Problem – D (General) → DATA

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
```

```
BOM = 1;
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 1
primary_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20
[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]];         // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [247.4227,268.0412,927.8350,2020.6190,2484.5360,2917.5260];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
```

```
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 2
primary_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-7: Sum of Product-1,2,3,4 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-8: Sum of Product-1,2,3,4 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-9: Sum of Product-1,2,3,4,5,6 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-10:Sum of Product-1,2,3,4,5,6 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-11:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-12:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-13:Equal to product-8
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-14:Equal to product-8
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-15:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-16:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-17:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-18:Equal to product-10
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-19:Equal to product-10
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-20:Equal to product-11
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-21:Sum of product-11 & 12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-22:Equal to product-12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-23:Equal to product-13
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-24:Equal to product-14
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-25:Sum of product-15 & 16
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-26:Equal to product-17
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-27:Equal to product-18
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-28:Equal to product-19
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-29:Equal to product-19
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-30:Equal to product-20
[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-32:Equal to product-23
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-33:Sum of product-23 & 24
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-34:Equal to product-24
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-35:Equal to product-25
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-36:Equal to product-26
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-37:Equal to product-27
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-38:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-39:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];
// Capacity Utilization Profile - I (90%)
productstagecapacity = [247.4227,268.0412,927.8350,2020.6190,2484.5360,2917.5260];
```

Test Instance-3: TGS1C1D3 (Test General Setup-Profile_1 Capacity-Profile_1 Demand-Series_3)

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 3
primary_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],
                  [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]
                  [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20
[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];        // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];
// Capacity Utilization Profile - I (90%)
productstagecapacity = [247.4227,268.0412,927.8350,2020.6190,2484.5360,2917.5260];
```

Test Instance-4: TGS1C1D4 (Test General Setup-Profile_1 Capacity-Profile_1 Demand-Series_4)

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 4
primary_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],
                  [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-7: Sum of Product-1,2,3,4 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-8: Sum of Product-1,2,3,4 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-9: Sum of Product-1,2,3,4,5,6 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-10:Sum of Product-1,2,3,4,5,6 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-11:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-12:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-13:Equal to product-8
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-14:Equal to product-8
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-15:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-16:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-17:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-18:Equal to product-10
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-19:Equal to product-10
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-20:Equal to product-11
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-22:Equal to product-12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-23:Equal to product-13
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-24:Equal to product-14
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],    // P-25:Sum of product-15 & 16
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-26:Equal to product-17
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-27:Equal to product-18
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-28:Equal to product-19
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-29:Equal to product-19
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-30:Equal to product-20
[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-32:Equal to product-23
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-34:Equal to product-24
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],    // P-35:Equal to product-25
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-36:Equal to product-26
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-37:Equal to product-27
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-38:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-39:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];
// Capacity Utilization Profile - I (90%)
productstagecapacity = [247.4227,268.0412,927.8350,2020.6190,2484.5360,2917.5260];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 5
primary_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],
                   [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],
                   [80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],
                   [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-11:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-12:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-13:Equal to product-8
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-14:Equal to product-8
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-15:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-16:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-17:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-18:Equal to product-10
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-19:Equal to product-10
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-20:Equal to product-11
[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-22:Equal to product-12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-23:Equal to product-13
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-24:Equal to product-14
[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-26:Equal to product-17
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-27:Equal to product-18
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-28:Equal to product-19
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-29:Equal to product-19
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-30:Equal to product-20
[559.6875,452.468,450.0555,450.0012,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],         // P-31:Sum of product-21 & 22
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-32:Equal to product-23
[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-34:Equal to product-24
[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-36:Equal to product-26
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-37:Equal to product-27
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-38:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-39:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]];    // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [247.4227,268.0412,927.8350,2020.6190,2484.5360,2917.5260];
```

Test Instance-6: TGS1C1D6 (Test General Setup-Profile_1 Capacity-Profile_1 Demand-Series_6)

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 6
primary_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],
                  [125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-11:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-12:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-13:Equal to product-8
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-14:Equal to product-8
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-15:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-16:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-17:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-18:Equal to product-10
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-19:Equal to product-10
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-20:Equal to product-11
[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-22:Equal to product-12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-23:Equal to product-13
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-24:Equal to product-14
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],        // P-25:Sum of product-15 & 16
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-26:Equal to product-17
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-27:Equal to product-18
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-28:Equal to product-19
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-29:Equal to product-19
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-30:Equal to product-20
[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-32:Equal to product-23
[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-34:Equal to product-24
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],        // P-35:Equal to product-25
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-36:Equal to product-26
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-37:Equal to product-27
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-38:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-39:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]];        // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [247.4227,268.0412,927.8350,2020.6190,2484.5360,2917.5260];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 7
primary_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],
                  [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary_demand = [
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-7: Sum of Product-1,2,3,4 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-8: Sum of Product-1,2,3,4 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-9: Sum of Product-1,2,3,4,5,6 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-10:Sum of Product-1,2,3,4,5,6 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-11:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-12:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-13:Equal to product-8
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-14:Equal to product-8
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-15:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-16:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-17:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-18:Equal to product-10
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-19:Equal to product-10
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-20:Equal to product-11
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-22:Equal to product-12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-23:Equal to product-13
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-24:Equal to product-14
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-25:Sum of product-15 & 16
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-26:Equal to product-17
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-27:Equal to product-18
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-28:Equal to product-19
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-29:Equal to product-19
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-30:Equal to product-20
[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],   // P-31:Sum of product-21 & 22
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-32:Equal to product-23
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-34:Equal to product-24
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-35:Equal to product-25
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-36:Equal to product-26
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-37:Equal to product-27
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-38:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-39:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [247.4227,268.0412,927.8350,2020.6190,2484.5360,2917.5260];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 8
primary_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],
                  [24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],
                  [96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],
                  [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-7: Sum of Product-1,2,3,4 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-8: Sum of Product-1,2,3,4 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-9: Sum of Product-1,2,3,4,5,6 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-10:Sum of Product-1,2,3,4,5,6 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-11:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-12:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-13:Equal to product-8
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-14:Equal to product-8
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-15:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-16:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-17:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-18:Equal to product-10
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-19:Equal to product-10
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-20:Equal to product-11
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-22:Equal to product-12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-23:Equal to product-13
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-24:Equal to product-14
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],       // P-25:Sum of product-15 & 16
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-26:Equal to product-17
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-27:Equal to product-18
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-28:Equal to product-19
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-29:Equal to product-19
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-30:Equal to product-20
[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-32:Equal to product-23
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-34:Equal to product-24
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],       // P-35:Equal to product-25
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-36:Equal to product-26
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-37:Equal to product-27
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-38:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-39:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];     // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [247.4227,268.0412,927.8350,2020.6190,2484.5360,2917.5260];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 9
primary_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],
                  [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                  [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],
                  [176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],
                  [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                  [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-7: Sum of Product-1,2,3,4 demands
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-8: Sum of Product-1,2,3,4 demands
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-9: Sum of Product-1,2,3,4,5,6 demands
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-10:Sum of Product-1,2,3,4,5,6 demands
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-11:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-12:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-13:Equal to product-8
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-14:Equal to product-8
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-15:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-16:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-17:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-18:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-19:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-20:Equal to product-11
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-21:Sum of product-11 & 12
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-22:Equal to product-12
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-23:Equal to product-13
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-24:Equal to product-14
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-26:Equal to product-17
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-27:Equal to product-18
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-28:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-29:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-30:Equal to product-20
[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-32:Equal to product-23
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-33:Sum of product-23 & 24
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-34:Equal to product-24
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-36:Equal to product-26
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-37:Equal to product-27
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-38:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-39:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300]];     // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [247.4227,268.0412,927.8350,2020.6190,2484.5360,2917.5260];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
```

```
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 1
primary_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],
                  [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20
[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]];        // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [311.6883,337.6624,1168.8310,2545.4550,3129.87,3675.3250];
```

Test Instance-11: TGS1C2D2 (Test General Setup-Profile_1 Capacity-Profile_2 Demand-Series_2)

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
```

```
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 2
primary_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],
                  [21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-7: Sum of Product-1,2,3,4 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-8: Sum of Product-1,2,3,4 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-9: Sum of Product-1,2,3,4,5,6 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-10:Sum of Product-1,2,3,4,5,6 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-11:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-12:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-13:Equal to product-8
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-14:Equal to product-8
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-15:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-16:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-17:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-18:Equal to product-10
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-19:Equal to product-10
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-20:Equal to product-11
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-21:Sum of product-11 & 12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-22:Equal to product-12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-23:Equal to product-13
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-24:Equal to product-14
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-25:Sum of product-15 & 16
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-26:Equal to product-17
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-27:Equal to product-18
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-28:Equal to product-19
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-29:Equal to product-19
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-30:Equal to product-20
[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-32:Equal to product-23
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-33:Sum of product-23 & 24
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-34:Equal to product-24
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-35:Equal to product-25
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-36:Equal to product-26
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-37:Equal to product-27
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-38:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-39:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [311.6883,337.6624,1168.8310,2545.4550,3129.87,3675.3250];
```

Test Instance-12: TGS1C2D3 (Test General Setup-Profile_1 Capacity-Profile_2 Demand-Series_3)

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 3
primary_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]
                   [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20
[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];       // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [311.6883,337.6624,1168.8310,2545.4550,3129.87,3675.3250];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 4
primary_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],
                  [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-7: Sum of Product-1,2,3,4 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-8: Sum of Product-1,2,3,4 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-9: Sum of Product-1,2,3,4,5,6 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-10:Sum of Product-1,2,3,4,5,6 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-11:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-12:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-13:Equal to product-8
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-14:Equal to product-8
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-15:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-16:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-17:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-18:Equal to product-10
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-19:Equal to product-10
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-20:Equal to product-11
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-22:Equal to product-12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-23:Equal to product-13
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-24:Equal to product-14
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-25:Sum of product-15 & 16
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-26:Equal to product-17
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-27:Equal to product-18
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-28:Equal to product-19
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-29:Equal to product-19
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-30:Equal to product-20
[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],   // P-31:Sum of product-21 & 22
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-32:Equal to product-23
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-34:Equal to product-24
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-35:Equal to product-25
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-36:Equal to product-26
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-37:Equal to product-27
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-38:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-39:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [311.6883,337.6624,1168.8310,2545.4550,3129.87,3675.3250];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 5
primary_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],
                  [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],
                  [80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],
                  [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-11:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-12:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-13:Equal to product-8
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-14:Equal to product-8
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-15:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-16:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-17:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-18:Equal to product-10
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-19:Equal to product-10
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-20:Equal to product-11
[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-22:Equal to product-12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-23:Equal to product-13
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-24:Equal to product-14
[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-26:Equal to product-17
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-27:Equal to product-18
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-28:Equal to product-19
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-29:Equal to product-19
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-30:Equal to product-20
[559.6875,452.468,450.0555,450.0012,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],       // P-31:Sum of product-21 & 22
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-32:Equal to product-23
[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-34:Equal to product-24
[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-36:Equal to product-26
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-37:Equal to product-27
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-38:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-39:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]];    // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [311.6883,337.6624,1168.8310,2545.4550,3129.87,3675.3250];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 6
primary_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],
                  [125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],     // P-11:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],     // P-12:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],     // P-13:Equal to product-8
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],     // P-14:Equal to product-8
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],     // P-15:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],     // P-16:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],     // P-17:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],     // P-18:Equal to product-10
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],     // P-19:Equal to product-10
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],     // P-20:Equal to product-11
[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],     // P-22:Equal to product-12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],     // P-23:Equal to product-13
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],     // P-24:Equal to product-14
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],     // P-25:Sum of product-15 & 16
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],     // P-26:Equal to product-17
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],     // P-27:Equal to product-18
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],     // P-28:Equal to product-19
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],     // P-29:Equal to product-19
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],     // P-30:Equal to product-20
[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],     // P-32:Equal to product-23
[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],     // P-34:Equal to product-24
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],     // P-35:Equal to product-25
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],     // P-36:Equal to product-26
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],     // P-37:Equal to product-27
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],     // P-38:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],     // P-39:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]];     // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [311.6883,337.6624,1168.8310,2545.4550,3129.87,3675.3250];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 7
primary_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],
                  [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary_demand = [
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-7: Sum of Product-1,2,3,4 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-8: Sum of Product-1,2,3,4 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-9: Sum of Product-1,2,3,4,5,6 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-10:Sum of Product-1,2,3,4,5,6 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-11:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-12:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-13:Equal to product-8
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-14:Equal to product-8
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-15:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-16:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-17:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-18:Equal to product-10
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-19:Equal to product-10
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-20:Equal to product-11
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],  // P-21:Sum of product-11 & 12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-22:Equal to product-12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-23:Equal to product-13
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-24:Equal to product-14
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],  // P-25:Sum of product-15 & 16
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-26:Equal to product-17
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-27:Equal to product-18
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-28:Equal to product-19
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-29:Equal to product-19
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-30:Equal to product-20
[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],  // P-31:Sum of product-21 & 22
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-32:Equal to product-23
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],  // P-33:Sum of product-23 & 24
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-34:Equal to product-24
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],  // P-35:Equal to product-25
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-36:Equal to product-26
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-37:Equal to product-27
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-38:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-39:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [311.6883,337.6624,1168.8310,2545.4550,3129.87,3675.3250];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 8
primary_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],
                  [24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],
                  [96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],
                  [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-7: Sum of Product-1,2,3,4 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-8: Sum of Product-1,2,3,4 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-9: Sum of Product-1,2,3,4,5,6 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-10:Sum of Product-1,2,3,4,5,6 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-11:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-12:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-13:Equal to product-8
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-14:Equal to product-8
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-15:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-16:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-17:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-18:Equal to product-10
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-19:Equal to product-10
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-20:Equal to product-11
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-22:Equal to product-12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-23:Equal to product-13
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-24:Equal to product-14
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],      // P-25:Sum of product-15 & 16
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-26:Equal to product-17
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-27:Equal to product-18
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-28:Equal to product-19
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-29:Equal to product-19
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-30:Equal to product-20
[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-32:Equal to product-23
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-34:Equal to product-24
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],      // P-35:Equal to product-25
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-36:Equal to product-26
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-37:Equal to product-27
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-38:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-39:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];    // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [311.6883,337.6624,1168.8310,2545.4550,3129.87,3675.3250];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 9
primary_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],
                 [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                 [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],
                 [176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],
                 [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                 [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-7: Sum of Product-1,2,3,4 demands
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-8: Sum of Product-1,2,3,4 demands
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-9: Sum of Product-1,2,3,4,5,6 demands
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-10:Sum of Product-1,2,3,4,5,6 demands
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-11:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-12:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-13:Equal to product-8
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-14:Equal to product-8
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-15:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-16:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-17:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-18:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-19:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-20:Equal to product-11
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-21:Sum of product-11 & 12
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-22:Equal to product-12
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-23:Equal to product-13
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-24:Equal to product-14
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-26:Equal to product-17
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-27:Equal to product-18
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-28:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-29:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-30:Equal to product-20
[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450],  // P-31:Sum of product-21 & 22
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-32:Equal to product-23
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-33:Sum of product-23 & 24
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-34:Equal to product-24
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-36:Equal to product-26
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-37:Equal to product-27
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-38:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-39:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300]];       // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [311.6883,337.6624,1168.8310,2545.4550,3129.87,3675.3250];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
```

```
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 1
primary_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],
                  [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20
[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]];      // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [421.0526,456.1404,1578.9470,3438.5960,4228.0700,4964.9120];
```

Test Instance-20: TGS1C3D2 (Test General Setup-Profile_1 Capacity-Profile_3 Demand-Series_2)

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
```

```
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 2
primary_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-7: Sum of Product-1,2,3,4 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-8: Sum of Product-1,2,3,4 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-9: Sum of Product-1,2,3,4,5,6 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-10:Sum of Product-1,2,3,4,5,6 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-11:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-12:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-13:Equal to product-8
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-14:Equal to product-8
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-15:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-16:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-17:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-18:Equal to product-10
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-19:Equal to product-10
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-20:Equal to product-11
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-21:Sum of product-11 & 12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-22:Equal to product-12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-23:Equal to product-13
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-24:Equal to product-14
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-25:Sum of product-15 & 16
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-26:Equal to product-17
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-27:Equal to product-18
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-28:Equal to product-19
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-29:Equal to product-19
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-30:Equal to product-20
[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],   // P-31:Sum of product-21 & 22
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-32:Equal to product-23
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-33:Sum of product-23 & 24
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-34:Equal to product-24
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-35:Equal to product-25
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-36:Equal to product-26
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-37:Equal to product-27
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-38:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-39:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [421.0526,456.1404,1578.9470,3438.5960,4228.0700,4964.9120];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
```

```
BOM = 1;
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 3
primary_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]
                   [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20
[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];        // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [421.0526,456.1404,1578.9470,3438.5960,4228.0700,4964.9120];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 4
primary_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],
                  [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-7: Sum of Product-1,2,3,4 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-8: Sum of Product-1,2,3,4 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-9: Sum of Product-1,2,3,4,5,6 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-10:Sum of Product-1,2,3,4,5,6 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-11:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-12:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-13:Equal to product-8
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-14:Equal to product-8
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-15:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-16:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-17:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-18:Equal to product-10
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-19:Equal to product-10
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-20:Equal to product-11
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-22:Equal to product-12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-23:Equal to product-13
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-24:Equal to product-14
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-25:Sum of product-15 & 16
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-26:Equal to product-17
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-27:Equal to product-18
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-28:Equal to product-19
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-29:Equal to product-19
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-30:Equal to product-20
[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],   // P-31:Sum of product-21 & 22
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-32:Equal to product-23
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-34:Equal to product-24
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-35:Equal to product-25
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-36:Equal to product-26
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-37:Equal to product-27
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-38:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-39:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [421.0526,456.1404,1578.9470,3438.5960,4228.0700,4964.9120];
```

Test Instance-23: TGS1C3D5 (Test General Setup-Profile_1 Capacity-Profile_3 Demand-Series_5)

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
```

```
BOM = 1;
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 5
primary_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],
                   [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],
                   [80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],
                   [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],     // P-11:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],     // P-12:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],     // P-13:Equal to product-8
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],     // P-14:Equal to product-8
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],      // P-15:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],      // P-16:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],      // P-17:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],      // P-18:Equal to product-10
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],      // P-19:Equal to product-10
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],      // P-20:Equal to product-11
[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],      // P-22:Equal to product-12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],      // P-23:Equal to product-13
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],      // P-24:Equal to product-14
[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],      // P-26:Equal to product-17
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],      // P-27:Equal to product-18
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],      // P-28:Equal to product-19
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],      // P-29:Equal to product-19
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],      // P-30:Equal to product-20
[559.6875,452.468,450.0555,450.0012,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],       // P-31:Sum of product-21 & 22
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],      // P-32:Equal to product-23
[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],      // P-34:Equal to product-24
[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],  // P-35:Equal to product-25
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],      // P-36:Equal to product-26
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],      // P-37:Equal to product-27
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],      // P-38:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],      // P-39:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]];     // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [421.0526,456.1404,1578.9470,3438.5960,4228.0700,4964.9120];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 6
primary_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],
                  [125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-11:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-12:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-13:Equal to product-8
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-14:Equal to product-8
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-15:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-16:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-17:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-18:Equal to product-10
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-19:Equal to product-10
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-20:Equal to product-11
[536.925,305.3308,300.1199,300.0027,300.0001,300,300,300,300,300,300,300,300,300,300,300],    // P-21:Sum of product-11 & 12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-22:Equal to product-12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-23:Equal to product-13
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-24:Equal to product-14
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],        // P-25:Sum of product-15 & 16
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-26:Equal to product-17
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-27:Equal to product-18
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-28:Equal to product-19
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-29:Equal to product-19
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-30:Equal to product-20
[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-32:Equal to product-23
[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-34:Equal to product-24
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],        // P-35:Equal to product-25
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-36:Equal to product-26
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-37:Equal to product-27
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-38:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-39:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]];        // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [421.0526,456.1404,1578.9470,3438.5960,4228.0700,4964.9120];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 7
primary_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],
                  [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary_demand = [
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-7: Sum of Product-1,2,3,4 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-8: Sum of Product-1,2,3,4 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-9: Sum of Product-1,2,3,4,5,6 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-10:Sum of Product-1,2,3,4,5,6 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-11:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-12:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-13:Equal to product-8
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-14:Equal to product-8
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-15:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-16:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-17:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-18:Equal to product-10
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-19:Equal to product-10
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-20:Equal to product-11
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-22:Equal to product-12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-23:Equal to product-13
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-24:Equal to product-14
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-25:Sum of product-15 & 16
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-26:Equal to product-17
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-27:Equal to product-18
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-28:Equal to product-19
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-29:Equal to product-19
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-30:Equal to product-20
[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],   // P-31:Sum of product-21 & 22
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-32:Equal to product-23
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-34:Equal to product-24
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-35:Equal to product-25
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-36:Equal to product-26
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-37:Equal to product-27
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-38:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-39:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [421.0526,456.1404,1578.9470,3438.5960,4228.0700,4964.9120];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 8
primary_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],
                  [24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],
                  [96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],
                  [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-7: Sum of Product-1,2,3,4 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-8: Sum of Product-1,2,3,4 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-9: Sum of Product-1,2,3,4,5,6 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-10:Sum of Product-1,2,3,4,5,6 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-11:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-12:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-13:Equal to product-8
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-14:Equal to product-8
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-15:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-16:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-17:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-18:Equal to product-10
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-19:Equal to product-10
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-20:Equal to product-11
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-22:Equal to product-12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-23:Equal to product-13
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-24:Equal to product-14
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],    // P-25:Sum of product-15 & 16
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-26:Equal to product-17
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-27:Equal to product-18
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-28:Equal to product-19
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-29:Equal to product-19
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-30:Equal to product-20
[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-32:Equal to product-23
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-34:Equal to product-24
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],    // P-35:Equal to product-25
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-36:Equal to product-26
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-37:Equal to product-27
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-38:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-39:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];    // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [421.0526,456.1404,1578.9470,3438.5960,4228.0700,4964.9120];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 9
primary_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],
                  [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                  [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],
                  [176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],
                  [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                  [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-7: Sum of Product-1,2,3,4 demands
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-8: Sum of Product-1,2,3,4 demands
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-9: Sum of Product-1,2,3,4,5,6 demands
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-10:Sum of Product-1,2,3,4,5,6 demands
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-11:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-12:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-13:Equal to product-8
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-14:Equal to product-8
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-15:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-16:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-17:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-18:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-19:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-20:Equal to product-11
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-21:Sum of product-11 & 12
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-22:Equal to product-12
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-23:Equal to product-13
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-24:Equal to product-14
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-25:Sum of product-15 & 16
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-26:Equal to product-17
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-27:Equal to product-18
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-28:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-29:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-30:Equal to product-20
[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-32:Equal to product-23
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-33:Sum of product-23 & 24
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-34:Equal to product-24
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-35:Equal to product-25
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-36:Equal to product-26
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-37:Equal to product-27
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-38:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-39:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300]];         // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [421.0526,456.1404,1578.9470,3438.5960,4228.0700,4964.9120];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
```

```
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 1
primary_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],
                  [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20
[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]];        // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [247.4227,268.0412,1168.8310,2545.4550,4228.07,4964.912];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
```

```
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 2
primary_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],
                  [21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-7: Sum of Product-1,2,3,4 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-8: Sum of Product-1,2,3,4 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-9: Sum of Product-1,2,3,4,5,6 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-10:Sum of Product-1,2,3,4,5,6 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-11:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-12:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-13:Equal to product-8
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-14:Equal to product-8
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-15:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-16:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-17:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-18:Equal to product-10
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-19:Equal to product-10
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-20:Equal to product-11
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],       // P-21:Sum of product-11 & 12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-22:Equal to product-12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-23:Equal to product-13
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-24:Equal to product-14
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-25:Sum of product-15 & 16
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-26:Equal to product-17
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-27:Equal to product-18
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-28:Equal to product-19
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-29:Equal to product-19
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-30:Equal to product-20
[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-32:Equal to product-23
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],       // P-33:Sum of product-23 & 24
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-34:Equal to product-24
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-35:Equal to product-25
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-36:Equal to product-26
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-37:Equal to product-27
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-38:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-39:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [247.4227,268.0412,1168.8310,2545.4550,4228.07,4964.912];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 3
primary_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]
                   [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20
[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];        // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [247.4227,268.0412,1168.8310,2545.4550,4228.07,4964.912];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 4
primary_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-7: Sum of Product-1,2,3,4 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-8: Sum of Product-1,2,3,4 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-9: Sum of Product-1,2,3,4,5,6 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-10:Sum of Product-1,2,3,4,5,6 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-11:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-12:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-13:Equal to product-8
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-14:Equal to product-8
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-15:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-16:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-17:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-18:Equal to product-10
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-19:Equal to product-10
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-20:Equal to product-11
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-22:Equal to product-12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-23:Equal to product-13
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-24:Equal to product-14
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-25:Sum of product-15 & 16
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-26:Equal to product-17
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-27:Equal to product-18
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-28:Equal to product-19
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-29:Equal to product-19
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-30:Equal to product-20
[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],   // P-31:Sum of product-21 & 22
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-32:Equal to product-23
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-34:Equal to product-24
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-35:Equal to product-25
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-36:Equal to product-26
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-37:Equal to product-27
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-38:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-39:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [247.4227,268.0412,1168.8310,2545.4550,4228.07,4964.912];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 5
primary_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],
                   [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],
                   [80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],
                   [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],     // P-11:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],     // P-12:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],     // P-13:Equal to product-8
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],     // P-14:Equal to product-8
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-15:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-16:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-17:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-18:Equal to product-10
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-19:Equal to product-10
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],     // P-20:Equal to product-11
[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],     // P-22:Equal to product-12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],     // P-23:Equal to product-13
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],     // P-24:Equal to product-14
[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-26:Equal to product-17
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-27:Equal to product-18
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-28:Equal to product-19
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-29:Equal to product-19
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],     // P-30:Equal to product-20
[559.6875,452.468,450.0555,450.0012,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],     // P-32:Equal to product-23
[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],     // P-34:Equal to product-24
[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-36:Equal to product-26
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-37:Equal to product-27
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-38:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-39:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]];     // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [247.4227,268.0412,1168.8310,2545.4550,4228.07,4964.912];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 6
primary_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],
                  [125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-11:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-12:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-13:Equal to product-8
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-14:Equal to product-8
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-15:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-16:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-17:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-18:Equal to product-10
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-19:Equal to product-10
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-20:Equal to product-11
[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-22:Equal to product-12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-23:Equal to product-13
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-24:Equal to product-14
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],      // P-25:Sum of product-15 & 16
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-26:Equal to product-17
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-27:Equal to product-18
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-28:Equal to product-19
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-29:Equal to product-19
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-30:Equal to product-20
[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],   // P-31:Sum of product-21 & 22
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-32:Equal to product-23
[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-34:Equal to product-24
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],      // P-35:Equal to product-25
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-36:Equal to product-26
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-37:Equal to product-27
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-38:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-39:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]];      // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [247.4227,268.0412,1168.8310,2545.4550,4228.07,4964.912];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 7
primary_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],
                  [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary_demand = [
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-7: Sum of Product-1,2,3,4 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-8: Sum of Product-1,2,3,4 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-9: Sum of Product-1,2,3,4,5,6 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-10:Sum of Product-1,2,3,4,5,6 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-11:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-12:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-13:Equal to product-8
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-14:Equal to product-8
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-15:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-16:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-17:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-18:Equal to product-10
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-19:Equal to product-10
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-20:Equal to product-11
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-22:Equal to product-12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-23:Equal to product-13
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-24:Equal to product-14
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-25:Sum of product-15 & 16
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-26:Equal to product-17
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-27:Equal to product-18
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-28:Equal to product-19
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-29:Equal to product-19
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-30:Equal to product-20
[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],   // P-31:Sum of product-21 & 22
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-32:Equal to product-23
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-34:Equal to product-24
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-35:Equal to product-25
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-36:Equal to product-26
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-37:Equal to product-27
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-38:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-39:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [247.4227,268.0412,1168.8310,2545.4550,4228.07,4964.912];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 8
primary_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],
                  [24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],
                  [96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],
                  [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-7: Sum of Product-1,2,3,4 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-8: Sum of Product-1,2,3,4 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-9: Sum of Product-1,2,3,4,5,6 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-10:Sum of Product-1,2,3,4,5,6 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-11:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-12:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-13:Equal to product-8
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-14:Equal to product-8
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-15:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-16:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-17:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-18:Equal to product-10
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-19:Equal to product-10
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-20:Equal to product-11
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-22:Equal to product-12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-23:Equal to product-13
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-24:Equal to product-14
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],       // P-25:Sum of product-15 & 16
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-26:Equal to product-17
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-27:Equal to product-18
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-28:Equal to product-19
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-29:Equal to product-19
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-30:Equal to product-20
[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-32:Equal to product-23
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-34:Equal to product-24
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],       // P-35:Equal to product-25
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-36:Equal to product-26
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-37:Equal to product-27
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-38:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-39:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];     // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [247.4227,268.0412,1168.8310,2545.4550,4228.07,4964.912];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 9
primary_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],
                  [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                  [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],
                  [176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],
                  [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                  [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-7: Sum of Product-1,2,3,4 demands
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-8: Sum of Product-1,2,3,4 demands
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-9: Sum of Product-1,2,3,4,5,6 demands
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-10:Sum of Product-1,2,3,4,5,6 demands
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-11:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-12:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-13:Equal to product-8
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-14:Equal to product-8
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-15:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-16:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-17:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-18:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-19:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-20:Equal to product-11
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-21:Sum of product-11 & 12
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-22:Equal to product-12
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-23:Equal to product-13
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-24:Equal to product-14
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400],  // P-25:Sum of product-15 & 16
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-26:Equal to product-17
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-27:Equal to product-18
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-28:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-29:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-30:Equal to product-20
[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450],  // P-31:Sum of product-21 & 22
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-32:Equal to product-23
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-33:Sum of product-23 & 24
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-34:Equal to product-24
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400],  // P-35:Equal to product-25
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-36:Equal to product-26
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-37:Equal to product-27
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-38:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-39:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300]];     // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [247.4227,268.0412,1168.8310,2545.4550,4228.07,4964.912];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
```

```
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 1
primary_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20
[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]];      // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [421.0526,456.1404,1168.8310,2545.4550,2484.5360,2917.5260];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 2
primary_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],
                  [21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-7: Sum of Product-1,2,3,4 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-8: Sum of Product-1,2,3,4 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-9: Sum of Product-1,2,3,4,5,6 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-10:Sum of Product-1,2,3,4,5,6 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-11:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-12:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-13:Equal to product-8
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-14:Equal to product-8
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-15:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-16:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-17:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-18:Equal to product-10
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-19:Equal to product-10
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-20:Equal to product-11
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],       // P-21:Sum of product-11 & 12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-22:Equal to product-12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-23:Equal to product-13
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-24:Equal to product-14
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-25:Sum of product-15 & 16
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-26:Equal to product-17
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-27:Equal to product-18
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-28:Equal to product-19
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-29:Equal to product-19
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-30:Equal to product-20
[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],  // P-31:Sum of product-21 & 22
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-32:Equal to product-23
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],       // P-33:Sum of product-23 & 24
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-34:Equal to product-24
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-35:Equal to product-25
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-36:Equal to product-26
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-37:Equal to product-27
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-38:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-39:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [421.0526,456.1404,1168.8310,2545.4550,2484.5360,2917.5260];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
```

```
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 3
primary_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]
                   [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20
[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];        // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [421.0526,456.1404,1168.8310,2545.4550,2484.5360,2917.5260];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
```

```
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 4
primary_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-7: Sum of Product-1,2,3,4 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-8: Sum of Product-1,2,3,4 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-9: Sum of Product-1,2,3,4,5,6 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-10:Sum of Product-1,2,3,4,5,6 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-11:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-12:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-13:Equal to product-8
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-14:Equal to product-8
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-15:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-16:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-17:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-18:Equal to product-10
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-19:Equal to product-10
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-20:Equal to product-11
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-22:Equal to product-12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-23:Equal to product-13
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-24:Equal to product-14
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-25:Sum of product-15 & 16
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-26:Equal to product-17
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-27:Equal to product-18
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-28:Equal to product-19
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-29:Equal to product-19
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-30:Equal to product-20
[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],   // P-31:Sum of product-21 & 22
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-32:Equal to product-23
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-34:Equal to product-24
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-35:Equal to product-25
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-36:Equal to product-26
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-37:Equal to product-27
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-38:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-39:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [421.0526,456.1404,1168.8310,2545.4550,2484.5360,2917.5260];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
```

```
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 5
primary_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],
                  [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],
                  [80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],
                  [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-11:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-12:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-13:Equal to product-8
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-14:Equal to product-8
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-15:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-16:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-17:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-18:Equal to product-10
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-19:Equal to product-10
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-20:Equal to product-11
[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-22:Equal to product-12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-23:Equal to product-13
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-24:Equal to product-14
[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-26:Equal to product-17
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-27:Equal to product-18
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-28:Equal to product-19
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-29:Equal to product-19
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-30:Equal to product-20
[559.6875,452.468,450.0555,450.0012,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],        // P-31:Sum of product-21 & 22
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-32:Equal to product-23
[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-34:Equal to product-24
[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],  // P-35:Equal to product-25
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-36:Equal to product-26
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-37:Equal to product-27
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-38:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-39:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]];    // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [421.0526,456.1404,1168.8310,2545.4550,2484.5360,2917.5260];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
```

```
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 6
primary_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],
                  [125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-11:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-12:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-13:Equal to product-8
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-14:Equal to product-8
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-15:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-16:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-17:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-18:Equal to product-10
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-19:Equal to product-10
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-20:Equal to product-11
[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-21:Sum of product-11 & 12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-22:Equal to product-12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-23:Equal to product-13
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-24:Equal to product-14
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],     // P-25:Sum of product-15 & 16
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-26:Equal to product-17
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-27:Equal to product-18
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-28:Equal to product-19
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-29:Equal to product-19
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-30:Equal to product-20
[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],     // P-31:Sum of product-21 & 22
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-32:Equal to product-23
[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-33:Sum of product-23 & 24
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-34:Equal to product-24
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],     // P-35:Equal to product-25
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-36:Equal to product-26
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-37:Equal to product-27
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-38:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-39:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]];       // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [421.0526,456.1404,1168.8310,2545.4550,2484.5360,2917.5260];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
```

```
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 7
primary_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],
                   [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary_demand = [
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-7: Sum of Product-1,2,3,4 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-8: Sum of Product-1,2,3,4 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-9: Sum of Product-1,2,3,4,5,6 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-10:Sum of Product-1,2,3,4,5,6 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-11:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-12:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-13:Equal to product-8
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-14:Equal to product-8
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-15:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-16:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-17:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-18:Equal to product-10
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-19:Equal to product-10
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-20:Equal to product-11
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-22:Equal to product-12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-23:Equal to product-13
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-24:Equal to product-14
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],    // P-25:Sum of product-15 & 16
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-26:Equal to product-17
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-27:Equal to product-18
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-28:Equal to product-19
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-29:Equal to product-19
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-30:Equal to product-20
[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-32:Equal to product-23
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-34:Equal to product-24
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],    // P-35:Equal to product-25
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-36:Equal to product-26
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-37:Equal to product-27
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-38:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-39:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [421.0526,456.1404,1168.8310,2545.4550,2484.5360,2917.5260];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
```

```
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 8
primary_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],
                  [24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],
                  [96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],
                  [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-7: Sum of Product-1,2,3,4 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-8: Sum of Product-1,2,3,4 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-9: Sum of Product-1,2,3,4,5,6 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-10:Sum of Product-1,2,3,4,5,6 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-11:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-12:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-13:Equal to product-8
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-14:Equal to product-8
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-15:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-16:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-17:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-18:Equal to product-10
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-19:Equal to product-10
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-20:Equal to product-11
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-22:Equal to product-12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-23:Equal to product-13
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-24:Equal to product-14
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],      // P-25:Sum of product-15 & 16
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-26:Equal to product-17
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-27:Equal to product-18
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-28:Equal to product-19
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-29:Equal to product-19
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-30:Equal to product-20
[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],   // P-31:Sum of product-21 & 22
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-32:Equal to product-23
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-34:Equal to product-24
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],      // P-35:Equal to product-25
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-36:Equal to product-26
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-37:Equal to product-27
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-38:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-39:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];    // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [421.0526,456.1404,1168.8310,2545.4550,2484.5360,2917.5260];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
```

```
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 9
primary_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],
                  [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                  [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],
                  [176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],
                  [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                  [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-7: Sum of Product-1,2,3,4 demands
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-8: Sum of Product-1,2,3,4 demands
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-9: Sum of Product-1,2,3,4,5,6 demands
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-10:Sum of Product-1,2,3,4,5,6 demands
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-11:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-12:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-13:Equal to product-8
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-14:Equal to product-8
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-15:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-16:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-17:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-18:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-19:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-20:Equal to product-11
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-21:Sum of product-11 & 12
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-22:Equal to product-12
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-23:Equal to product-13
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-24:Equal to product-14
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-26:Equal to product-17
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-27:Equal to product-18
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-28:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-29:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-30:Equal to product-20
[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450],  // P-31:Sum of product-21 & 22
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-32:Equal to product-23
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-33:Sum of product-23 & 24
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-34:Equal to product-24
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-36:Equal to product-26
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-37:Equal to product-27
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-38:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-39:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300]];       // P-40:Equal to product-29


// Setup Profile - I
setuptime =
[25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [421.0526,456.1404,1168.8310,2545.4550,2484.5360,2917.5260];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
```

```
BOM = 1;
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 1
primary_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20
[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]];        // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [154.6392,175.2577,804.1237,1927.8350,2567.01,3237.1130];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
```

```
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 2
primary_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-7: Sum of Product-1,2,3,4 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-8: Sum of Product-1,2,3,4 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-9: Sum of Product-1,2,3,4,5,6 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-10:Sum of Product-1,2,3,4,5,6 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-11:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-12:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-13:Equal to product-8
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-14:Equal to product-8
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-15:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-16:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-17:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-18:Equal to product-10
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-19:Equal to product-10
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-20:Equal to product-11
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-21:Sum of product-11 & 12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-22:Equal to product-12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-23:Equal to product-13
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-24:Equal to product-14
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-25:Sum of product-15 & 16
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-26:Equal to product-17
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-27:Equal to product-18
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-28:Equal to product-19
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-29:Equal to product-19
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-30:Equal to product-20
[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],     // P-31:Sum of product-21 & 22
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-32:Equal to product-23
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-33:Sum of product-23 & 24
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-34:Equal to product-24
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-35:Equal to product-25
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-36:Equal to product-26
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-37:Equal to product-27
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-38:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-39:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [154.6392,175.2577,804.1237,1927.8350,2567.01,3237.1130];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 3
primary_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]
                   [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20
[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [154.6392,175.2577,804.1237,1927.8350,2567.01,3237.1130];
```

Test Instance-4: TGS2C1D4 (Test General Setup-Profile_2 Capacity-Profile_1 Demand-Series_4)

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 4
primary_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],
                  [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-7: Sum of Product-1,2,3,4 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-8: Sum of Product-1,2,3,4 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-9: Sum of Product-1,2,3,4,5,6 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-10:Sum of Product-1,2,3,4,5,6 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-11:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-12:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-13:Equal to product-8
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-14:Equal to product-8
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-15:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-16:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-17:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-18:Equal to product-10
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-19:Equal to product-10
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-20:Equal to product-11
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-22:Equal to product-12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-23:Equal to product-13
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-24:Equal to product-14
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-25:Sum of product-15 & 16
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-26:Equal to product-17
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-27:Equal to product-18
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-28:Equal to product-19
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-29:Equal to product-19
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-30:Equal to product-20
[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],   // P-31:Sum of product-21 & 22
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-32:Equal to product-23
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-34:Equal to product-24
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-35:Equal to product-25
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-36:Equal to product-26
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-37:Equal to product-27
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-38:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-39:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [154.6392,175.2577,804.1237,1927.8350,2567.01,3237.1130];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 5
primary_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],
                  [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],
                  [80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],
                  [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-11:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-12:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-13:Equal to product-8
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-14:Equal to product-8
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-15:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-16:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-17:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-18:Equal to product-10
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-19:Equal to product-10
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-20:Equal to product-11
[373.125,301.6453,300.037,300.0008,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-22:Equal to product-12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-23:Equal to product-13
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-24:Equal to product-14
[487.75,401.9744,400.0444,400.001,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-26:Equal to product-17
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-27:Equal to product-18
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-28:Equal to product-19
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-29:Equal to product-19
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-30:Equal to product-20
[559.6875,452.468,450.0555,450.0012,450,450,450,450,450,450,450,450,450,450,450,450],         // P-31:Sum of product-21 & 22
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-32:Equal to product-23
[373.125,301.6453,300.037,300.0008,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-34:Equal to product-24
[487.75,401.9744,400.0444,400.001,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-36:Equal to product-26
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-37:Equal to product-27
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-38:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-39:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]];    // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [154.6392,175.2577,804.1237,1927.8350,2567.01,3237.1130];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 6
primary_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],
                  [125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-11:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-12:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-13:Equal to product-8
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-14:Equal to product-8
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-15:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-16:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-17:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-18:Equal to product-10
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-19:Equal to product-10
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-20:Equal to product-11
[536.925,305.3308,300.1199,300.0027,300.0001,300,300,300,300,300,300,300,300,300,300,300],    // P-21:Sum of product-11 & 12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-22:Equal to product-12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-23:Equal to product-13
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-24:Equal to product-14
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],      // P-25:Sum of product-15 & 16
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-26:Equal to product-17
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-27:Equal to product-18
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-28:Equal to product-19
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-29:Equal to product-19
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-30:Equal to product-20
[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-32:Equal to product-23
[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-34:Equal to product-24
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],      // P-35:Equal to product-25
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-36:Equal to product-26
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-37:Equal to product-27
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-38:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-39:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]];      // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [154.6392,175.2577,804.1237,1927.8350,2567.01,3237.1130];
```

Test Instance-7: TGS2C1D7 (Test General Setup-Profile_2 Capacity-Profile_1 Demand-Series_7)

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 7
primary_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],
                  [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary_demand = [
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-7: Sum of Product-1,2,3,4 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-8: Sum of Product-1,2,3,4 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-9: Sum of Product-1,2,3,4,5,6 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-10:Sum of Product-1,2,3,4,5,6 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-11:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-12:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-13:Equal to product-8
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-14:Equal to product-8
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-15:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-16:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-17:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-18:Equal to product-10
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-19:Equal to product-10
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-20:Equal to product-11
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-22:Equal to product-12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-23:Equal to product-13
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-24:Equal to product-14
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-25:Sum of product-15 & 16
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-26:Equal to product-17
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-27:Equal to product-18
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-28:Equal to product-19
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-29:Equal to product-19
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-30:Equal to product-20
[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],   // P-31:Sum of product-21 & 22
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-32:Equal to product-23
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-34:Equal to product-24
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-35:Equal to product-25
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-36:Equal to product-26
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-37:Equal to product-27
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-38:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-39:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [154.6392,175.2577,804.1237,1927.8350,2567.01,3237.1130];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 8
primary_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],
                  [24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],
                  [96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],
                  [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-7: Sum of Product-1,2,3,4 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-8: Sum of Product-1,2,3,4 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-9: Sum of Product-1,2,3,4,5,6 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-10:Sum of Product-1,2,3,4,5,6 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-11:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-12:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-13:Equal to product-8
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-14:Equal to product-8
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-15:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-16:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-17:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-18:Equal to product-10
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-19:Equal to product-10
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-20:Equal to product-11
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-22:Equal to product-12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-23:Equal to product-13
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-24:Equal to product-14
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],       // P-25:Sum of product-15 & 16
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-26:Equal to product-17
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-27:Equal to product-18
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-28:Equal to product-19
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-29:Equal to product-19
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-30:Equal to product-20
[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-32:Equal to product-23
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-34:Equal to product-24
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],       // P-35:Equal to product-25
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-36:Equal to product-26
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-37:Equal to product-27
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-38:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-39:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];     // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [154.6392,175.2577,804.1237,1927.8350,2567.01,3237.1130];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 9
primary_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],
                  [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                  [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],
                  [176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],
                  [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                  [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],      // P-7: Sum of Product-1,2,3,4 demands
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],      // P-8: Sum of Product-1,2,3,4 demands
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],      // P-9: Sum of Product-1,2,3,4,5,6 demands
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],      // P-10:Sum of Product-1,2,3,4,5,6 demands
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],      // P-11:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],      // P-12:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],      // P-13:Equal to product-8
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],      // P-14:Equal to product-8
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],      // P-15:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],      // P-16:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],      // P-17:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],      // P-18:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],      // P-19:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],      // P-20:Equal to product-11
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],      // P-21:Sum of product-11 & 12
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],      // P-22:Equal to product-12
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],      // P-23:Equal to product-13
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],      // P-24:Equal to product-14
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],      // P-26:Equal to product-17
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],      // P-27:Equal to product-18
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],      // P-28:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],      // P-29:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],      // P-30:Equal to product-20
[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],      // P-32:Equal to product-23
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],      // P-33:Sum of product-23 & 24
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],      // P-34:Equal to product-24
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],      // P-36:Equal to product-26
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],      // P-37:Equal to product-27
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],      // P-38:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],      // P-39:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300]];     // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [154.6392,175.2577,804.1237,1927.8350,2567.01,3237.1130];
```

Test Instance-10: TGS2C2D1 (Test General Setup-Profile_2 Capacity-Profile_2 Demand-Series_1)

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
```

```
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 1
primary_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20
[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]];       // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [194.8052,220.7792,1012.9870,2428.5720,3233.7660,4077.9220];
```

Test Instance-11: TGS2C2D2 (Test General Setup-Profile_2 Capacity-Profile_2 Demand-Series_2)

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
```

```
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 2
primary_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],
                  [21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-7: Sum of Product-1,2,3,4 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-8: Sum of Product-1,2,3,4 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-9: Sum of Product-1,2,3,4,5,6 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-10:Sum of Product-1,2,3,4,5,6 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-11:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-12:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-13:Equal to product-8
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-14:Equal to product-8
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-15:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-16:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-17:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-18:Equal to product-10
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-19:Equal to product-10
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-20:Equal to product-11
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],       // P-21:Sum of product-11 & 12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-22:Equal to product-12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-23:Equal to product-13
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-24:Equal to product-14
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-25:Sum of product-15 & 16
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-26:Equal to product-17
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-27:Equal to product-18
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-28:Equal to product-19
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-29:Equal to product-19
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-30:Equal to product-20
[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],  // P-31:Sum of product-21 & 22
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-32:Equal to product-23
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],       // P-33:Sum of product-23 & 24
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-34:Equal to product-24
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-35:Equal to product-25
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-36:Equal to product-26
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-37:Equal to product-27
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-38:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-39:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [194.8052,220.7792,1012.9870,2428.5720,3233.7660,4077.9220];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 3
primary_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],
                  [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]
                  [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20
[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];        // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [194.8052,220.7792,1012.9870,2428.5720,3233.7660,4077.9220];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 4
primary_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],
                  [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-7: Sum of Product-1,2,3,4 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-8: Sum of Product-1,2,3,4 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-9: Sum of Product-1,2,3,4,5,6 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-10:Sum of Product-1,2,3,4,5,6 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-11:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-12:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-13:Equal to product-8
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-14:Equal to product-8
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-15:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-16:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-17:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-18:Equal to product-10
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-19:Equal to product-10
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-20:Equal to product-11
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-21:Sum of product-11 & 12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-22:Equal to product-12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-23:Equal to product-13
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-24:Equal to product-14
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],      // P-25:Sum of product-15 & 16
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-26:Equal to product-17
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-27:Equal to product-18
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-28:Equal to product-19
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-29:Equal to product-19
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-30:Equal to product-20
[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],      // P-31:Sum of product-21 & 22
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-32:Equal to product-23
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],      // P-33:Sum of product-23 & 24
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-34:Equal to product-24
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],      // P-35:Equal to product-25
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-36:Equal to product-26
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-37:Equal to product-27
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-38:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-39:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [194.8052,220.7792,1012.9870,2428.5720,3233.7660,4077.9220];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 5
primary_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],
                   [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],
                   [80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],
                   [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-11:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-12:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-13:Equal to product-8
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-14:Equal to product-8
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-15:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-16:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-17:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-18:Equal to product-10
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-19:Equal to product-10
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-20:Equal to product-11
[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-22:Equal to product-12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-23:Equal to product-13
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-24:Equal to product-14
[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-26:Equal to product-17
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-27:Equal to product-18
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-28:Equal to product-19
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-29:Equal to product-19
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-30:Equal to product-20
[559.6875,452.468,450.0555,450.0012,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],     // P-31:Sum of product-21 & 22
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-32:Equal to product-23
[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-34:Equal to product-24
[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-36:Equal to product-26
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-37:Equal to product-27
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-38:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-39:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]];    // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [194.8052,220.7792,1012.9870,2428.5720,3233.7660,4077.9220];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 6
primary_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],
                  [125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-11:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-12:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-13:Equal to product-8
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-14:Equal to product-8
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-15:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-16:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-17:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-18:Equal to product-10
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-19:Equal to product-10
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-20:Equal to product-11
[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-22:Equal to product-12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-23:Equal to product-13
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-24:Equal to product-14
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],       // P-25:Sum of product-15 & 16
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-26:Equal to product-17
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-27:Equal to product-18
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-28:Equal to product-19
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-29:Equal to product-19
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-30:Equal to product-20
[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-32:Equal to product-23
[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],      // P-34:Equal to product-24
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],    // P-35:Equal to product-25
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-36:Equal to product-26
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-37:Equal to product-27
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-38:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],      // P-39:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]];      // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [194.8052,220.7792,1012.9870,2428.5720,3233.7660,4077.9220];
```

Test Instance-16: TGS2C2D7 (Test General Setup-Profile_2 Capacity-Profile_2 Demand-Series_7)

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 7
primary_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],
                  [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary_demand = [
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-7: Sum of Product-1,2,3,4 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-8: Sum of Product-1,2,3,4 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-9: Sum of Product-1,2,3,4,5,6 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-10:Sum of Product-1,2,3,4,5,6 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-11:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-12:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-13:Equal to product-8
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-14:Equal to product-8
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-15:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-16:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-17:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-18:Equal to product-10
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-19:Equal to product-10
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-20:Equal to product-11
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],  // P-21:Sum of product-11 & 12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-22:Equal to product-12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-23:Equal to product-13
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-24:Equal to product-14
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],  // P-25:Sum of product-15 & 16
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-26:Equal to product-17
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-27:Equal to product-18
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-28:Equal to product-19
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-29:Equal to product-19
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-30:Equal to product-20
[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],  // P-31:Sum of product-21 & 22
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-32:Equal to product-23
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],  // P-33:Sum of product-23 & 24
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-34:Equal to product-24
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],  // P-35:Equal to product-25
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-36:Equal to product-26
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-37:Equal to product-27
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-38:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-39:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [194.8052,220.7792,1012.9870,2428.5720,3233.7660,4077.9220];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 8
primary_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],
                  [24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],
                  [96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],
                  [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-7: Sum of Product-1,2,3,4 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-8: Sum of Product-1,2,3,4 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-9: Sum of Product-1,2,3,4,5,6 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-10:Sum of Product-1,2,3,4,5,6 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-11:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-12:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-13:Equal to product-8
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-14:Equal to product-8
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-15:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-16:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-17:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-18:Equal to product-10
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-19:Equal to product-10
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-20:Equal to product-11
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-22:Equal to product-12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-23:Equal to product-13
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-24:Equal to product-14
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],    // P-25:Sum of product-15 & 16
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-26:Equal to product-17
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-27:Equal to product-18
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-28:Equal to product-19
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-29:Equal to product-19
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-30:Equal to product-20
[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-32:Equal to product-23
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-34:Equal to product-24
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],    // P-35:Equal to product-25
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-36:Equal to product-26
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-37:Equal to product-27
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-38:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-39:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];    // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [194.8052,220.7792,1012.9870,2428.5720,3233.7660,4077.9220];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 9
primary_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],
                  [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                  [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],
                  [176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],
                  [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                  [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-7: Sum of Product-1,2,3,4 demands
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-8: Sum of Product-1,2,3,4 demands
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-9: Sum of Product-1,2,3,4,5,6 demands
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-10:Sum of Product-1,2,3,4,5,6 demands
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-11:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-12:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-13:Equal to product-8
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-14:Equal to product-8
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-15:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-16:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-17:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-18:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-19:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-20:Equal to product-11
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-22:Equal to product-12
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-23:Equal to product-13
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-24:Equal to product-14
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400],  // P-25:Sum of product-15 & 16
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-26:Equal to product-17
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-27:Equal to product-18
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-28:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-29:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-30:Equal to product-20
[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450],  // P-31:Sum of product-21 & 22
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-32:Equal to product-23
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-34:Equal to product-24
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400],  // P-35:Equal to product-25
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-36:Equal to product-26
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-37:Equal to product-27
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-38:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-39:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300]];    // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [194.8052,220.7792,1012.9870,2428.5720,3233.7660,4077.9220];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
```

```
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 1
primary_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],
                  [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20
[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]];     // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [263.1579,298.2456,1368.4210,3280.7020,4368.4210,5508.7720];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
```

```
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 2
primary_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-7: Sum of Product-1,2,3,4 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-8: Sum of Product-1,2,3,4 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-9: Sum of Product-1,2,3,4,5,6 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-10:Sum of Product-1,2,3,4,5,6 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-11:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-12:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-13:Equal to product-8
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-14:Equal to product-8
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-15:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-16:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-17:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-18:Equal to product-10
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-19:Equal to product-10
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-20:Equal to product-11
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],         // P-21:Sum of product-11 & 12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-22:Equal to product-12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-23:Equal to product-13
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-24:Equal to product-14
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-25:Sum of product-15 & 16
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-26:Equal to product-17
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-27:Equal to product-18
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-28:Equal to product-19
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-29:Equal to product-19
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-30:Equal to product-20
[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-32:Equal to product-23
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],         // P-33:Sum of product-23 & 24
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],      // P-34:Equal to product-24
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-35:Equal to product-25
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-36:Equal to product-26
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-37:Equal to product-27
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-38:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-39:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [263.1579,298.2456,1368.4210,3280.7020,4368.4210,5508.7720];
```

Test Instance-21: TGS2C3D3 (Test General Setup-Profile_2 Capacity-Profile_3 Demand-Series_3)

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 3
primary_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]
                   [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20
[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];        // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [263.1579,298.2456,1368.4210,3280.7020,4368.4210,5508.7720];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 4
primary_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-7: Sum of Product-1,2,3,4 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-8: Sum of Product-1,2,3,4 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-9: Sum of Product-1,2,3,4,5,6 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-10:Sum of Product-1,2,3,4,5,6 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-11:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-12:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-13:Equal to product-8
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-14:Equal to product-8
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-15:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-16:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-17:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-18:Equal to product-10
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-19:Equal to product-10
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-20:Equal to product-11
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-22:Equal to product-12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-23:Equal to product-13
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-24:Equal to product-14
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-25:Sum of product-15 & 16
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-26:Equal to product-17
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-27:Equal to product-18
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-28:Equal to product-19
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-29:Equal to product-19
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-30:Equal to product-20
[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],   // P-31:Sum of product-21 & 22
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-32:Equal to product-23
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-34:Equal to product-24
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-35:Equal to product-25
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-36:Equal to product-26
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-37:Equal to product-27
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-38:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-39:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [263.1579,298.2456,1368.4210,3280.7020,4368.4210,5508.7720];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 5
primary_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],
                  [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],
                  [80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],
                  [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-11:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-12:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-13:Equal to product-8
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-14:Equal to product-8
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-15:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-16:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-17:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-18:Equal to product-10
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-19:Equal to product-10
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-20:Equal to product-11
[373.125,301.6453,300.037,300.0008,300,300,300,300,300,300,300,300,300,300,300,300],// P-21:Sum of product-11 & 12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-22:Equal to product-12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-23:Equal to product-13
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-24:Equal to product-14
[487.75,401.9744,400.0444,400.001,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-26:Equal to product-17
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-27:Equal to product-18
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-28:Equal to product-19
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-29:Equal to product-19
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-30:Equal to product-20
[559.6875,452.468,450.0555,450.0012,450,450,450,450,450,450,450,450,450,450,450],         // P-31:Sum of product-21 & 22
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-32:Equal to product-23
[373.125,301.6453,300.037,300.0008,300,300,300,300,300,300,300,300,300,300,300,300],// P-33:Sum of product-23 & 24
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-34:Equal to product-24
[487.75,401.9744,400.0444,400.001,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-36:Equal to product-26
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-37:Equal to product-27
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-38:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],     // P-39:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]];     // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [263.1579,298.2456,1368.4210,3280.7020,4368.4210,5508.7720];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 6
primary_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],
                  [125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-11:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-12:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-13:Equal to product-8
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-14:Equal to product-8
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-15:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-16:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-17:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-18:Equal to product-10
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-19:Equal to product-10
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-20:Equal to product-11
[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-22:Equal to product-12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-23:Equal to product-13
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-24:Equal to product-14
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],        // P-25:Sum of product-15 & 16
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-26:Equal to product-17
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-27:Equal to product-18
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-28:Equal to product-19
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-29:Equal to product-19
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-30:Equal to product-20
[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-32:Equal to product-23
[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-33:Sum of product-23 & 24
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],       // P-34:Equal to product-24
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],       // P-35:Equal to product-25
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-36:Equal to product-26
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-37:Equal to product-27
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-38:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],       // P-39:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]];       // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [263.1579,298.2456,1368.4210,3280.7020,4368.4210,5508.7720];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 7
primary_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],
                  [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary_demand = [
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-7: Sum of Product-1,2,3,4 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-8: Sum of Product-1,2,3,4 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-9: Sum of Product-1,2,3,4,5,6 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-10:Sum of Product-1,2,3,4,5,6 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-11:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-12:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-13:Equal to product-8
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-14:Equal to product-8
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-15:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-16:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-17:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-18:Equal to product-10
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-19:Equal to product-10
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-20:Equal to product-11
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],  // P-21:Sum of product-11 & 12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-22:Equal to product-12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-23:Equal to product-13
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-24:Equal to product-14
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],  // P-25:Sum of product-15 & 16
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-26:Equal to product-17
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-27:Equal to product-18
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-28:Equal to product-19
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-29:Equal to product-19
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-30:Equal to product-20
[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],  // P-31:Sum of product-21 & 22
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-32:Equal to product-23
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],  // P-33:Sum of product-23 & 24
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],  // P-34:Equal to product-24
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],  // P-35:Equal to product-25
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-36:Equal to product-26
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-37:Equal to product-27
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-38:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-39:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [263.1579,298.2456,1368.4210,3280.7020,4368.4210,5508.7720];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 8
primary_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],
                  [24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],
                  [96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],
                  [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-7: Sum of Product-1,2,3,4 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-8: Sum of Product-1,2,3,4 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-9: Sum of Product-1,2,3,4,5,6 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-10:Sum of Product-1,2,3,4,5,6 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-11:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-12:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-13:Equal to product-8
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-14:Equal to product-8
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-15:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-16:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-17:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-18:Equal to product-10
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-19:Equal to product-10
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-20:Equal to product-11
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-22:Equal to product-12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-23:Equal to product-13
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-24:Equal to product-14
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],    // P-25:Sum of product-15 & 16
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-26:Equal to product-17
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-27:Equal to product-18
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-28:Equal to product-19
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-29:Equal to product-19
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-30:Equal to product-20
[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-32:Equal to product-23
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-34:Equal to product-24
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],    // P-35:Equal to product-25
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-36:Equal to product-26
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-37:Equal to product-27
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-38:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-39:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];    // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [263.1579,298.2456,1368.4210,3280.7020,4368.4210,5508.7720];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 9
primary_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],
                  [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                  [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],
                  [176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],
                  [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                  [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-7: Sum of Product-1,2,3,4 demands
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-8: Sum of Product-1,2,3,4 demands
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-9: Sum of Product-1,2,3,4,5,6 demands
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-10:Sum of Product-1,2,3,4,5,6 demands
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-11:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-12:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-13:Equal to product-8
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-14:Equal to product-8
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-15:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-16:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-17:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-18:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-19:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-20:Equal to product-11
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-21:Sum of product-11 & 12
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-22:Equal to product-12
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-23:Equal to product-13
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-24:Equal to product-14
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-26:Equal to product-17
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-27:Equal to product-18
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-28:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-29:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-30:Equal to product-20
[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450],  // P-31:Sum of product-21 & 22
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-32:Equal to product-23
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-33:Sum of product-23 & 24
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],        // P-34:Equal to product-24
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-36:Equal to product-26
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-37:Equal to product-27
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-38:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],        // P-39:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300]];       // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [263.1579,298.2456,1368.4210,3280.7020,4368.4210,5508.7720];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
```

```
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 1
primary_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20
[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]];      // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [154.6392,175.2577,1012.9870,2428.5720,4368.4210,5508.7720];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
```

```
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 2
primary_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],
                  [21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-7: Sum of Product-1,2,3,4 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-8: Sum of Product-1,2,3,4 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-9: Sum of Product-1,2,3,4,5,6 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-10:Sum of Product-1,2,3,4,5,6 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-11:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-12:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-13:Equal to product-8
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-14:Equal to product-8
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-15:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-16:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-17:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-18:Equal to product-10
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-19:Equal to product-10
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-20:Equal to product-11
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-22:Equal to product-12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-23:Equal to product-13
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-24:Equal to product-14
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-25:Sum of product-15 & 16
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-26:Equal to product-17
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-27:Equal to product-18
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-28:Equal to product-19
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-29:Equal to product-19
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-30:Equal to product-20
[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-32:Equal to product-23
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-34:Equal to product-24
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-35:Equal to product-25
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-36:Equal to product-26
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-37:Equal to product-27
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-38:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-39:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [154.6392,175.2577,1012.9870,2428.5720,4368.4210,5508.7720];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 3
primary_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],
                  [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]
                  [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20
[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];       // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [154.6392,175.2577,1012.9870,2428.5720,4368.4210,5508.7720];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 4
primary_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-7: Sum of Product-1,2,3,4 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-8: Sum of Product-1,2,3,4 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-9: Sum of Product-1,2,3,4,5,6 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-10:Sum of Product-1,2,3,4,5,6 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-11:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-12:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-13:Equal to product-8
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-14:Equal to product-8
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-15:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-16:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-17:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-18:Equal to product-10
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-19:Equal to product-10
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-20:Equal to product-11
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-22:Equal to product-12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-23:Equal to product-13
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-24:Equal to product-14
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-25:Sum of product-15 & 16
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-26:Equal to product-17
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-27:Equal to product-18
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-28:Equal to product-19
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-29:Equal to product-19
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-30:Equal to product-20
[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],   // P-31:Sum of product-21 & 22
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-32:Equal to product-23
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-34:Equal to product-24
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-35:Equal to product-25
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-36:Equal to product-26
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-37:Equal to product-27
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-38:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],   // P-39:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [154.6392,175.2577,1012.9870,2428.5720,4368.4210,5508.7720];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 5
primary_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],
                   [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],
                   [80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],
                   [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-11:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-12:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-13:Equal to product-8
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-14:Equal to product-8
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-15:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-16:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-17:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-18:Equal to product-10
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-19:Equal to product-10
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-20:Equal to product-11
[373.125,301.6453,300.037,300.0008,300,300,300,300,300,300,300,300,300,300,300,300],// P-21:Sum of product-11 & 12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-22:Equal to product-12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-23:Equal to product-13
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-24:Equal to product-14
[487.75,401.9744,400.0444,400.001,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-26:Equal to product-17
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-27:Equal to product-18
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-28:Equal to product-19
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-29:Equal to product-19
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-30:Equal to product-20
[559.6875,452.468,450.0555,450.0012,450,450,450,450,450,450,450,450,450,450,450,450],       // P-31:Sum of product-21 & 22
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-32:Equal to product-23
[373.125,301.6453,300.037,300.0008,300,300,300,300,300,300,300,300,300,300,300,300],// P-33:Sum of product-23 & 24
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-34:Equal to product-24
[487.75,401.9744,400.0444,400.001,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-36:Equal to product-26
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-37:Equal to product-27
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-38:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-39:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]];    // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [154.6392,175.2577,1012.9870,2428.5720,4368.4210,5508.7720];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 6
primary_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],
                  [125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-11:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-12:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-13:Equal to product-8
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-14:Equal to product-8
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-15:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-16:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-17:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-18:Equal to product-10
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-19:Equal to product-10
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-20:Equal to product-11
[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-22:Equal to product-12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-23:Equal to product-13
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-24:Equal to product-14
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],        // P-25:Sum of product-15 & 16
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-26:Equal to product-17
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-27:Equal to product-18
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-28:Equal to product-19
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-29:Equal to product-19
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-30:Equal to product-20
[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-32:Equal to product-23
[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],        // P-34:Equal to product-24
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],     // P-35:Equal to product-25
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-36:Equal to product-26
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-37:Equal to product-27
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-38:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],        // P-39:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]];        // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [154.6392,175.2577,1012.9870,2428.5720,4368.4210,5508.7720];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 7
primary_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],
                  [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary_demand = [
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-7: Sum of Product-1,2,3,4 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-8: Sum of Product-1,2,3,4 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-9: Sum of Product-1,2,3,4,5,6 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-10:Sum of Product-1,2,3,4,5,6 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-11:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-12:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-13:Equal to product-8
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-14:Equal to product-8
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-15:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-16:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-17:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-18:Equal to product-10
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-19:Equal to product-10
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-20:Equal to product-11
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-22:Equal to product-12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-23:Equal to product-13
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-24:Equal to product-14
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-25:Sum of product-15 & 16
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-26:Equal to product-17
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-27:Equal to product-18
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-28:Equal to product-19
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-29:Equal to product-19
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-30:Equal to product-20
[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],   // P-31:Sum of product-21 & 22
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-32:Equal to product-23
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-34:Equal to product-24
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-35:Equal to product-25
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-36:Equal to product-26
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-37:Equal to product-27
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-38:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-39:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [154.6392,175.2577,1012.9870,2428.5720,4368.4210,5508.7720];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 8
primary_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],
                  [24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],
                  [96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],
                  [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-7: Sum of Product-1,2,3,4 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-8: Sum of Product-1,2,3,4 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-9: Sum of Product-1,2,3,4,5,6 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-10:Sum of Product-1,2,3,4,5,6 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-11:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-12:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-13:Equal to product-8
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-14:Equal to product-8
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-15:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-16:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-17:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-18:Equal to product-10
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-19:Equal to product-10
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-20:Equal to product-11
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-22:Equal to product-12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-23:Equal to product-13
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-24:Equal to product-14
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],       // P-25:Sum of product-15 & 16
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-26:Equal to product-17
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-27:Equal to product-18
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-28:Equal to product-19
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-29:Equal to product-19
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-30:Equal to product-20
[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],   // P-31:Sum of product-21 & 22
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-32:Equal to product-23
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],   // P-34:Equal to product-24
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],       // P-35:Equal to product-25
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-36:Equal to product-26
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-37:Equal to product-27
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-38:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],      // P-39:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];     // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [154.6392,175.2577,1012.9870,2428.5720,4368.4210,5508.7720];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 9
primary_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],
                  [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                  [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],
                  [176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],
                  [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                  [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-7: Sum of Product-1,2,3,4 demands
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-8: Sum of Product-1,2,3,4 demands
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-9: Sum of Product-1,2,3,4,5,6 demands
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-10:Sum of Product-1,2,3,4,5,6 demands
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-11:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-12:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-13:Equal to product-8
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-14:Equal to product-8
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-15:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-16:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-17:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-18:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-19:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-20:Equal to product-11
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-21:Sum of product-11 & 12
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-22:Equal to product-12
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-23:Equal to product-13
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-24:Equal to product-14
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-25:Sum of product-15 & 16
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-26:Equal to product-17
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-27:Equal to product-18
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-28:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-29:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-30:Equal to product-20
[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450],   // P-31:Sum of product-21 & 22
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-32:Equal to product-23
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-33:Sum of product-23 & 24
[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],          // P-34:Equal to product-24
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400],   // P-35:Equal to product-25
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-36:Equal to product-26
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-37:Equal to product-27
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-38:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],          // P-39:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300]];         // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [154.6392,175.2577,1012.9870,2428.5720,4368.4210,5508.7720];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
```

```
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 1
primary_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20
[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23
[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24
[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24
[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28
[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]];    // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [263.1579,298.2456,1012.9870,2428.5720,2567.0100,3237.1130];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 2
primary_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-7: Sum of Product-1,2,3,4 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-8: Sum of Product-1,2,3,4 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-9: Sum of Product-1,2,3,4,5,6 demands
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-10:Sum of Product-1,2,3,4,5,6 demands
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-11:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-12:Equal to product-7
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-13:Equal to product-8
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-14:Equal to product-8
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-15:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-16:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-17:Equal to product-9
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-18:Equal to product-10
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-19:Equal to product-10
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-20:Equal to product-11
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-21:Sum of product-11 & 12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-22:Equal to product-12
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-23:Equal to product-13
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-24:Equal to product-14
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-25:Sum of product-15 & 16
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-26:Equal to product-17
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-27:Equal to product-18
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-28:Equal to product-19
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-29:Equal to product-19
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-30:Equal to product-20
[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],     // P-31:Sum of product-21 & 22
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-32:Equal to product-23
[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-33:Sum of product-23 & 24
[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-34:Equal to product-24
[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],// P-35:Equal to product-25
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-36:Equal to product-26
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-37:Equal to product-27
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-38:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],     // P-39:Equal to product-28
[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [263.1579,298.2456,1012.9870,2428.5720,2567.0100,3237.1130];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 3
primary_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],
                   [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],
                   [89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],
                   [23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]
                   [37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-21:Sum of product-11 & 12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20
[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23
[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],   // P-33:Sum of product-23 & 24
[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24
[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28
[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];         // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [263.1579,298.2456,1012.9870,2428.5720,2567.0100,3237.1130];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 4
primary_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],
                  [20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-7: Sum of Product-1,2,3,4 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-8: Sum of Product-1,2,3,4 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-9: Sum of Product-1,2,3,4,5,6 demands
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-10:Sum of Product-1,2,3,4,5,6 demands
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-11:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-12:Equal to product-7
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-13:Equal to product-8
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-14:Equal to product-8
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-15:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-16:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-17:Equal to product-9
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-18:Equal to product-10
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-19:Equal to product-10
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-20:Equal to product-11
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-22:Equal to product-12
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-23:Equal to product-13
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-24:Equal to product-14
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],    // P-25:Sum of product-15 & 16
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-26:Equal to product-17
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-27:Equal to product-18
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-28:Equal to product-19
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-29:Equal to product-19
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-30:Equal to product-20
[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-32:Equal to product-23
[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-34:Equal to product-24
[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],    // P-35:Equal to product-25
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-36:Equal to product-26
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-37:Equal to product-27
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-38:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-39:Equal to product-28
[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [263.1579,298.2456,1012.9870,2428.5720,2567.0100,3237.1130];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 5
primary_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],
                   [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],
                   [80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],
                   [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                   [35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-11:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-12:Equal to product-7
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-13:Equal to product-8
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-14:Equal to product-8
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-15:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-16:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-17:Equal to product-9
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-18:Equal to product-10
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-19:Equal to product-10
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-20:Equal to product-11
[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-22:Equal to product-12
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-23:Equal to product-13
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-24:Equal to product-14
[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-26:Equal to product-17
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-27:Equal to product-18
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-28:Equal to product-19
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-29:Equal to product-19
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-30:Equal to product-20
[559.6875,452.468,450.0555,450.0012,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],         // P-31:Sum of product-21 & 22
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-32:Equal to product-23
[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24
[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],    // P-34:Equal to product-24
[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-36:Equal to product-26
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-37:Equal to product-27
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-38:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],    // P-39:Equal to product-28
[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]];    // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [263.1579,298.2456,1012.9870,2428.5720,2567.0100,3237.1130];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
```

```
BOM = 1;
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 6
primary_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],
                  [125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],
                  [27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],
                  [46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],         // P-11:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],         // P-12:Equal to product-7
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],         // P-13:Equal to product-8
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],         // P-14:Equal to product-8
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],         // P-15:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],         // P-16:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],         // P-17:Equal to product-9
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],         // P-18:Equal to product-10
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],         // P-19:Equal to product-10
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],         // P-20:Equal to product-11
[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],         // P-22:Equal to product-12
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],         // P-23:Equal to product-13
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],         // P-24:Equal to product-14
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],        // P-25:Sum of product-15 & 16
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],         // P-26:Equal to product-17
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],         // P-27:Equal to product-18
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],         // P-28:Equal to product-19
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],         // P-29:Equal to product-19
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],         // P-30:Equal to product-20
[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],         // P-32:Equal to product-23
[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],         // P-34:Equal to product-24
[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],        // P-35:Equal to product-25
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],         // P-36:Equal to product-26
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],         // P-37:Equal to product-27
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],         // P-38:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],         // P-39:Equal to product-28
[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]];        // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [263.1579,298.2456,1012.9870,2428.5720,2567.0100,3237.1130];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
```

```
BOM = 1;
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 7
primary_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],
                  [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],
                  [61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],
                  [20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary_demand = [
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-7: Sum of Product-1,2,3,4 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-8: Sum of Product-1,2,3,4 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-9: Sum of Product-1,2,3,4,5,6 demands
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-10:Sum of Product-1,2,3,4,5,6 demands
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-11:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-12:Equal to product-7
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-13:Equal to product-8
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-14:Equal to product-8
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-15:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-16:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-17:Equal to product-9
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-18:Equal to product-10
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-19:Equal to product-10
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-20:Equal to product-11
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-21:Sum of product-11 & 12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-22:Equal to product-12
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-23:Equal to product-13
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-24:Equal to product-14
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],     // P-25:Sum of product-15 & 16
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-26:Equal to product-17
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-27:Equal to product-18
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-28:Equal to product-19
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-29:Equal to product-19
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-30:Equal to product-20
[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],     // P-31:Sum of product-21 & 22
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-32:Equal to product-23
[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],     // P-33:Sum of product-23 & 24
[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],     // P-34:Equal to product-24
[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],     // P-35:Equal to product-25
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-36:Equal to product-26
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-37:Equal to product-27
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-38:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],  // P-39:Equal to product-28
[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [263.1579,298.2456,1012.9870,2428.5720,2567.0100,3237.1130];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 8
primary_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],
                  [24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],
                  [96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],
                  [22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],
                  [39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-7: Sum of Product-1,2,3,4 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-8: Sum of Product-1,2,3,4 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-9: Sum of Product-1,2,3,4,5,6 demands
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-10:Sum of Product-1,2,3,4,5,6 demands
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-11:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-12:Equal to product-7
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-13:Equal to product-8
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-14:Equal to product-8
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-15:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-16:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-17:Equal to product-9
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-18:Equal to product-10
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-19:Equal to product-10
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-20:Equal to product-11
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-21:Sum of product-11 & 12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-22:Equal to product-12
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-23:Equal to product-13
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-24:Equal to product-14
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],    // P-25:Sum of product-15 & 16
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-26:Equal to product-17
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-27:Equal to product-18
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-28:Equal to product-19
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-29:Equal to product-19
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-30:Equal to product-20
[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450],    // P-31:Sum of product-21 & 22
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-32:Equal to product-23
[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300],    // P-33:Sum of product-23 & 24
[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150],    // P-34:Equal to product-24
[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400],    // P-35:Equal to product-25
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-36:Equal to product-26
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-37:Equal to product-27
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-38:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200],    // P-39:Equal to product-28
[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];    // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [263.1579,298.2456,1012.9870,2428.5720,2567.0100,3237.1130];
```

```
FP = 6;
RP = 40;
J = 40;
L = 6;
T = 16;
S = 48;
allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};
allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};
allproductsonstage3 = {11,12,13,14,15,16,17,18,19};
allproductsonstage4 = {7,8,9,10};
allproductsonstage5_1 = {1,2,3};
allproductsonstage5_2 = {4,5,6};
family1stage1 = {30};
family2stage1 = {31};
family3stage1 = {32,33};
family4stage1 = {33,34};
family5stage1 = {35};
family6stage1 = {36};
family7stage1 = {37};
family8stage1 = {38,39};
family9stage1 = {40};
family1stage2 = {20};
family2stage2 = {21,22};
family3stage2 = {23};
family4stage2 = {24};
family5stage2 = {25};
family6stage2 = {26};
family7stage2 = {27};
family8stage2 = {28};
family9stage2 = {29};
family10stage2 = {20,21};
family11stage2 = {21,22};
family12stage2 = {28,29};
family1stage3 = {11};
family2stage3 = {12};
family3stage3 = {13};
family4stage3 = {14};
family5stage3 = {15,16};
family6stage3 = {17};
family7stage3 = {18};
family8stage3 = {19};
family9stage3 = {11,12};
family10stage3 = {13,14};
family11stage3 = {15,16,17};
family12stage3 = {18,19};
family1stage4 = {7};
family2stage4 = {8};
family3stage4 = {9};
family4stage4 = {10};
family5stage4 = {7,8,9,10};
family6stage4 = {9,10};
family1stage5_1 = {1,2,3};
family1stage5_2 = {4};
family2stage5_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
microperiods5tomacroperiod = {13,14,15};
microperiods6tomacroperiod = {16,17,18};
microperiods7tomacroperiod = {19,20,21};
microperiods8tomacroperiod = {22,23,24};
microperiods9tomacroperiod = {25,26,27};
microperiods10tomacroperiod = {28,29,30};
microperiods11tomacroperiod = {31,32,33};
microperiods12tomacroperiod = {34,35,36};
microperiods13tomacroperiod = {37,38,39};
microperiods14tomacroperiod = {40,41,42};
microperiods15tomacroperiod = {43,44,45};
microperiods16tomacroperiod = {46,47,48};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
```

```
BigM = 10000;
holdingcost = [41,41,41,41,21,21,11,9,10,10,5,5,4,4,3,3,3,3,6,2,2,2,3,3,2,2,2,3,2,1,1,1,1,1,1,1,1,1,1,1];

//Product Demand - Series# 9
primary_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],
                  [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                  [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],
                  [176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],
                  [32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],
                  [59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];
secondary_demand = [
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],       // P-7: Sum of Product-1,2,3,4 demands
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],       // P-8: Sum of Product-1,2,3,4 demands
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],       // P-9: Sum of Product-1,2,3,4,5,6 demands
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],       // P-10:Sum of Product-1,2,3,4,5,6 demands
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],       // P-11:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],       // P-12:Equal to product-7
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],       // P-13:Equal to product-8
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],       // P-14:Equal to product-8
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],       // P-15:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],       // P-16:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],       // P-17:Equal to product-9
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],       // P-18:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],       // P-19:Equal to product-10
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],       // P-20:Equal to product-11
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],       // P-21:Sum of product-11 & 12
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],       // P-22:Equal to product-12
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],       // P-23:Equal to product-13
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],       // P-24:Equal to product-14
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],       // P-26:Equal to product-17
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],       // P-27:Equal to product-18
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],       // P-28:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],       // P-29:Equal to product-19
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],       // P-30:Equal to product-20
[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],       // P-32:Equal to product-23
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],       // P-33:Sum of product-23 & 24
[360.6,158.424,150.337,150.0135,150.0005,150,150,150,150,150,150,150,150,150,150,150],       // P-34:Equal to product-24
[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],       // P-36:Equal to product-26
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],       // P-37:Equal to product-27
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],       // P-38:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300],       // P-39:Equal to product-28
[721.2,316.848,300.6739,300.027,300.0011,300,300,300,300,300,300,300,300,300,300,300]];      // P-40:Equal to product-29


// Setup Profile - II
setuptime =
[50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];
setupcost =
[20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,
100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [263.1579,298.2456,1012.9870,2428.5720,2567.0100,3237.1130];
```