0.00	0.00	7.17	0	0.00	0.00	0.00	0.00
24/6/99	P01	8.00	0.00	8.00	0.00	0	7.33	0.00	0.00	7.33	0	0.00	0.00	0.00	0.00
25/6/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
26/6/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
28/6/99	P01	8.00	0.00	8.00	0.00	0	7.67	0.00	0.00	7.67	0	0.00	0.00	0.00	0.00
29/6/99	P01	8.00	0.00	8.00	0.00	0	7.33	0.00	0.00	7.33	0	0.00	0.00	0.00	0.00
30/6/99	P01	7.00	0.00	8.00	1.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
1/7/99	P01	7.00	0.17	8.00	0.83	1	7.00	0.17	0.00	7.17	0	100.00	8.50	8.50	0.00
2/7/99	P01	6.00	0.00	8.00	2.00	0	6.00	0.00	0.00	6.00	0	0.00	0.00	0.00	0.00
3/7/99	P01	7.00	1.00	8.00	0.00	6	7.17	0.51	0.00	7.68	0	83.33	125.50	75.50	0.00
5/7/99	P01	5.00	1.00	8.00	2.00	1	4.50	1.00	0.00	5.50	0	100.00	50.00	50.00	0.00
6/7/99	P01	5.00	0.00	8.00	3.00	0	6.00	0.00	0.00	6.00	0	0.00	0.00	0.00	0.00
7/7/99	P01	7.00	0.00	8.00	1.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
8/7/99	P01	6.00	0.00	8.00	2.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
9/7/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
10/7/99	P01	8.00	0.00	8.00	0.00	0	7.67	0.00	0.00	7.67	0	0.00	0.00	0.00	0.00

date	mc_no	prod_hrs	workhrs	avaihrs	freehrs	no_job	act_prodhrs	act_hrs	downtime	total_hrs	unfinish_job	percent	expect_cost	act_cost	bd_cost
12/7/99	P01	8.00	0.00	8.00	0.00	0	7.33	0.00	0.00	7.33	0	0.00	0.00	0.00	0.00
13/7/99	P01	12.00	0.00	12.00	0.00	0	9.17	0.00	2.00	11.17	0	0.00	0.00	3800.00	3800.00
14/7/99	P01	12.00	0.00	12.00	0.00	0	11.50	0.00	0.00	11.50	0	0.00	0.00	0.00	0.00
15/7/99	P01	7.00	0.00	8.00	1.00	0	5.33	0.00	2.00	7.33	0	0.00	0.00	5000.00	5000.00
16/7/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
17/7/99	P01	8.00	0.00	8.00	0.00	0	7.67	0.00	0.00	7.67	0	0.00	0.00	0.00	0.00
19/7/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
20/7/99	P01	7.00	0.00	8.00	1.00	0	7.17	0.00	0.00	7.17	0	0.00	0.00	0.00	0.00
21/7/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
22/7/99	P01	8.00	0.00	8.00	0.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
23/7/99	P01	10.00	0.00	10.00	0.00	0	9.33	0.00	0.00	9.33	0	0.00	0.00	0.00	0.00
24/7/99	P01	10.00	0.00	10.00	0.00	0	9.50	0.00	0.00	9.50	0	0.00	0.00	0.00	0.00
26/7/99	P01	8.00	4.00	12.00	0.00	1	7.33	4.00	0.00	11.33	0	100.00	400.00	400.00	0.00
27/7/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
28/7/99	P01	12.00	0.00	12.00	0.00	0	11.67	0.00	0.00	11.67	0	0.00	0.00	0.00	0.00
29/7/99	P01	11.00	0.00	11.00	0.00	0	11.00	0.00	2.00	13.00	0	0.00	0.00	6500.00	5500.00
30/7/99	P01	9.00	0.00	10.00	1.00	0	8.67	0.00	0.00	8.67	0	0.00	0.00	0.00	0.00
31/7/99	P01	8.00	0.00	8.00	0.00	0	7.33	0.00	0.00	7.33	0	0.00	0.00	0.00	0.00
2/8/99	P01	7.00	1.00	8.00	0.00	6	7.50	0.50	0.00	8.00	0	66.67	67.00	67.00	0.00
3/8/99	P01	7.00	0.17	8.00	0.83	2	7.00	0.17	0.00	7.17	0	100.00	17.00	17.00	0.00
4/8/99	P01	6.00	1.00	8.00	2.00	1	6.50	1.00	0.00	7.50	0	100.00	50.00	50.00	0.00
5/8/99	P01	5.00	0.00	8.00	3.00	0	5.00	0.00	0.00	5.00	0	0.00	0.00	0.00	0.00
6/8/99	P01	7.00	0.00	8.00	1.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
7/8/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
9/8/99	P01	8.00	0.00	8.00	0.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
10/8/99	P01	8.00	0.00	8.00	0.00	0	7.33	0.00	0.00	7.33	0	0.00	0.00	0.00	0.00
11/8/99	P01	8.00	0.00	8.00	0.00	0	7.67	0.00	0.00	7.67	0	0.00	0.00	0.00	0.00
13/8/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
14/8/99	P01	8.00	0.00	8.00	0.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
16/8/99	P01	7.00	4.00	12.00	0.00	3	7.67	4.00	0.00	11.67	0	66.67	508.50	408.50	0.00
17/8/99	P01	10.00	0.00	10.00	0.00	0	9.33	0.00	0.00	9.33	0	0.00	0.00	0.00	0.00
18/8/99	P01	12.00	0.00	12.00	0.00	0	11.50	0.00	0.00	11.50	0	0.00	0.00	0.00	0.00
19/8/99	P01	10.00	0.00	10.00	0.00	0	8.00	0.00	0.00	8.00	0	0.00	0.00	0.00	0.00

date	mc_no	prod_hrs	workhrs	avaihrs	freehrs	no_job	act_prodhrs	act_hrs	downtime	total_hrs	unfinish_job	percent	expect_cost	act_cost	bd_cost
20/8/99	P01	9.00	0.00	9.00	0.00	0	8.50	0.00	0.00	8.50	0	0.00	0.00	0.00	0.00
21/8/99	P01	8.00	0.00	8.00	0.00	0	7.33	0.00	0.00	7.33	0	0.00	0.00	0.00	0.00
23/8/99	P01	8.00	1.00	9.00	0.00	1	7.00	1.00	0.00	8.00	0	100.00	100.00	100.00	0.00
24/8/99	P01	8.00	0.00	8.00	0.00	0	7.17	0.00	0.00	7.17	0	0.00	0.00	0.00	0.00
25/8/99	P01	8.00	0.00	8.00	0.00	0	7.33	0.00	0.00	7.33	0	0.00	0.00	0.00	0.00
26/8/99	P01	10.00	0.00	10.00	0.00	0	9.50	0.00	0.00	9.50	0	0.00	0.00	0.00	0.00
27/8/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
28/8/99	P01	8.00	0.00	8.00	0.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
30/8/99	P01	8.00	0.00	8.00	0.00	0	7.17	0.00	0.00	7.17	0	0.00	0.00	0.00	0.00
31/8/99	P01	7.00	0.00	8.00	1.00	0	7.17	0.00	0.00	7.17	0	0.00	0.00	0.00	0.00
1/9/99	P01	6.00	0.17	8.00	1.83	1	7.00	0.17	0.00	7.17	0	100.00	8.50	8.50	0.00
2/9/99	P01	5.00	0.00	8.00	3.00	0	5.00	0.00	0.00	5.00	0	0.00	0.00	0.00	0.00
3/9/99	P01	6.00	0.00	8.00	2.00	0	5.50	0.00	0.00	5.50	0	0.00	0.00	0.00	0.00
4/9/99	P01	7.00	1.00	8.00	0.00	6	7.33	0.51	0.00	7.84	0	83.33	125.50	75.50	0.00
6/9/99	P01	8.00	1.00	9.00	0.00	1	7.50	1.00	0.00	8.50	0	100.00	50.00	50.00	0.00
7/9/99	P01	7.00	0.00	8.00	1.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
8/9/99	P01	7.00	0.00	8.00	1.00	0	6.67	0.00	0.00	6.67	0	0.00	0.00	0.00	0.00
9/9/99	P01	8.00	0.00	8.00	0.00	0	7.67	0.00	0.00	7.67	0	0.00	0.00	0.00	0.00
10/9/99	P01	8.00	0.00	8.00	0.00	0	7.17	0.00	0.00	7.17	0	0.00	0.00	0.00	0.00
11/9/99	P01	10.00	0.00	10.00	0.00	0	9.33	0.00	0.00	9.33	0	0.00	0.00	0.00	0.00
13/9/99	P01	10.00	0.00	10.00	0.00	0	9.50	0.00	0.00	9.50	0	0.00	0.00	0.00	0.00
14/9/99	P01	8.00	4.00	12.00	0.00	1	7.50	4.00	0.00	11.50	0	100.00	400.00	400.00	0.00
15/9/99	P01	8.00	0.00	8.00	0.00	0	7.67	0.00	0.00	7.67	0	0.00	0.00	0.00	0.00
16/9/99	P01	7.00	0.00	8.00	1.00	0	6.50	0.00	0.00	6.50	0	0.00	0.00	0.00	0.00
17/9/99	P01	5.00	0.00	8.00	3.00	0	5.00	0.00	0.00	5.00	0	0.00	0.00	0.00	0.00
18/9/99	P01	5.00	0.00	8.00	3.00	0	4.50	0.00	0.00	4.50	0	0.00	0.00	0.00	0.00
20/9/99	P01	8.00	0.00	9.00	0.00	0	7.33	0.00	0.00	7.33	0	0.00	0.00	0.00	0.00
21/9/99	P01	10.00	0.00	10.00	0.00	0	9.17	0.00	0.00	9.17	0	0.00	0.00	0.00	0.00
22/9/99	P01	12.00	0.00	12.00	0.00	0	11.50	0.00	0.00	11.50	0	0.00	0.00	0.00	0.00
23/9/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
24/9/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
25/9/99	P01	8.00	0.00	8.00	0.00	0	7.33	0.00	0.00	7.33	0	0.00	0.00	0.00	0.00
27/9/99	P01	10.00	0.00	10.00	0.00	0	9.50	0.00	0.00	9.50	0	0.00	0.00	0.00	0.00

date	mc_no	prod_hrs	workhrs	avaihrs	freehrs	no_job	act_prodhrs	act_hrs	downtime	total_hrs	unfinish_job	percent	expect_cost	act_cost	bd_cost
28/9/99	P01	11.00	0.00	11.00	0.00	0	10.67	0.00	0.00	10.67	0	0.00	0.00	0.00	0.00
29/9/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
30/9/99	P01	8.00	0.00	8.00	0.00	0	7.33	0.00	0.00	7.33	0	0.00	0.00	0.00	0.00
1/10/99	P01	8.00	0.00	8.00	0.00	0	7.33	0.00	0.00	7.33	0	0.00	0.00	0.00	0.00
2/10/99	P01	8.00	1.00	9.00	0.00	7	7.50	1.00	0.00	8.50	0	100.00	134.00	134.00	0.00
4/10/99	P01	7.00	4.00	11.00	0.00	1	7.00	4.00	0.00	11.00	0	100.00	400.00	0.00	0.00
5/10/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
6/10/99	P01	7.00	0.00	8.00	1.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
7/10/99	P01	6.00	0.00	8.00	2.00	0	5.00	0.00	0.00	5.00	0	0.00	0.00	0.00	0.00
8/10/99	P01	8.00	0.00	8.00	0.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
9/10/99	P01	8.00	0.00	8.00	0.00	0	7.17	0.00	0.00	7.17	0	0.00	0.00	0.00	0.00
11/10/99	P01	7.00	0.00	8.00	1.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
12/10/99	P01	8.00	0.00	8.00	0.00	0	7.67	0.00	0.00	7.67	0	0.00	0.00	0.00	0.00
13/10/99	P01	9.00	0.00	9.00	0.00	0	8.33	0.00	0.00	8.33	0	0.00	0.00	0.00	0.00
14/10/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
15/10/99	P01	8.00	0.00	8.00	0.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
16/10/99	P01	9.00	0.00	9.00	0.00	0	8.50	0.00	0.00	8.50	0	0.00	0.00	0.00	0.00
18/10/99	P01	10.00	0.17	11.00	0.83	1	9.33	0.17	0.00	9.50	0	100.00	8.50	8.50	0.00
19/10/99	P01	8.00	0.00	8.00	0.00	0	7.17	0.00	0.00	7.17	0	0.00	0.00	0.00	0.00
20/10/99	P01	12.00	0.00	12.00	0.00	0	11.50	0.00	0.00	11.50	0	0.00	0.00	0.00	0.00
21/10/99	P01	10.00	0.00	10.00	0.00	0	9.33	0.00	0.00	9.33	0	0.00	0.00	0.00	0.00
22/10/99	P01	10.00	0.00	10.00	0.00	0	9.50	0.00	0.00	9.50	0	0.00	0.00	0.00	0.00
23/10/99	P01	8.00	0.00	8.00	0.00	0	7.33	0.00	0.00	7.33	0	0.00	0.00	0.00	0.00
25/10/99	P01	8.00	0.00	8.00	0.00	0	7.00	0.00	2.00	9.00	0	0.00	0.00	5325.00	5325.00
26/10/99	P01	12.00	0.00	12.00	0.00	0	11.50	0.00	0.00	11.50	0	0.00	0.00	0.00	0.00
27/10/99	P01	12.00	0.00	12.00	0.00	0	11.00	0.00	0.00	11.00	0	0.00	0.00	0.00	0.00
28/10/99	P01	12.00	0.00	12.00	0.00	0	11.67	0.00	0.00	11.67	0	0.00	0.00	0.00	0.00
29/10/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
30/10/99	P01	8.00	0.00	8.00	0.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00
1/11/99	P01	6.00	1.00	8.00	1.00	7	6.33	1.00	0.00	7.33	0	100.00	134.00	134.00	0.00
2/11/99	P01	7.00	4.00	11.00	0.00	0	7.00	4.00	0.00	11.00	0	100.00	400.00	400.00	0.00
3/11/99	P01	8.00	0.00	8.00	0.00	0	7.17	0.00	0.00	7.17	0	0.00	0.00	0.00	0.00
4/11/99	P01	8.00	0.00	8.00	0.00	0	7.00	0.00	0.00	7.00	0	0.00	0.00	0.00	0.00

date	mc_no	prod_hrs	workhrs	avaihrs	freehrs	no_job	act_prodhrs	act_hrs	downtime	total_hrs	unfinish_job	percent	expect_cost	act_cost	bd_cost
5/11/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
6/11/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
8/11/99	P01	8.00	0.00	8.00	0.00	0	7.33	0.00	0.00	7.33	0	0.00	0.00	0.00	0.00
9/11/99	P01	8.00	0.00	8.00	0.00	0	7.17	0.00	0.00	7.17	0	0.00	0.00	0.00	0.00
10/11/99	P01	13.00	0.00	13.00	0.00	0	12.50	0.00	0.00	12.50	0	0.00	0.00	0.00	0.00
11/11/99	P01	10.00	0.00	10.00	0.00	0	9.50	0.00	0.00	9.50	0	0.00	0.00	0.00	0.00
12/11/99	P01	14.00	0.00	14.00	0.00	0	13.17	0.00	0.00	13.17	0	0.00	0.00	0.00	0.00
13/11/99	P01	14.00	0.00	14.00	0.00	0	13.33	0.00	0.00	13.33	0	0.00	0.00	0.00	0.00
15/11/99	P01	12.00	0.00	12.00	0.00	0	11.50	0.00	0.00	11.50	0	0.00	0.00	0.00	0.00
16/11/99	P01	6.00	0.00	8.00	2.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
17/11/99	P01	7.00	1.00	8.00	0.00	2	7.17	0.17	0.00	7.34	0	50.00	8.50	8.50	0.00
18/11/99	P01	6.00	1.00	8.00	1.00	1	7.00	1.00	0.00	8.00	0	100.00	100.00	100.00	0.00
19/11/99	P01	8.00	0.00	8.00	0.00	0	7.67	0.00	0.00	7.67	0	0.00	0.00	0.00	0.00
20/11/99	P01	8.00	0.00	8.00	0.00	0	7.50	0.00	0.00	7.50	0	0.00	0.00	0.00	0.00
22/11/99	P01	13.00	0.00	13.00	0.00	0	12.17	0.00	0.00	12.17	0	0.00	0.00	0.00	0.00
23/11/99	P01	12.00	0.00	12.00	0.00	0	11.00	0.00	0.00	11.00	0	0.00	0.00	0.00	0.00
24/11/99	P01	10.00	0.00	11.00	1.00	0	9.33	0.00	0.00	9.33	0	0.00	0.00	0.00	0.00
25/11/99	P01	12.00	0.00	12.00	0.00	0	11.50	0.00	0.00	11.50	0	0.00	0.00	0.00	0.00
26/11/99	P01	12.00	0.00	12.00	0.00	0	11.33	0.00	0.00	11.33	0	0.00	0.00	0.00	0.00
27/11/99	P01	12.00	0.00	12.00	0.00	0	11.00	0.00	0.00	11.00	0	0.00	0.00	0.00	0.00
29/11/99	P01	12.00	0.00	12.00	0.00	0	11.50	0.00	0.00	11.50	0	0.00	0.00	0.00	0.00
30/11/99	P01	10.00	0.00	10.00	0.00	0	9.50	0.00	0.00	9.50	0	0.00	0.00	0.00	0.00
22/11/99	P01	13.00	0.00	13.00	0.00	0	12.17	0.00	0.00	12.17	0	0.00	0.00	0.00	0.00
23/11/99	P01	12.00	0.00	12.00	0.00	0	11.00	0.00	0.00	11.00	0	0.00	0.00	0.00	0.00
24/11/99	P01	10.00	1.00	11.00	0.00	3	9.33	1.00	0.00	10.33	0	100.00	112.50	112.50	0.00
25/11/99	P01	12.00	0.00	12.00	0.00	0	11.50	0.00	0.00	11.50	0	0.00	0.00	0.00	0.00
26/11/99	P01	12.00	0.00	12.00	0.00	0	11.33	0.00	0.00	11.33	0	0.00	0.00	0.00	0.00
27/11/99	P01	12.00	0.00	12.00	0.00	0	11.00	0.00	0.00	11.00	0	0.00	0.00	0.00	0.00
29/11/99	P01	12.00	0.00	12.00	0.00	0	11.50	0.00	0.00	11.50	0	0.00	0.00	0.00	0.00
30/11/99	P01	10.00	0.00	10.00	0.00	0	9.50	0.00	0.00	9.50	0	0.00	0.00	0.00	0.00
											Total	6637.50	135540.00	125002.50
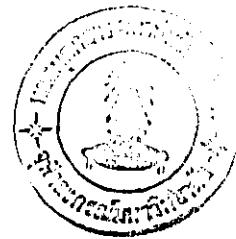
Biography

Chalermlarp Rungkamol was born in August, 2nd 1977 in Bangkok. He was graduated in the Bachelor of Engineering in Industrial Engineer from Chulalongkorn University in 1997. Then, he studied for the Master degree in Engineering Management at the Regional Centre for Manufacturing Systems Engineering, Chulalongkorn University and University of Warwick. At the present, he works for the Bangkok Printing (1984) Co., Ltd. as an engineer in the production department.