

Problem – B (General) → DATA

Test Instance-1: TGS1C1D1 (Test General Setup-Profile_1 Capacity-Profile_1 Demand-Series_1)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900],      //Product-1
                  [30.0900],      //Products-2
                  [50.2500],      //Prodcut-3
                  [101.0000]];    //Product-4

secondary_demand = [
    [100.5800], //Product-5 (Sum of Product-1 & 2)
    [80.3400],  //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800], //Product-8 (equal to Prodcut-5)
    [180.9200], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049],           //Product-1
                  [30.0900,30.0009],           //Products-2
                  [50.2500,50.0025],           //Prodcut-3
                  [101.0000,100.0100]];        //Product-4

secondary_demand = [
    [100.5800,100.0058],           //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034],             //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125],           //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058],           //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092],           //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159]];          //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000], //Product-1
                  [30.0900,30.0009,30.0000], //Products-2
                  [50.2500,50.0025,50.0000], //Prodcut-3
                  [101.0000,100.0100,100.0001]]; //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000], //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1
                  [30.0900,30.0009,30.0000,30.0000], //Products-2
                  [50.2500,50.0025,50.0000,50.0000], //Prodcut-3
                  [101.0000,100.0100,100.0001,100.0000]]; //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Test Instance-2: TGS1C1D2 (Test General Setup-Profile_1 Capacity-Profile_1 Demand-Series_2)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400], //Product-1
                  [31.4400], //Products-2
                  [54.0000], //Prodcut-3
                  [116.0000]]; //Product-4

secondary_demand = [
    [109.2800], //Product-5 (Sum of Product-1 & 2)
    [85.4400], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800], //Product-8 (equal to Prodcut-5)
    [194.7200], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784],           //Product-1
                  [31.4400,30.0144],           //Products-2
                  [54.0000,50.0040],           //Prodcut-3
                  [116.0000,100.1600]];         //Product-4

secondary_demand = [
    [109.2800,100.0928], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544],   //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784,70.0008], //Product-1
                  [31.4400,30.0144,30.0001], //Products-2
                  [54.0000,50.0040,50.0004], //Prodcut-3
                  [116.0000,100.1600,100.0016]]; //Product-4

secondary_demand = [
    [109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544,80.0005], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544,230.0025]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1
                  [31.4400,30.0144,30.0001,30.0000], //Products-2
                  [54.0000,50.0040,50.0004,50.0000], //Prodcut-3
                  [116.0000,100.1600,100.0016,100.0000]]; //Product-4

secondary_demand = [
    [109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000,150.0020,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928,100.0009,100.0000], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472,180.0015,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544,230.0025,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```


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

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100], //Product-1
                  [34.4100], //Products-2
                  [62.2500], //Prodcut-3
                  [149.0000]]; //Product-4

secondary_demand = [
    [128.4200], //Product-5 (Sum of Product-1 & 2)
    [96.6600], //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200], //Product-8 (equal to Prodcut-5)
    [225.0800], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401],           //Product-1
                  [34.4100,30.0441],           //Products-2
                  [62.2500,50.1225],           //Prodcut-3
                  [149.0000,100.4900]];        //Product-4

secondary_demand = [
    [128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666],   //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842], //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401,70.0024],           //Product-1
                  [34.4100,30.0441,30.0004],           //Products-2
                  [62.2500,50.1225,50.0012],           //Prodcut-3
                  [149.0000,100.4900,100.0049]];         //Product-4

secondary_demand = [
    [128.4200,100.2842,100.0028],           //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666,80.0017],             //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125,150.0061],           //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842,100.0028],           //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508,180.0045],           //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791,230.0078]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1
                  [34.4100,30.0441,30.0004,30.0000], //Products-2
                  [62.2500,50.1225,50.0012,50.0000], //Prodcut-3
                  [149.0000,100.4900,100.0049,100.0000]]; //Product-4

secondary_demand = [
    [128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

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

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025], //Product-1
                  [30.2025], //Products-2
                  [50.5625], //Prodcut-3
                  [102.2500]]; //Product-4

secondary_demand = [
    [101.3050], //Product-5 (Sum of Product-1 & 2)
    [80.7650], //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050], //Product-8 (equal to Prodcut-5)
    [182.0700], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048], //Product-1
                  [30.2025,30.0046], //Products-2
                  [50.5625,50.0127], //Prodcut-3
                  [102.2500,100.0506]]; //Product-4

secondary_demand = [
    [101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172], //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294], //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006],           //Product-1
                  [30.2025,30.0046,30.0001],         //Products-2
                  [50.5625,50.0127,50.0003],         //Prodcut-3
                  [102.2500,100.0506,100.0011]];      //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007],           //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004],             //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014],          //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007],          //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010],          //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006,70.0000],           //Product-1
                  [30.2025,30.0046,30.0001,30.0000],         //Products-2
                  [50.5625,50.0127,50.0003,50.0000],         //Prodcut-3
                  [102.2500,100.0506,100.0011,100.0000]];     //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007,100.0000],           //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004,80.0000],               //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014,150.0000],           //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007,100.0000],           //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010,180.0000],           //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018,230.0000]];          //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```


Test Instance-5: TGS1C1D5 (Test General Setup-Profile_1 Capacity-Profile_1 Demand-Series_5)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400], //Product-1
                  [33.2400], //Products-2
                  [59.0000], //Prodcut-3
                  [136.0000]]; //Product-4

secondary_demand = [
    [120.8800], //Product-5 (Sum of Product-1 & 2)
    [92.2400], //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800], //Product-8 (equal to Prodcut-5)
    [213.1200], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969],           //Product-1
                  [33.2400,30.0729],           //Products-2
                  [59.0000,50.2025],           //Prodcut-3
                  [136.0000,100.8100]];        //Product-4

secondary_demand = [
    [120.8800,100.4698],           //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754],             //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125],           //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698],           //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452],           //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969,70.0089],           //Product-1
                  [33.2400,30.0729,30.0016],           //Products-2
                  [59.0000,50.2025,50.0046],           //Prodcut-3
                  [136.0000,100.8100,100.0182]];        //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062],    //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969,70.0089,70.0002], //Product-1
                  [33.2400,30.0729,30.0016,30.0000], //Products-2
                  [59.0000,50.2025,50.0046,50.0001], //Prodcut-3
                  [136.0000,100.8100,100.0182,100.0004]]]; //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106,100.0002], //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062,80.0001], //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228,150.0005], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106,100.0002], //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168,180.0004], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290,230.0007]]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

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

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225], //Product-1
                  [39.9225],   //Products-2
                  [77.5625],   //Prodcut-3
                  [210.2500]]; //Product-4

secondary_demand = [
    [163.9450], //Product-5 (Sum of Product-1 & 2)
    [117.4850], //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450], //Product-8 (equal to Prodcut-5)
    [281.4300], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155],           //Product-1
                  [39.9225,30.2233],             //Products-2
                  [77.5625,50.6202],             //Prodcut-3
                  [210.2500,102.4806]];          //Product-4

secondary_demand = [
    [163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434],  //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388], //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155,70.0273],           //Product-1
                  [39.9225,30.2233,30.0050],           //Products-2
                  [77.5625,50.6202,50.0140],           //Prodcut-3
                  [210.2500,102.4806,100.0558]];        //Product-4

secondary_demand = [
    [163.9450,101.4388,100.0324],           //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434,80.0190],           //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008,150.0698],         //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388,100.0324],         //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822,180.0513],         //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442,230.0887]];        //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155,70.0273,70.0006],      //Product-1
                  [39.9225,30.2233,30.0050,30.0001],      //Products-2
                  [77.5625,50.6202,50.0140,50.0003],      //Prodcut-3
                  [210.2500,102.4806,100.0558,100.0013]];  //Product-4

secondary_demand = [
    [163.9450,101.4388,100.0324,100.0007],                //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434,80.0190,80.0004],                  //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008,150.0698,150.0016],                //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388,100.0324,100.0007],                //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822,180.0513,180.0012],                //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442,230.0887,230.0020]];              //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```


Test Instance-7: TGS1C1D7 (Test General Setup-Profile_1 Capacity-Profile_1 Demand-Series_7)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600], //Product-1
                  [30.3600], //Products-2
                  [51.0000], //Prodcut-3
                  [104.0000]]; //Product-4

secondary_demand = [
    [102.3200], //Product-5 (Sum of Product-1 & 2)
    [81.3600], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200], //Product-8 (equal to Prodcut-5)
    [183.6800], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600,70.0784],           //Product-1
                  [30.3600,30.0144],           //Products-2
                  [51.0000,50.0400],           //Prodcut-3
                  [104.0000,100.1600]];        //Product-4

secondary_demand = [
    [102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544],   //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928], //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600,70.0784,70.0031],           //Product-1
                  [30.3600,30.0144,30.0006],           //Products-2
                  [51.0000,50.0400,50.0016],           //Prodcut-3
                  [104.0000,100.1600,100.0064]];         //Product-4

secondary_demand = [
    [102.3200,100.0928,100.0037],           //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544,80.0022],             //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000,150.0080],           //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928,100.0037],           //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472,180.0059],           //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544,230.0102]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600,70.0784,70.0031,70.0001], //Product-1
                  [30.3600,30.0144,30.0006,30.0000], //Products-2
                  [51.0000,50.0400,50.0016,50.0001], //Prodcut-3
                  [104.0000,100.1600,100.0064,100.0003]]; //Product-4

secondary_demand = [
    [102.3200,100.0928,100.0037,100.0001], //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544,80.0022,80.0001], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000,150.0080,150.0003], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928,100.0037,100.0001], //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472,180.0059,180.0002], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544,230.0102,230.0004]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Test Instance-8: TGS1C1D8 (Test General Setup-Profile_1 Capacity-Profile_1 Demand-Series_8)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600], //Product-1
                  [35.7600],   //Products-2
                  [66.0000],   //Prodcut-3
                  [164.0000]]; //Product-4

secondary_demand = [
    [137.1200], //Product-5 (Sum of Product-1 & 2)
    [101.7600], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200], //Product-8 (equal to Prodcut-5)
    [238.8800], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544],           //Product-1
                  [35.7600,30.2304],           //Products-2
                  [66.0000,50.6400],           //Prodcut-3
                  [164.0000,102.5600]];        //Product-4

secondary_demand = [
    [137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704],  //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.0502],           //Product-1
                  [35.7600,30.2304,30.0092],           //Products-2
                  [66.0000,50.6400,50.0256],           //Prodcut-3
                  [164.0000,102.5600,100.1024]];        //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594],           //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348],           //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280],           //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594],           //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942],           //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628]];        //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1
                  [35.7600,30.2304,30.0092,30.0004], //Products-2
                  [66.0000,50.6400,50.0256,50.0010], //Prodcut-3
                  [164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```


Test Instance-9: TGS1C1D9 (Test General Setup-Profile_1 Capacity-Profile_1 Demand-Series_9)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400], //Product-1
                  [47.6400],   //Products-2
                  [99.0000],   //Prodcut-3
                  [296.0000]]; //Product-4

secondary_demand = [
    [213.6800], //Product-5 (Sum of Product-1 & 2)
    [146.6400], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800], //Product-8 (equal to Prodcut-5)
    [360.3200], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416],           //Product-1
                  [47.6400,30.7056],           //Products-2
                  [99.0000,51.9600],           //Prodcut-3
                  [296.0000,107.8400]];        //Product-4

secondary_demand = [
    [213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656],  //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537],           //Product-1
                  [47.6400,30.7056,30.0282],           //Products-2
                  [99.0000,51.9600,50.0784],           //Prodcut-3
                  [296.0000,107.8400,100.3136]];        //Product-4

secondary_demand = [
    [213.6800,104.5472,100.1819],           //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066],           //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920],           //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819],           //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885],           //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986]];          //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1
                  [47.6400,30.7056,30.0282,30.0011], //Products-2
                  [99.0000,51.9600,50.0784,50.0031], //Prodcut-3
                  [296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary_demand = [
    [213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,377.7778,711.1111];
```

Test Instance-10: TGS1C2D1 (Test General Setup-Profile_1 Capacity-Profile_2 Demand-Series_1)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900], //Product-1
                  [30.0900], //Products-2
                  [50.2500], //Prodcut-3
                  [101.0000]]; //Product-4

secondary_demand = [
    [100.5800], //Product-5 (Sum of Product-1 & 2)
    [80.3400], //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800], //Product-8 (equal to Prodcut-5)
    [180.9200], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049],           //Product-1
                  [30.0900,30.0009],           //Products-2
                  [50.2500,50.0025],           //Prodcut-3
                  [101.0000,100.0100]];        //Product-4

secondary_demand = [
    [100.5800,100.0058],           //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034],             //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125],           //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058],           //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092],           //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000],           //Product-1
                  [30.0900,30.0009,30.0000],           //Products-2
                  [50.2500,50.0025,50.0000],           //Prodcut-3
                  [101.0000,100.0100,100.0001]];        //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000],     //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001],  //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000],  //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000],  //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1
                  [30.0900,30.0009,30.0000,30.0000], //Products-2
                  [50.2500,50.0025,50.0000,50.0000], //Prodcut-3
                  [101.0000,100.0100,100.0001,100.0000]]; //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```


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

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400], //Product-1
                  [31.4400], //Products-2
                  [54.0000], //Prodcut-3
                  [116.0000]]; //Product-4

secondary_demand = [
    [109.2800], //Product-5 (Sum of Product-1 & 2)
    [85.4400], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800], //Product-8 (equal to Prodcut-5)
    [194.7200], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784],           //Product-1
                  [31.4400,30.0144],           //Products-2
                  [54.0000,50.0040],           //Prodcut-3
                  [116.0000,100.1600]];        //Product-4

secondary_demand = [
    [109.2800,100.0928], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544],   //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784,70.0008], //Product-1
                  [31.4400,30.0144,30.0001], //Products-2
                  [54.0000,50.0040,50.0004], //Prodcut-3
                  [116.0000,100.1600,100.0016]]; //Product-4

secondary_demand = [
    [109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544,80.0005], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544,230.0025]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1
                  [31.4400,30.0144,30.0001,30.0000], //Products-2
                  [54.0000,50.0040,50.0004,50.0000], //Prodcut-3
                  [116.0000,100.1600,100.0016,100.0000]]; //Product-4

secondary_demand = [
    [109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000,150.0020,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928,100.0009,100.0000], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472,180.0015,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544,230.0025,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

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

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100],      //Product-1
                  [34.4100],      //Products-2
                  [62.2500],      //Prodcut-3
                  [149.0000]];    //Product-4

secondary_demand = [
    [128.4200], //Product-5 (Sum of Product-1 & 2)
    [96.6600],  //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200], //Product-8 (equal to Prodcut-5)
    [225.0800], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401],           //Product-1
                  [34.4100,30.0441],           //Products-2
                  [62.2500,50.1225],           //Prodcut-3
                  [149.0000,100.4900]];        //Product-4

secondary_demand = [
    [128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666],   //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842], //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401,70.0024],           //Product-1
                  [34.4100,30.0441,30.0004],           //Products-2
                  [62.2500,50.1225,50.0012],           //Prodcut-3
                  [149.0000,100.4900,100.0049]];        //Product-4

secondary_demand = [
    [128.4200,100.2842,100.0028],           //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666,80.0017],             //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125,150.0061],          //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842,100.0028],          //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508,180.0045],          //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791,230.0078]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1
                  [34.4100,30.0441,30.0004,30.0000], //Products-2
                  [62.2500,50.1225,50.0012,50.0000], //Prodcut-3
                  [149.0000,100.4900,100.0049,100.0000]]; //Product-4

secondary_demand = [
    [128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```


Test Instance-13: TGS1C2D4 (Test General Setup-Profile_1 Capacity-Profile_2 Demand-Series_4)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025], //Product-1
                  [30.2025], //Products-2
                  [50.5625], //Prodcut-3
                  [102.2500]]; //Product-4

secondary_demand = [
    [101.3050], //Product-5 (Sum of Product-1 & 2)
    [80.7650], //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050], //Product-8 (equal to Prodcut-5)
    [182.0700], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048], //Product-1
                  [30.2025,30.0046], //Products-2
                  [50.5625,50.0127], //Prodcut-3
                  [102.2500,100.0506]]; //Product-4

secondary_demand = [
    [101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172], //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294], //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006],           //Product-1
                  [30.2025,30.0046,30.0001],           //Products-2
                  [50.5625,50.0127,50.0003],           //Prodcut-3
                  [102.2500,100.0506,100.0011]];        //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007],           //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004],             //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014],           //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007],           //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010],           //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006,70.0000],           //Product-1
                  [30.2025,30.0046,30.0001,30.0000],         //Products-2
                  [50.5625,50.0127,50.0003,50.0000],         //Prodcut-3
                  [102.2500,100.0506,100.0011,100.0000]];     //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007,100.0000],           //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004,80.0000],               //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014,150.0000],           //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007,100.0000],           //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010,180.0000],           //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018,230.0000]];          //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Test Instance-14: TGS1C2D5 (Test General Setup-Profile_1 Capacity-Profile_2 Demand-Series_5)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400], //Product-1
                  [33.2400], //Products-2
                  [59.0000], //Prodcut-3
                  [136.0000]]; //Product-4

secondary_demand = [
    [120.8800], //Product-5 (Sum of Product-1 & 2)
    [92.2400], //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800], //Product-8 (equal to Prodcut-5)
    [213.1200], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969],           //Product-1
                  [33.2400,30.0729],           //Products-2
                  [59.0000,50.2025],           //Prodcut-3
                  [136.0000,100.8100]];        //Product-4

secondary_demand = [
    [120.8800,100.4698],           //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754],             //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125],           //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698],           //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452],           //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969,70.0089],           //Product-1
                  [33.2400,30.0729,30.0016],           //Products-2
                  [59.0000,50.2025,50.0046],           //Prodcut-3
                  [136.0000,100.8100,100.0182]];        //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062],    //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969,70.0089,70.0002],      //Product-1
                  [33.2400,30.0729,30.0016,30.0000],      //Products-2
                  [59.0000,50.2025,50.0046,50.0001],      //Prodcut-3
                  [136.0000,100.8100,100.0182,100.0004]];  //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106,100.0002],      //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062,80.0001],          //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228,150.0005],      //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106,100.0002],      //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168,180.0004],      //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290,230.0007]];      //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```


Test Instance-15: TGS1C2D6 (Test General Setup-Profile_1 Capacity-Profile_2 Demand-Series_6)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225], //Product-1
                  [39.9225],   //Products-2
                  [77.5625],   //Prodcut-3
                  [210.2500]]; //Product-4

secondary_demand = [
    [163.9450], //Product-5 (Sum of Product-1 & 2)
    [117.4850], //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450], //Product-8 (equal to Prodcut-5)
    [281.4300], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155],           //Product-1
                  [39.9225,30.2233],             //Products-2
                  [77.5625,50.6202],             //Prodcut-3
                  [210.2500,102.4806]];           //Product-4

secondary_demand = [
    [163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434],  //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388], //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155,70.0273],           //Product-1
                  [39.9225,30.2233,30.0050],           //Products-2
                  [77.5625,50.6202,50.0140],           //Prodcut-3
                  [210.2500,102.4806,100.0558]];        //Product-4

secondary_demand = [
    [163.9450,101.4388,100.0324],           //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434,80.0190],           //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008,150.0698],         //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388,100.0324],         //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822,180.0513],         //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442,230.0887];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155,70.0273,70.0006],      //Product-1
                  [39.9225,30.2233,30.0050,30.0001],      //Products-2
                  [77.5625,50.6202,50.0140,50.0003],      //Prodcut-3
                  [210.2500,102.4806,100.0558,100.0013]];  //Product-4

secondary_demand = [
    [163.9450,101.4388,100.0324,100.0007],                //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434,80.0190,80.0004],                  //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008,150.0698,150.0016],                //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388,100.0324,100.0007],                //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822,180.0513,180.0012],                //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442,230.0887,230.0020]];              //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Test Instance-16: TGS1C2D7 (Test General Setup-Profile_1 Capacity-Profile_2 Demand-Series_7)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600], //Product-1
                  [30.3600], //Products-2
                  [51.0000], //Prodcut-3
                  [104.0000]]; //Product-4

secondary_demand = [
    [102.3200], //Product-5 (Sum of Product-1 & 2)
    [81.3600], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200], //Product-8 (equal to Prodcut-5)
    [183.6800], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600,70.0784],           //Product-1
                  [30.3600,30.0144],           //Products-2
                  [51.0000,50.0400],           //Prodcut-3
                  [104.0000,100.1600]];         //Product-4

secondary_demand = [
    [102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544],   //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928], //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600,70.0784,70.0031],           //Product-1
                  [30.3600,30.0144,30.0006],           //Products-2
                  [51.0000,50.0400,50.0016],           //Prodcut-3
                  [104.0000,100.1600,100.0064]];        //Product-4

secondary_demand = [
    [102.3200,100.0928,100.0037],           //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544,80.0022],             //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000,150.0080],           //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928,100.0037],           //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472,180.0059],           //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544,230.0102]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600,70.0784,70.0031,70.0001], //Product-1
                  [30.3600,30.0144,30.0006,30.0000], //Products-2
                  [51.0000,50.0400,50.0016,50.0001], //Prodcut-3
                  [104.0000,100.1600,100.0064,100.0003]]; //Product-4

secondary_demand = [
    [102.3200,100.0928,100.0037,100.0001], //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544,80.0022,80.0001], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000,150.0080,150.0003], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928,100.0037,100.0001], //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472,180.0059,180.0002], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544,230.0102,230.0004]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```


Test Instance-17: TGS1C2D8 (Test General Setup-Profile_1 Capacity-Profile_2 Demand-Series_8)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600], //Product-1
                  [35.7600],   //Products-2
                  [66.0000],   //Prodcut-3
                  [164.0000]]; //Product-4

secondary_demand = [
    [137.1200], //Product-5 (Sum of Product-1 & 2)
    [101.7600], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200], //Product-8 (equal to Prodcut-5)
    [238.8800], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544],           //Product-1
                  [35.7600,30.2304],           //Products-2
                  [66.0000,50.6400],           //Prodcut-3
                  [164.0000,102.5600]];         //Product-4

secondary_demand = [
    [137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704],  //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.050],           //Product-1
                  [35.7600,30.2304,30.0092],           //Products-2
                  [66.0000,50.6400,50.0256],           //Prodcut-3
                  [164.0000,102.5600,100.1024]];        //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594],           //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348],           //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280],           //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594],           //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942],           //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1
                  [35.7600,30.2304,30.0092,30.0004], //Products-2
                  [66.0000,50.6400,50.0256,50.0010], //Prodcut-3
                  [164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Test Instance-18: TGS1C2D9 (Test General Setup-Profile_1 Capacity-Profile_2 Demand-Series_9)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400], //Product-1
                  [47.6400],   //Products-2
                  [99.0000],   //Prodcut-3
                  [296.0000]]; //Product-4

secondary_demand = [
    [213.6800], //Product-5 (Sum of Product-1 & 2)
    [146.6400], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800], //Product-8 (equal to Prodcut-5)
    [360.3200], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416],           //Product-1
                  [47.6400,30.7056],             //Products-2
                  [99.0000,51.9600],             //Prodcut-3
                  [296.0000,107.8400]];          //Product-4

secondary_demand = [
    [213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656],  //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537],           //Product-1
                  [47.6400,30.7056,30.0282],           //Products-2
                  [99.0000,51.9600,50.0784],           //Prodcut-3
                  [296.0000,107.8400,100.3136]];         //Product-4

secondary_demand = [
    [213.6800,104.5472,100.1819],           //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066],           //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920],           //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819],           //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885],           //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1
                  [47.6400,30.7056,30.0282,30.0011], //Products-2
                  [99.0000,51.9600,50.0784,50.0031], //Prodcut-3
                  [296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary_demand = [
    [213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,485.7143,914.2857];
```


Test Instance-19: TGS1C3D1 (Test General Setup-Profile_1 Capacity-Profile_3 Demand-Series_1)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900], //Product-1
                  [30.0900], //Products-2
                  [50.2500], //Prodcut-3
                  [101.0000]]; //Product-4

secondary_demand = [
    [100.5800], //Product-5 (Sum of Product-1 & 2)
    [80.3400], //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800], //Product-8 (equal to Prodcut-5)
    [180.9200], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049],           //Product-1
                  [30.0900,30.0009],           //Products-2
                  [50.2500,50.0025],           //Prodcut-3
                  [101.0000,100.0100]];         //Product-4

secondary_demand = [
    [100.5800,100.0058],           //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034],             //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125],           //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058],           //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092],           //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000], //Product-1
                  [30.0900,30.0009,30.0000], //Products-2
                  [50.2500,50.0025,50.0000], //Prodcut-3
                  [101.0000,100.0100,100.0001]]; //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000], //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1
                  [30.0900,30.0009,30.0000,30.0000], //Products-2
                  [50.2500,50.0025,50.0000,50.0000], //Prodcut-3
                  [101.0000,100.0100,100.0001,100.0000]]; //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

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

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400], //Product-1
                  [31.4400], //Products-2
                  [54.0000], //Prodcut-3
                  [116.0000]]; //Product-4

secondary_demand = [
    [109.2800], //Product-5 (Sum of Product-1 & 2)
    [85.4400], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800], //Product-8 (equal to Prodcut-5)
    [194.7200], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784],           //Product-1
                  [31.4400,30.0144],           //Products-2
                  [54.0000,50.0040],           //Prodcut-3
                  [116.0000,100.1600]];        //Product-4

secondary_demand = [
    [109.2800,100.0928],           //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544],             //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000],           //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928],           //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472],           //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544]];          //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784,70.0008], //Product-1
                  [31.4400,30.0144,30.0001], //Products-2
                  [54.0000,50.0040,50.0004], //Prodcut-3
                  [116.0000,100.1600,100.0016]]; //Product-4

secondary_demand = [
    [109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544,80.0005], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544,230.0025]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1
                  [31.4400,30.0144,30.0001,30.0000], //Products-2
                  [54.0000,50.0040,50.0004,50.0000], //Prodcut-3
                  [116.0000,100.1600,100.0016,100.0000]]; //Product-4

secondary_demand = [
    [109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000,150.0020,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928,100.0009,100.0000], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472,180.0015,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544,230.0025,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```


Test Instance-21: TGS1C3D3 (Test General Setup-Profile_1 Capacity-Profile_3 Demand-Series_3)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100], //Product-1
                  [34.4100], //Products-2
                  [62.2500], //Prodcut-3
                  [149.0000]]; //Product-4

secondary_demand = [
    [128.4200], //Product-5 (Sum of Product-1 & 2)
    [96.6600], //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200], //Product-8 (equal to Prodcut-5)
    [225.0800], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401],           //Product-1
                  [34.4100,30.0441],           //Products-2
                  [62.2500,50.1225],           //Prodcut-3
                  [149.0000,100.4900]];        //Product-4

secondary_demand = [
    [128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666],   //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842], //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401,70.0024],           //Product-1
                  [34.4100,30.0441,30.0004],           //Products-2
                  [62.2500,50.1225,50.0012],           //Prodcut-3
                  [149.0000,100.4900,100.0049]];        //Product-4

secondary_demand = [
    [128.4200,100.2842,100.0028],           //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666,80.0017],             //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125,150.0061],          //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842,100.0028],          //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508,180.0045],          //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791,230.0078]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1
                  [34.4100,30.0441,30.0004,30.0000], //Products-2
                  [62.2500,50.1225,50.0012,50.0000], //Prodcut-3
                  [149.0000,100.4900,100.0049,100.0000]]; //Product-4

secondary_demand = [
    [128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Test Instance-22: TGS1C3D4 (Test General Setup-Profile_1 Capacity-Profile_3 Demand-Series_4)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025], //Product-1
                  [30.2025], //Products-2
                  [50.5625], //Prodcut-3
                  [102.2500]]; //Product-4

secondary_demand = [
    [101.3050], //Product-5 (Sum of Product-1 & 2)
    [80.7650], //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050], //Product-8 (equal to Prodcut-5)
    [182.0700], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048],      //Product-1
                  [30.2025,30.0046],      //Products-2
                  [50.5625,50.0127],      //Prodcut-3
                  [102.2500,100.0506]];    //Product-4

secondary_demand = [
    [101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172],   //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294], //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006],           //Product-1
                  [30.2025,30.0046,30.0001],         //Products-2
                  [50.5625,50.0127,50.0003],         //Prodcut-3
                  [102.2500,100.0506,100.0011]];      //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007],           //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004],             //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014],          //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007],          //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010],          //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006,70.0000],           //Product-1
                  [30.2025,30.0046,30.0001,30.0000],         //Products-2
                  [50.5625,50.0127,50.0003,50.0000],         //Prodcut-3
                  [102.2500,100.0506,100.0011,100.0000]];     //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007,100.0000],           //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004,80.0000],               //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014,150.0000],           //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007,100.0000],           //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010,180.0000],           //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018,230.0000]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```


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

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400], //Product-1
                  [33.2400], //Products-2
                  [59.0000], //Prodcut-3
                  [136.0000]]; //Product-4

secondary_demand = [
    [120.8800], //Product-5 (Sum of Product-1 & 2)
    [92.2400], //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800], //Product-8 (equal to Prodcut-5)
    [213.1200], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969],           //Product-1
                  [33.2400,30.0729],           //Products-2
                  [59.0000,50.2025],           //Prodcut-3
                  [136.0000,100.8100]];        //Product-4

secondary_demand = [
    [120.8800,100.4698],           //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754],             //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125],           //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698],           //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452],           //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879]];          //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969,70.0089],           //Product-1
                  [33.2400,30.0729,30.0016],           //Products-2
                  [59.0000,50.2025,50.0046],           //Prodcut-3
                  [136.0000,100.8100,100.0182]];        //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062],    //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969,70.0089,70.0002], //Product-1
                  [33.2400,30.0729,30.0016,30.0000], //Products-2
                  [59.0000,50.2025,50.0046,50.0001], //Prodcut-3
                  [136.0000,100.8100,100.0182,100.0004]]; //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106,100.0002], //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062,80.0001], //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228,150.0005], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106,100.0002], //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168,180.0004], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290,230.0007]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Test Instance-24: TGS1C3D6 (Test General Setup-Profile_1 Capacity-Profile_3 Demand-Series_6)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225], //Product-1
                  [39.9225],   //Products-2
                  [77.5625],   //Prodcut-3
                  [210.2500]]; //Product-4

secondary_demand = [
    [163.9450], //Product-5 (Sum of Product-1 & 2)
    [117.4850], //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450], //Product-8 (equal to Prodcut-5)
    [281.4300], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155],           //Product-1
                  [39.9225,30.2233],             //Products-2
                  [77.5625,50.6202],             //Prodcut-3
                  [210.2500,102.4806]];           //Product-4

secondary_demand = [
    [163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434],  //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388], //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155,70.0273],           //Product-1
                  [39.9225,30.2233,30.0050],           //Products-2
                  [77.5625,50.6202,50.0140],           //Prodcut-3
                  [210.2500,102.4806,100.0558]];        //Product-4

secondary_demand = [
    [163.9450,101.4388,100.0324],           //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434,80.0190],           //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008,150.0698],         //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388,100.0324],         //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822,180.0513],         //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442,230.0887]];        //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155,70.0273,70.0006], //Product-1
                  [39.9225,30.2233,30.0050,30.0001], //Products-2
                  [77.5625,50.6202,50.0140,50.0003], //Prodcut-3
                  [210.2500,102.4806,100.0558,100.0013]]; //Product-4

secondary_demand = [
    [163.9450,101.4388,100.0324,100.0007], //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434,80.0190,80.0004], //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008,150.0698,150.0016], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388,100.0324,100.0007], //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822,180.0513,180.0012], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442,230.0887,230.0020]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```


Test Instance-25: TGS1C3D7 (Test General Setup-Profile_1 Capacity-Profile_3 Demand-Series_7)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600], //Product-1
                  [30.3600], //Products-2
                  [51.0000], //Prodcut-3
                  [104.0000]]; //Product-4

secondary_demand = [
    [102.3200], //Product-5 (Sum of Product-1 & 2)
    [81.3600], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200], //Product-8 (equal to Prodcut-5)
    [183.6800], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600,70.0784],           //Product-1
                  [30.3600,30.0144],           //Products-2
                  [51.0000,50.0400],           //Prodcut-3
                  [104.0000,100.1600]];         //Product-4

secondary_demand = [
    [102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544],   //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928], //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600,70.0784,70.0031],           //Product-1
                  [30.3600,30.0144,30.0006],           //Products-2
                  [51.0000,50.0400,50.0016],           //Prodcut-3
                  [104.0000,100.1600,100.0064]];        //Product-4

secondary_demand = [
    [102.3200,100.0928,100.0037],           //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544,80.0022],             //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000,150.0080],           //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928,100.0037],           //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472,180.0059],           //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544,230.0102]];          //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600,70.0784,70.0031,70.0001], //Product-1
                  [30.3600,30.0144,30.0006,30.0000], //Products-2
                  [51.0000,50.0400,50.0016,50.0001], //Prodcut-3
                  [104.0000,100.1600,100.0064,100.0003]]; //Product-4

secondary_demand = [
    [102.3200,100.0928,100.0037,100.0001], //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544,80.0022,80.0001], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000,150.0080,150.0003], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928,100.0037,100.0001], //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472,180.0059,180.0002], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544,230.0102,230.0004]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Test Instance-26: TGS1C3D8 (Test General Setup-Profile_1 Capacity-Profile_3 Demand-Series_8)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600], //Product-1
                  [35.7600],   //Products-2
                  [66.0000],   //Prodcut-3
                  [164.0000]]; //Product-4

secondary_demand = [
    [137.1200], //Product-5 (Sum of Product-1 & 2)
    [101.7600], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200], //Product-8 (equal to Prodcut-5)
    [238.8800], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544],           //Product-1
                  [35.7600,30.2304],           //Products-2
                  [66.0000,50.6400],           //Prodcut-3
                  [164.0000,102.5600]];        //Product-4

secondary_demand = [
    [137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704],  //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.0502],           //Product-1
                  [35.7600,30.2304,30.0092],           //Products-2
                  [66.0000,50.6400,50.0256],           //Prodcut-3
                  [164.0000,102.5600,100.1024]];        //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594],           //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348],           //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280],           //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594],           //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942],           //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628]];        //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1
                  [35.7600,30.2304,30.0092,30.0004], //Products-2
                  [66.0000,50.6400,50.0256,50.0010], //Prodcut-3
                  [164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```


Test Instance-27: TGS1C3D9 (Test General Setup-Profile_1 Capacity-Profile_3 Demand-Series_9)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400], //Product-1
                  [47.6400],   //Products-2
                  [99.0000],   //Prodcut-3
                  [296.0000]]; //Product-4

secondary_demand = [
    [213.6800], //Product-5 (Sum of Product-1 & 2)
    [146.6400], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800], //Product-8 (equal to Prodcut-5)
    [360.3200], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416],           //Product-1
                  [47.6400,30.7056],             //Products-2
                  [99.0000,51.9600],             //Prodcut-3
                  [296.0000,107.8400]];          //Product-4

secondary_demand = [
    [213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656],  //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537],           //Product-1
                  [47.6400,30.7056,30.0282],           //Products-2
                  [99.0000,51.9600,50.0784],           //Prodcut-3
                  [296.0000,107.8400,100.3136]];         //Product-4

secondary_demand = [
    [213.6800,104.5472,100.1819],           //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066],           //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920],           //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819],           //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885],           //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1
                  [47.6400,30.7056,30.0282,30.0011], //Products-2
                  [99.0000,51.9600,50.0784,50.0031], //Prodcut-3
                  [296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary_demand = [
    [213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,680.0000,1280.0000];
```

Test Instance-28: TGS1C4D1 (Test General Setup-Profile_1 Capacity-Profile_4 Demand-Series_1)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900], //Product-1
                  [30.0900], //Products-2
                  [50.2500], //Prodcut-3
                  [101.0000]]; //Product-4

secondary_demand = [
    [100.5800], //Product-5 (Sum of Product-1 & 2)
    [80.3400], //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800], //Product-8 (equal to Prodcut-5)
    [180.9200], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049],           //Product-1
                  [30.0900,30.0009],           //Products-2
                  [50.2500,50.0025],           //Prodcut-3
                  [101.0000,100.0100]];         //Product-4

secondary_demand = [
    [100.5800,100.0058],           //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034],             //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125],           //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058],           //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092],           //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000],           //Product-1
                  [30.0900,30.0009,30.0000],           //Products-2
                  [50.2500,50.0025,50.0000],           //Prodcut-3
                  [101.0000,100.0100,100.0001]];        //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000],     //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000], //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1
                  [30.0900,30.0009,30.0000,30.0000], //Products-2
                  [50.2500,50.0025,50.0000,50.0000], //Prodcut-3
                  [101.0000,100.0100,100.0001,100.0000]]; //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```


Test Instance-29: TGS1C4D2 (Test General Setup-Profile_1 Capacity-Profile_4 Demand-Series_2)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400], //Product-1
                  [31.4400], //Products-2
                  [54.0000], //Prodcut-3
                  [116.0000]]; //Product-4

secondary_demand = [
    [109.2800], //Product-5 (Sum of Product-1 & 2)
    [85.4400], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800], //Product-8 (equal to Prodcut-5)
    [194.7200], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784],           //Product-1
                  [31.4400,30.0144],           //Products-2
                  [54.0000,50.0040],           //Prodcut-3
                  [116.0000,100.1600]];         //Product-4

secondary_demand = [
    [109.2800,100.0928], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544],   //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784,70.0008], //Product-1
                  [31.4400,30.0144,30.0001], //Products-2
                  [54.0000,50.0040,50.0004], //Prodcut-3
                  [116.0000,100.1600,100.0016]]; //Product-4

secondary_demand = [
    [109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544,80.0005], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544,230.0025]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1
                  [31.4400,30.0144,30.0001,30.0000], //Products-2
                  [54.0000,50.0040,50.0004,50.0000], //Prodcut-3
                  [116.0000,100.1600,100.0016,100.0000]]; //Product-4

secondary_demand = [
    [109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000,150.0020,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928,100.0009,100.0000], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472,180.0015,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544,230.0025,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Test Instance-30: TGS1C4D3 (Test General Setup-Profile_1 Capacity-Profile_4 Demand-Series_3)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100], //Product-1
                  [34.4100], //Products-2
                  [62.2500], //Prodcut-3
                  [149.0000]]; //Product-4

secondary_demand = [
    [128.4200], //Product-5 (Sum of Product-1 & 2)
    [96.6600], //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200], //Product-8 (equal to Prodcut-5)
    [225.0800], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401],           //Product-1
                  [34.4100,30.0441],           //Products-2
                  [62.2500,50.1225],           //Prodcut-3
                  [149.0000,100.4900]];        //Product-4

secondary_demand = [
    [128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666],   //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842], //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401,70.0024],           //Product-1
                  [34.4100,30.0441,30.0004],           //Products-2
                  [62.2500,50.1225,50.0012],           //Prodcut-3
                  [149.0000,100.4900,100.0049]];        //Product-4

secondary_demand = [
    [128.4200,100.2842,100.0028],           //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666,80.0017],             //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125,150.0061],          //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842,100.0028],          //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508,180.0045],          //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791,230.0078]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1
                  [34.4100,30.0441,30.0004,30.0000], //Products-2
                  [62.2500,50.1225,50.0012,50.0000], //Prodcut-3
                  [149.0000,100.4900,100.0049,100.0000]]; //Product-4

secondary_demand = [
    [128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```


Test Instance-31: TGS1C4D4 (Test General Setup-Profile_1 Capacity-Profile_4 Demand-Series_4)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025], //Product-1
                  [30.2025], //Products-2
                  [50.5625], //Prodcut-3
                  [102.2500]]; //Product-4

secondary_demand = [
    [101.3050], //Product-5 (Sum of Product-1 & 2)
    [80.7650], //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050], //Product-8 (equal to Prodcut-5)
    [182.0700], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048], //Product-1
                  [30.2025,30.0046], //Products-2
                  [50.5625,50.0127], //Prodcut-3
                  [102.2500,100.0506]]; //Product-4

secondary_demand = [
    [101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172], //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294], //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006],           //Product-1
                  [30.2025,30.0046,30.0001],         //Products-2
                  [50.5625,50.0127,50.0003],         //Prodcut-3
                  [102.2500,100.0506,100.0011]];      //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007],           //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004],             //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014],          //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007],          //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010],          //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006,70.0000],           //Product-1
                  [30.2025,30.0046,30.0001,30.0000],         //Products-2
                  [50.5625,50.0127,50.0003,50.0000],         //Prodcut-3
                  [102.2500,100.0506,100.0011,100.0000]];     //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007,100.0000],           //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004,80.0000],               //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014,150.0000],           //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007,100.0000],           //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010,180.0000],           //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018,230.0000]];          //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Test Instance-32: TGS1C4D5 (Test General Setup-Profile_1 Capacity-Profile_4 Demand-Series_5)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400], //Product-1
                  [33.2400], //Products-2
                  [59.0000], //Prodcut-3
                  [136.0000]]; //Product-4

secondary_demand = [
    [120.8800], //Product-5 (Sum of Product-1 & 2)
    [92.2400], //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800], //Product-8 (equal to Prodcut-5)
    [213.1200], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969],           //Product-1
                  [33.2400,30.0729],           //Products-2
                  [59.0000,50.2025],           //Prodcut-3
                  [136.0000,100.8100]];        //Product-4

secondary_demand = [
    [120.8800,100.4698],           //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754],             //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125],           //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698],           //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452],           //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969,70.0089],           //Product-1
                  [33.2400,30.0729,30.0016],           //Products-2
                  [59.0000,50.2025,50.0046],           //Prodcut-3
                  [136.0000,100.8100,100.0182]];        //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062],    //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969,70.0089,70.0002], //Product-1
                  [33.2400,30.0729,30.0016,30.0000], //Products-2
                  [59.0000,50.2025,50.0046,50.0001], //Prodcut-3
                  [136.0000,100.8100,100.0182,100.0004]]; //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106,100.0002], //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062,80.0001], //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228,150.0005], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106,100.0002], //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168,180.0004], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290,230.0007]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```


Test Instance-33: TGS1C4D6 (Test General Setup-Profile_1 Capacity-Profile_4 Demand-Series_6)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225], //Product-1
                  [39.9225],   //Products-2
                  [77.5625],   //Prodcut-3
                  [210.2500]]; //Product-4

secondary_demand = [
    [163.9450], //Product-5 (Sum of Product-1 & 2)
    [117.4850], //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450], //Product-8 (equal to Prodcut-5)
    [281.4300], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155],           //Product-1
                  [39.9225,30.2233],             //Products-2
                  [77.5625,50.6202],             //Prodcut-3
                  [210.2500,102.4806]];           //Product-4

secondary_demand = [
    [163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434],  //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388], //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155,70.0273],      //Product-1
                  [39.9225,30.2233,30.0050],      //Products-2
                  [77.5625,50.6202,50.0140],      //Prodcut-3
                  [210.2500,102.4806,100.0558]];   //Product-4

secondary_demand = [
    [163.9450,101.4388,100.0324],      //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434,80.0190],      //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008,150.0698],    //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388,100.0324],    //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822,180.0513],    //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442,230.0887]];   //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155,70.0273,70.0006],      //Product-1
                  [39.9225,30.2233,30.0050,30.0001],      //Products-2
                  [77.5625,50.6202,50.0140,50.0003],      //Prodcut-3
                  [210.2500,102.4806,100.0558,100.0013]];  //Product-4

secondary_demand = [
    [163.9450,101.4388,100.0324,100.0007],                //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434,80.0190,80.0004],                  //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008,150.0698,150.0016],                //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388,100.0324,100.0007],                //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822,180.0513,180.0012],                //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442,230.0887,230.0020]];               //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Test Instance-34: TGS1C4D7 (Test General Setup-Profile_1 Capacity-Profile_4 Demand-Series_7)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600], //Product-1
                  [30.3600], //Products-2
                  [51.0000], //Prodcut-3
                  [104.0000]]; //Product-4

secondary_demand = [
    [102.3200], //Product-5 (Sum of Product-1 & 2)
    [81.3600], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200], //Product-8 (equal to Prodcut-5)
    [183.6800], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
```

```

L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600,70.0784],           //Product-1
                  [30.3600,30.0144],           //Products-2
                  [51.0000,50.0400],           //Prodcut-3
                  [104.0000,100.1600]];        //Product-4

secondary_demand = [
    [102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544],   //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928], //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};

```

```

allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600,70.0784,70.0031],           //Product-1
                  [30.3600,30.0144,30.0006],           //Products-2
                  [51.0000,50.0400,50.0016],           //Prodcut-3
                  [104.0000,100.1600,100.0064]];         //Product-4

secondary_demand = [
    [102.3200,100.0928,100.0037],           //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544,80.0022],           //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000,150.0080],         //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928,100.0037],         //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472,180.0059],         //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544,230.0102]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};

```

```

family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600,70.0784,70.0031,70.0001], //Product-1
                  [30.3600,30.0144,30.0006,30.0000], //Products-2
                  [51.0000,50.0400,50.0016,50.0001], //Prodcut-3
                  [104.0000,100.1600,100.0064,100.0003]]; //Product-4

secondary_demand = [
    [102.3200,100.0928,100.0037,100.0001], //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544,80.0022,80.0001], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000,150.0080,150.0003], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928,100.0037,100.0001], //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472,180.0059,180.0002], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544,230.0102,230.0004]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];

```


Test Instance-35: TGS1C4D8 (Test General Setup-Profile_1 Capacity-Profile_4 Demand-Series_8)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600], //Product-1
                  [35.7600],   //Products-2
                  [66.0000],   //Prodcut-3
                  [164.0000]]; //Product-4

secondary_demand = [
    [137.1200], //Product-5 (Sum of Product-1 & 2)
    [101.7600], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200], //Product-8 (equal to Prodcut-5)
    [238.8800], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
```

```

J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544], //Product-1
                  [35.7600,30.2304], //Products-2
                  [66.0000,50.6400], //Prodcut-3
                  [164.0000,102.5600]]; //Product-4

secondary_demand = [
    [137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;

```

```

S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.0502],      //Product-1
                  [35.7600,30.2304,30.0092],      //Products-2
                  [66.0000,50.6400,50.0256],      //Prodcut-3
                  [164.0000,102.5600,100.1024]];   //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594],      //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348],      //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280],      //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594],      //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942],      //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628]];     //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};

```

```

allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1
                  [35.7600,30.2304,30.0092,30.0004], //Products-2
                  [66.0000,50.6400,50.0256,50.0010], //Prodcut-3
                  [164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];

```

Test Instance-36: TGS1C4D9 (Test General Setup-Profile_1 Capacity-Profile_4 Demand-Series_9)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400], //Product-1
                  [47.6400],   //Products-2
                  [99.0000],   //Prodcut-3
                  [296.0000]]; //Product-4

secondary_demand = [
    [213.6800], //Product-5 (Sum of Product-1 & 2)
    [146.6400], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800], //Product-8 (equal to Prodcut-5)
    [360.3200], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
```

```

L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416],           //Product-1
                  [47.6400,30.7056],           //Products-2
                  [99.0000,51.9600],           //Prodcut-3
                  [296.0000,107.8400]];        //Product-4

secondary_demand = [
    [213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656],  //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};

```

```

allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537],      //Product-1
                  [47.6400,30.7056,30.0282],      //Products-2
                  [99.0000,51.9600,50.0784],      //Prodcut-3
                  [296.0000,107.8400,100.3136]];    //Product-4

secondary_demand = [
    [213.6800,104.5472,100.1819],    //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066],      //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920],    //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819],    //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885],    //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986]];   //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};

```

```

family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1
                  [47.6400,30.7056,30.0282,30.0011], //Products-2
                  [99.0000,51.9600,50.0784,50.0031], //Prodcut-3
                  [296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary_demand = [
    [213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,485.7143,1280.0000];

```

Test Instance-37: TGS1C5D1 (Test General Setup-Profile_1 Capacity-Profile_5 Demand-Series_1)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};

```



```

family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900],      //Product-1
                  [30.0900],      //Products-2
                  [50.2500],      //Prodcut-3
                  [101.0000]];     //Product-4

secondary_demand = [
    [100.5800], //Product-5 (Sum of Product-1 & 2)
    [80.3400],  //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800], //Product-8 (equal to Prodcut-5)
    [180.9200], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};

```

```

family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049],           //Product-1
                  [30.0900,30.0009],           //Products-2
                  [50.2500,50.0025],           //Prodcut-3
                  [101.0000,100.0100]];         //Product-4

secondary_demand = [
    [100.5800,100.0058],           //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034],             //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125],           //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058],           //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092],           //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

```

```

microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000],           //Product-1
                  [30.0900,30.0009,30.0000],           //Products-2
                  [50.2500,50.0025,50.0000],           //Prodcut-3
                  [101.0000,100.0100,100.0001]];        //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000],    //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000], //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1
                  [30.0900,30.0009,30.0000,30.0000], //Products-2
                  [50.2500,50.0025,50.0000,50.0000], //Prodcut-3
                  [101.0000,100.0100,100.0001,100.0000]]; //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Test Instance-38: TGS1C5D2 (Test General Setup-Profile_1 Capacity-Profile_5 Demand-Series_2)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

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

```

```

BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400], //Product-1
                  [31.4400], //Products-2
                  [54.0000], //Prodcut-3
                  [116.0000]]; //Product-4

secondary_demand = [
    [109.2800], //Product-5 (Sum of Product-1 & 2)
    [85.4400], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800], //Product-8 (equal to Prodcut-5)
    [194.7200], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784],           //Product-1
                  [31.4400,30.0144],           //Products-2
                  [54.0000,50.0040],           //Prodcut-3
                  [116.0000,100.1600]];         //Product-4

secondary_demand = [
    [109.2800,100.0928], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544],   //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784,70.0008], //Product-1
                  [31.4400,30.0144,30.0001], //Products-2

```

```

[54.0000,50.0040,50.0004],          //Prodcut-3
[116.0000,100.1600,100.0016]];      //Product-4

secondary_demand = [
    [109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544,80.0005],    //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544,230.0025]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1
    [31.4400,30.0144,30.0001,30.0000], //Products-2
    [54.0000,50.0040,50.0004,50.0000], //Prodcut-3
    [116.0000,100.1600,100.0016,100.0000]]; //Product-4

```

```

secondary_demand = [
    [109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000,150.0020,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928,100.0009,100.0000], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472,180.0015,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544,230.0025,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Test Instance-39: TGS1C5D3 (Test General Setup-Profile_1 Capacity-Profile_5 Demand-Series_3)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100], //Product-1
                  [34.4100], //Products-2
                  [62.2500], //Prodcut-3
                  [149.0000]]; //Product-4

secondary_demand = [
    [128.4200], //Product-5 (Sum of Product-1 & 2)
    [96.6600], //Product-6 (Sum of Prodcut-2 & 3)

```



```

[211.2500], //Product-7 (Sum of Prodcut-3 & 4)
[128.4200], //Product-8 (equal to Prodcut-5)
[225.0800], //Product-9 (Sum of Prodcut-5 & 6)
[307.9100]]; //Product-10 (Sum of Prodcut-6 & 7)

```

// Setup Profile - I

```

setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

// Capacity Utilization Profile - V (50%, 70%, 90%)

```

productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

// Product Demand - Series# 3

```

primary_demand = [[94.0100,70.2401], //Product-1
                  [34.4100,30.0441], //Products-2
                  [62.2500,50.1225], //Prodcut-3
                  [149.0000,100.4900]]; //Product-4

```

secondary_demand = [

```

[128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)
[96.6600,80.1666], //Product-6 (Sum of Prodcut-2 & 3)
[211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)
[128.4200,100.2842], //Product-8 (equal to Prodcut-5)
[225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)
[307.9100,230.7791]]; //Product-10 (Sum of Prodcut-6 & 7)

```

```
// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
```

```
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];
```

// Product Demand - Series# 3

```
primary_demand = [[94.0100,70.2401,70.0024], //Product-1
                  [34.4100,30.0441,30.0004], //Products-2
                  [62.2500,50.1225,50.0012], //Prodcut-3
                  [149.0000,100.4900,100.0049]]]; //Product-4
```

```
secondary_demand = [
    [128.4200,100.2842,100.0028], //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666,80.0017], //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125,150.0061], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842,100.0028], //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508,180.0045], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791,230.0078]]]; //Product-10 (Sum of Prodcut-6 & 7)
```

```
// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
```

```

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

// Product Demand - Series# 3

```

primary_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1
                  [34.4100,30.0441,30.0004,30.0000], //Products-2
                  [62.2500,50.1225,50.0012,50.0000], //Prodcut-3
                  [149.0000,100.4900,100.0049,100.0000]]; //Product-4

```

```

secondary_demand = [
    [128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)

```

// Setup Profile - I

```

setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

```
// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];
```

Test Instance-40: TGS1C5D4 (Test General Setup-Profile_1 Capacity-Profile_5 Demand-Series_4)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];
```

// Product Demand - Series# 4

```
primary_demand = [[71.1025], //Product-1
                  [30.2025], //Products-2
                  [50.5625], //Prodcut-3
                  [102.2500]]; //Product-4
```

```
secondary_demand = [
    [101.3050,100.0294,100.0007,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007,100.0000], //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)
```

// Setup Profile - I

```
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];
```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048],      //Product-1
                  [30.2025,30.0046],      //Products-2
                  [50.5625,50.0127],      //Prodcut-3
                  [102.2500,100.0506]];    //Product-4

secondary_demand = [
    [101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172],   //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294], //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;

```

```

T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006],           //Product-1
                  [30.2025,30.0046,30.0001],           //Products-2
                  [50.5625,50.0127,50.0003],           //Prodcut-3
                  [102.2500,100.0506,100.0011]];        //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007],           //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004],             //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014],           //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007],           //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010],           //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};

```

```

allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006,70.0000], //Product-1
                  [30.2025,30.0046,30.0001,30.0000], //Products-2
                  [50.5625,50.0127,50.0003,50.0000], //Prodcut-3
                  [102.2500,100.0506,100.0011,100.0000]]; //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007,100.0000], //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Test Instance-41: TGS1C5D5 (Test General Setup-Profile_1 Capacity-Profile_5 Demand-Series_5)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};

```

```

allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400], //Product-1
                  [33.2400], //Products-2
                  [59.0000], //Prodcut-3
                  [136.0000]]; //Product-4

secondary_demand = [
    [120.8800], //Product-5 (Sum of Product-1 & 2)
    [92.2400], //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800], //Product-8 (equal to Prodcut-5)
    [213.1200], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};

```



```

family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969],           //Product-1
                  [33.2400,30.0729],           //Products-2
                  [59.0000,50.2025],           //Prodcut-3
                  [136.0000,100.8100]];         //Product-4

secondary_demand = [
    [120.8800,100.4698], //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754],   //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698], //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};

```

```

family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969,70.0089], //Product-1
                  [33.2400,30.0729,30.0016], //Products-2
                  [59.0000,50.2025,50.0046], //Prodcut-3
                  [136.0000,100.8100,100.0182]]; //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062], //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

```

```

microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969,70.0089,70.0002],      //Product-1
                  [33.2400,30.0729,30.0016,30.0000],      //Products-2
                  [59.0000,50.2025,50.0046,50.0001],      //Prodcut-3
                  [136.0000,100.8100,100.0182,100.0004]]; //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106,100.0002],      //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062,80.0001],          //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228,150.0005],      //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106,100.0002],      //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168,180.0004],      //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290,230.0007]];      //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Test Instance-42: TGS1C5D6 (Test General Setup-Profile_1 Capacity-Profile_5 Demand-Series_6)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;

```

```

production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225], //Product-1
                  [39.9225],   //Products-2
                  [77.5625],   //Prodcut-3
                  [210.2500]]; //Product-4

secondary_demand = [
    [163.9450], //Product-5 (Sum of Product-1 & 2)
    [117.4850], //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450], //Product-8 (equal to Prodcut-5)
    [281.4300], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

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

```

```

BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155],           //Product-1
                  [39.9225,30.2233],           //Products-2
                  [77.5625,50.6202],           //Prodcut-3
                  [210.2500,102.4806]];         //Product-4

secondary_demand = [
    [163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434],  //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388], //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155,70.0273],           //Product-1
                  [39.9225,30.2233,30.0050],           //Products-2
                  [77.5625,50.6202,50.0140],           //Prodcut-3
                  [210.2500,102.4806,100.0558]]];        //Product-4

secondary_demand = [
    [163.9450,101.4388,100.0324],           //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434,80.0190],           //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008,150.0698],         //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388,100.0324],         //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822,180.0513],         //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442,230.0887]]];        //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155,70.0273,70.0006], //Product-1

```

```

[39.9225,30.2233,30.0050,30.0001],      //Products-2
[77.5625,50.6202,50.0140,50.0003],      //Prodcut-3
[210.2500,102.4806,100.0558,100.0013]]; //Product-4

secondary_demand = [
    [163.9450,101.4388,100.0324,100.0007], //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434,80.0190,80.0004],    //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008,150.0698,150.0016], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388,100.0324,100.0007], //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822,180.0513,180.0012], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442,230.0887,230.0020]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Test Instance-43: TGS1C5D7 (Test General Setup-Profile_1 Capacity-Profile_5 Demand-Series_7)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600],           //Product-1
                  [30.3600],           //Products-2
                  [51.0000],           //Prodcut-3
                  [104.0000]];         //Product-4

```

```

secondary_demand = [
    [102.3200], //Product-5 (Sum of Product-1 & 2)
    [81.3600], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200], //Product-8 (equal to Prodcut-5)
    [183.6800], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600]]; //Product-10 (Sum of Prodcut-6 & 7)

```

```
// Setup Profile - I
```

```

setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

```
// Capacity Utilization Profile - V (50%, 70%, 90%)
```

```
productstagecapacity = [220.0000,485.7143,711.1111];
```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```
// Product Demand - Series# 7
```

```

primary_demand = [[71.9600,70.0784], //Product-1
    [30.3600,30.0144], //Products-2
    [51.0000,50.0400], //Prodcut-3
    [104.0000,100.1600]]; //Product-4

```

```

secondary_demand = [
    [102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

```



```

[102.3200,100.0928], //Product-8 (equal to Prodcut-5)
[183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)
[236.3600,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600,70.0784,70.0031], //Product-1
[30.3600,30.0144,30.0006], //Products-2
[51.0000,50.0400,50.0016], //Prodcut-3
[104.0000,100.1600,100.0064]]; //Product-4

secondary_demand = [
[102.3200,100.0928,100.0037], //Product-5 (Sum of Product-1 & 2)
[81.3600,80.0544,80.0022], //Product-6 (Sum of Prodcut-2 & 3)
[155.0000,150.2000,150.0080], //Product-7 (Sum of Prodcut-3 & 4)
[102.3200,100.0928,100.0037], //Product-8 (equal to Prodcut-5)
[183.6800,180.1472,180.0059], //Product-9 (Sum of Prodcut-5 & 6)
[236.3600,230.2544,230.0102]]; //Product-10 (Sum of Prodcut-6 & 7)

```

```
// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
```

```
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];
```

Product Demand - Series# 7

```
primary_demand = [[71.9600,70.0784,70.0031,70.0001], //Product-1
                  [30.3600,30.0144,30.0006,30.0000], //Products-2
                  [51.0000,50.0400,50.0016,50.0001], //Prodcut-3
                  [104.0000,100.1600,100.0064,100.0003]]]; //Product-4

secondary_demand = [
    [102.3200,100.0928,100.0037,100.0001], //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544,80.0022,80.0001], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000,150.0080,150.0003], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928,100.0037,100.0001], //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472,180.0059,180.0002], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544,230.0102,230.0004]]]; //Product-10 (Sum of Prodcut-6 & 7)
```

```
// Setup Profile - I
```

```

setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Test Instance-44: TGS1C5D8 (Test General Setup-Profile_1 Capacity-Profile_5 Demand-Series_8)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600], //Product-1
                  [35.7600],   //Products-2
                  [66.0000],   //Prodcut-3
                  [164.0000]]; //Product-4

secondary_demand = [
    [137.1200], //Product-5 (Sum of Product-1 & 2)
    [101.7600], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200], //Product-8 (equal to Prodcut-5)
    [238.8800], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

```

```
productstagecapacity = [220.0000,485.7143,711.1111];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544],           //Product-1
                  [35.7600,30.2304],           //Products-2
                  [66.0000,50.6400],           //Prodcut-3
                  [164.0000,102.5600]];        //Product-4

secondary_demand = [
    [137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704],  //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];
```

Model-3 Data:

```
FP = 4;
```

```

RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.0502],      //Product-1
                  [35.7600,30.2304,30.0092],      //Products-2
                  [66.0000,50.6400,50.0256],      //Prodcut-3
                  [164.0000,102.5600,100.1024]];   //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594],      //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348],      //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280],      //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594],      //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942],      //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628]];     //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;

```

```

T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1
                  [35.7600,30.2304,30.0092,30.0004], //Products-2
                  [66.0000,50.6400,50.0256,50.0010], //Prodcut-3
                  [164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Test Instance-45: TGS1C5D9 (Test General Setup-Profile_1 Capacity-Profile_5 Demand-Series_9)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;

```

```

S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400], //Product-1
                  [47.6400],   //Products-2
                  [99.0000],   //Prodcut-3
                  [296.0000]]; //Product-4

secondary_demand = [
    [213.6800], //Product-5 (Sum of Product-1 & 2)
    [146.6400], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800], //Product-8 (equal to Prodcut-5)
    [360.3200], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};

```

```

family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416],           //Product-1
                  [47.6400,30.7056],           //Products-2
                  [99.0000,51.9600],           //Prodcut-3
                  [296.0000,107.8400]];         //Product-4

secondary_demand = [
    [213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656],  //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};

```



```

family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537],      //Product-1
                  [47.6400,30.7056,30.0282],      //Products-2
                  [99.0000,51.9600,50.0784],      //Prodcut-3
                  [296.0000,107.8400,100.3136]];    //Product-4

secondary_demand = [
    [213.6800,104.5472,100.1819],    //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066],      //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920],    //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819],    //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885],    //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986]];   //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};

```

```

family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1
                  [47.6400,30.7056,30.0282,30.0011], //Products-2
                  [99.0000,51.9600,50.0784,50.0031], //Prodcut-3
                  [296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary_demand = [
    [213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I
setuptime = [10,10,15,15,10,10,5,5,5,5];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,485.7143,711.1111];

```

SETUP-II (Profile)

Test Instance-1: TGS2C1D1 (Test General Setup-Profile_2 Capacity-Profile_1 Demand-Series_1)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};

```

```

family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900],      //Product-1
                  [30.0900],      //Products-2
                  [50.2500],      //Prodcut-3
                  [101.0000]];     //Product-4

secondary_demand = [
    [100.5800], //Product-5 (Sum of Product-1 & 2)
    [80.3400],  //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800], //Product-8 (equal to Prodcut-5)
    [180.9200], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049],           //Product-1
                  [30.0900,30.0009],           //Products-2
                  [50.2500,50.0025],           //Prodcut-3
                  [101.0000,100.0100]];         //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000,100.0000],     //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000,80.0000],         //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001,150.0000],     //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000,100.0000],     //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000,180.0000],     //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000,230.0000]];   //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;

```

```

production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000],           //Product-1
                  [30.0900,30.0009,30.0000],           //Products-2
                  [50.2500,50.0025,50.0000],           //Prodcut-3
                  [101.0000,100.0100,100.0001]];         //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000,100.0000],           //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000,80.0000],               //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001,150.0000],           //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000,100.0000],           //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000,180.0000],           //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000,230.0000]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

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

```

```

BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1
                  [30.0900,30.0009,30.0000,30.0000], //Products-2
                  [50.2500,50.0025,50.0000,50.0000], //Prodcut-3
                  [101.0000,100.0100,100.0001,100.0000]]; //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Test Instance-2: TGS2C1D2 (Test General Setup-Profile_2 Capacity-Profile_1 Demand-Series_2)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 2
primary_demand = [[77.8400],          //Product-1
                  [31.4400],          //Products-2
                  [54.0000],          //Prodcut-3
                  [116.0000]];         //Product-4

secondary_demand = [
    [109.2800], //Product-5 (Sum of Product-1 & 2)
    [85.4400],  //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800], //Product-8 (equal to Prodcut-5)
    [194.7200], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784], //Product-1
                  [31.4400,30.0144], //Products-2

```

```

[54.0000,50.0040],          //Prodcut-3
[116.0000,100.1600]];      //Product-4

secondary_demand = [
    [109.2800,100.0928],      //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544],        //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000],      //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928],      //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472],      //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544]];     //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784,70.0008],      //Product-1
                  [31.4400,30.0144,30.0001],      //Products-2
                  [54.0000,50.0040,50.0004],      //Prodcut-3
                  [116.0000,100.1600,100.0016]];   //Product-4

```



```

secondary_demand = [
    [109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544,80.0005],    //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544,230.0025]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1
    [31.4400,30.0144,30.0001,30.0000], //Products-2
    [54.0000,50.0040,50.0004,50.0000], //Prodcut-3
    [116.0000,100.1600,100.0016,100.0000]]; //Product-4

secondary_demand = [
    [109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)

```

```

[85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
[170.0000,150.2000,150.0020,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
[109.2800,100.0928,100.0009,100.0000], //Product-8 (equal to Prodcut-5)
[194.7200,180.1472,180.0015,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
[255.4400,230.2544,230.0025,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

```

// Setup Profile - II

```

setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

// Capacity Utilization Profile - I (90%)

```

productstagecapacity = [122.2222,355.5556,755.5556];

```

Test Instance-3: TGS2C1D3 (Test General Setup-Profile_2 Capacity-Profile_1 Demand-Series_3)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

// Product Demand - Series# 3

```

primary_demand = [[94.0100], //Product-1
                  [34.4100], //Products-2
                  [62.2500], //Prodcut-3
                  [149.0000]]; //Product-4

```

```

secondary_demand = [
    [128.4200], //Product-5 (Sum of Product-1 & 2)
    [96.6600], //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200], //Product-8 (equal to Prodcut-5)
    [225.0800], //Product-9 (Sum of Prodcut-5 & 6)

```

```

[307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401], //Product-1
[34.4100,30.0441], //Products-2
[62.2500,50.1225], //Prodcut-3
[149.0000,100.4900]]; //Product-4

secondary_demand = [
[128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)
[96.6600,80.1666], //Product-6 (Sum of Prodcut-2 & 3)
[211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)
[128.4200,100.2842], //Product-8 (equal to Prodcut-5)
[225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)
[307.9100,230.7791]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];

```

```
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - I (90%)
```

```
productstagecapacity = [122.2222,355.5556,755.5556];
```

Model-3 Data:

```
FP = 4;
```

```
RP = 10;
```

```
J = 10;
```

```
L = 3;
```

```
T = 3;
```

```
S = 9;
```

```
allproductsonstage1 = {8,9,10};
```

```
allproductsonstage2 = {5,6,7};
```

```
allproductsonstage3 = {1,2,3,4};
```

```
family1stage1 = {8,9};
```

```
family2stage1 = {9,10};
```

```
family3stage1 = {10};
```

```
family1stage2 = {5};
```

```
family2stage2 = {6};
```

```
family3stage2 = {7};
```

```
family1stage3 = {1,2};
```

```
family2stage3 = {2,3};
```

```
family3stage3 = {3,4};
```

```
microperiods1tomacroperiod = {1,2,3};
```

```
microperiods2tomacroperiod = {4,5,6};
```

```
microperiods3tomacroperiod = {7,8,9};
```

```
min_lotsize = 1;
```

```
production_cost = 1;
```

```
production_time = 1;
```

```
standby_cost = 1;
```

```
BOM = 1;
```

```
BigM = 10000;
```

```
holdingcost = [4,7,6,3,3,3,2,1,1,1];
```

```
// Product Demand - Series# 3
```

```
primary_demand = [[94.0100,70.2401,70.0024], //Product-1  
[34.4100,30.0441,30.0004], //Products-2  
[62.2500,50.1225,50.0012], //Prodcut-3  
[149.0000,100.4900,100.0049]]; //Product-4
```

```
secondary_demand = [  
[128.4200,100.2842,100.0028], //Product-5 (Sum of Product-1 & 2)  
[96.6600,80.1666,80.0017], //Product-6 (Sum of Prodcut-2 & 3)  
[211.2500,150.6125,150.0061], //Product-7 (Sum of Prodcut-3 & 4)  
[128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)  
[225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)  
[307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)
```

```
// Setup Profile - II
```

```
setuptime = [10,10,5,5,10,10,15,15,15,15];
```

```
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - I (90%)
```

```
productstagecapacity = [122.2222,355.5556,755.5556];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1
                  [34.4100,30.0441,30.0004,30.0000], //Products-2
                  [62.2500,50.1225,50.0012,50.0000], //Prodcut-3
                  [149.0000,100.4900,100.0049,100.0000]]; //Product-4

secondary_demand = [
    [128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];
```

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

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025], //Product-1
                  [30.2025], //Products-2
                  [50.5625], //Prodcut-3
                  [102.2500]]; //Product-4

secondary_demand = [
    [101.3050], //Product-5 (Sum of Product-1 & 2)
    [80.7650], //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050], //Product-8 (equal to Prodcut-5)
    [182.0700], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
```

```

L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048],      //Product-1
                  [30.2025,30.0046],      //Products-2
                  [50.5625,50.0127],      //Prodcut-3
                  [102.2500,100.0506]];    //Product-4

secondary_demand = [
    [101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172],   //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294], //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};

```

```

allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006],           //Product-1
                  [30.2025,30.0046,30.0001],         //Products-2
                  [50.5625,50.0127,50.0003],         //Prodcut-3
                  [102.2500,100.0506,100.0011]];      //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007],           //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004],             //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014],          //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007],          //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010],          //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};

```



```

family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006,70.0000], //Product-1
                  [30.2025,30.0046,30.0001,30.0000], //Products-2
                  [50.5625,50.0127,50.0003,50.0000], //Prodcut-3
                  [102.2500,100.0506,100.0011,100.0000]]; //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007,100.0000], //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Test Instance-5: TGS2C1D5 (Test General Setup-Profile_2 Capacity-Profile_1 Demand-Series_5)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};

```

```

family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400],      //Product-1
                  [33.2400],      //Products-2
                  [59.0000],      //Prodcut-3
                  [136.0000]];    //Product-4

secondary_demand = [
    [120.8800], //Product-5 (Sum of Product-1 & 2)
    [92.2400],  //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800], //Product-8 (equal to Prodcut-5)
    [213.1200], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};

```

```

family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969],           //Product-1
                  [33.2400,30.0729],           //Products-2
                  [59.0000,50.2025],           //Prodcut-3
                  [136.0000,100.8100]];         //Product-4

secondary_demand = [
    [120.8800,100.4698],           //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754],             //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125],           //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698],           //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452],           //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

```

```

microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969,70.0089],           //Product-1
                  [33.2400,30.0729,30.0016],           //Products-2
                  [59.0000,50.2025,50.0046],           //Prodcut-3
                  [136.0000,100.8100,100.0182]];        //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062],    //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969,70.0089,70.0002], //Product-1
                  [33.2400,30.0729,30.0016,30.0000], //Products-2
                  [59.0000,50.2025,50.0046,50.0001], //Prodcut-3
                  [136.0000,100.8100,100.0182,100.0004]]; //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106,100.0002], //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062,80.0001], //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228,150.0005], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106,100.0002], //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168,180.0004], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290,230.0007]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Test Instance-6: TGS2C1D6 (Test General Setup-Profile_2 Capacity-Profile_1 Demand-Series_6)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

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

```

```

BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225], //Product-1
                  [39.9225],   //Products-2
                  [77.5625],   //Prodcut-3
                  [210.2500]]; //Product-4

secondary_demand = [
    [163.9450], //Product-5 (Sum of Product-1 & 2)
    [117.4850], //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450], //Product-8 (equal to Prodcut-5)
    [281.4300], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155],           //Product-1
                  [39.9225,30.2233],           //Products-2
                  [77.5625,50.6202],           //Prodcut-3
                  [210.2500,102.4806]];         //Product-4

secondary_demand = [
    [163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434], //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388], //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155,70.0273], //Product-1
                  [39.9225,30.2233,30.0050], //Products-2

```

```

[77.5625,50.6202,50.0140],          //Prodcut-3
[210.2500,102.4806,100.0558]];      //Product-4

secondary_demand = [
    [163.9450,101.4388,100.0324],    //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434,80.0190],      //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008,150.0698],    //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388,100.0324],    //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822,180.0513],    //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442,230.0887]];  //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155,70.0273,70.0006],    //Product-1
    [39.9225,30.2233,30.0050,30.0001],                  //Products-2
    [77.5625,50.6202,50.0140,50.0003],                  //Prodcut-3
    [210.2500,102.4806,100.0558,100.0013]];              //Product-4

```



```

secondary_demand = [
    [163.9450,101.4388,100.0324,100.0007], //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434,80.0190,80.0004], //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008,150.0698,150.0016], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388,100.0324,100.0007], //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822,180.0513,180.0012], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442,230.0887,230.0020]]; //Product-10 (Sum of Prodcut-6 & 7)

```

```
// Setup Profile - II
```

```

setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

```
// Capacity Utilization Profile - I (90%)
```

```
productstagecapacity = [122.2222,355.5556,755.5556];
```

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

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```
// Product Demand - Series# 7
```

```

primary_demand = [[71.9600], //Product-1
                  [30.3600], //Products-2
                  [51.0000], //Prodcut-3
                  [104.0000]]; //Product-4

```

```

secondary_demand = [
    [102.3200], //Product-5 (Sum of Product-1 & 2)
    [81.3600], //Product-6 (Sum of Prodcut-2 & 3)

```

```

[155.0000], //Product-7 (Sum of Prodcut-3 & 4)
[102.3200], //Product-8 (equal to Prodcut-5)
[183.6800], //Product-9 (Sum of Prodcut-5 & 6)
[236.3600]]; //Product-10 (Sum of Prodcut-6 & 7)

```

// Setup Profile - II

```

setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

// Capacity Utilization Profile - I (90%)

```

productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

// Product Demand - Series# 7

```

primary_demand = [[71.9600,70.0784], //Product-1
                  [30.3600,30.0144], //Products-2
                  [51.0000,50.0400], //Prodcut-3
                  [104.0000,100.1600]]; //Product-4

```

```

secondary_demand = [
    [102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928], //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

```

```
// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600,70.0784,70.0031], //Product-1
                  [30.3600,30.0144,30.0006], //Products-2
                  [51.0000,50.0400,50.0016], //Prodcut-3
                  [104.0000,100.1600,100.0064]]]; //Product-4

secondary_demand = [
    [102.3200,100.0928,100.0037], //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544,80.0022], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000,150.0080], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928,100.0037], //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472,180.0059], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544,230.0102]]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
```

```
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - I (90%)
```

```
productstagecapacity = [122.2222,355.5556,755.5556];
```

Model-4 Data:

```
FP = 4;
```

```
RP = 10;
```

```
J = 10;
```

```
L = 3;
```

```
T = 4;
```

```
S = 12;
```

```
allproductsonstage1 = {8,9,10};
```

```
allproductsonstage2 = {5,6,7};
```

```
allproductsonstage3 = {1,2,3,4};
```

```
family1stage1 = {8,9};
```

```
family2stage1 = {9,10};
```

```
family3stage1 = {10};
```

```
family1stage2 = {5};
```

```
family2stage2 = {6};
```

```
family3stage2 = {7};
```

```
family1stage3 = {1,2};
```

```
family2stage3 = {2,3};
```

```
family3stage3 = {3,4};
```

```
microperiods1tomacroperiod = {1,2,3};
```

```
microperiods2tomacroperiod = {4,5,6};
```

```
microperiods3tomacroperiod = {7,8,9};
```

```
microperiods4tomacroperiod = {10,11,12};
```

```
min_lotsize = 1;
```

```
production_cost = 1;
```

```
production_time = 1;
```

```
standby_cost = 1;
```

```
BOM = 1;
```

```
BigM = 10000;
```

```
holdingcost = [4,7,6,3,3,3,2,1,1,1];
```

```
// Product Demand - Series# 7
```

```
primary_demand = [[71.9600,70.0784,70.0031,70.0001], //Product-1  
                  [30.3600,30.0144,30.0006,30.0000], //Products-2  
                  [51.0000,50.0400,50.0016,50.0001], //Prodcut-3  
                  [104.0000,100.1600,100.0064,100.0003]]; //Product-4
```

```
secondary_demand = [  
    [102.3200,100.0928,100.0037,100.0001], //Product-5 (Sum of Product-1 & 2)  
    [81.3600,80.0544,80.0022,80.0001], //Product-6 (Sum of Prodcut-2 & 3)  
    [155.0000,150.2000,150.0080,150.0003], //Product-7 (Sum of Prodcut-3 & 4)  
    [102.3200,100.0928,100.0037,100.0001], //Product-8 (equal to Prodcut-5)  
    [183.6800,180.1472,180.0059,180.0002], //Product-9 (Sum of Prodcut-5 & 6)  
    [236.3600,230.2544,230.0102,230.0004]]; //Product-10 (Sum of Prodcut-6 & 7)
```

```
// Setup Profile - II
```

```
setuptime = [10,10,5,5,10,10,15,15,15,15];
```

```
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];
```

Test Instance-8: TGS2C1D8 (Test General Setup-Profile_2 Capacity-Profile_1 Demand-Series_8)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];
```

```
// Product Demand - Series# 8
primary_demand = [[101.3600], //Product-1
                  [35.7600],  //Products-2
                  [66.0000],  //Prodcut-3
                  [164.0000]]; //Product-4
```

```
secondary_demand = [
    [137.1200], //Product-5 (Sum of Product-1 & 2)
    [101.7600], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200], //Product-8 (equal to Prodcut-5)
    [238.8800], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)
```

```
// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];
```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544],           //Product-1
                  [35.7600,30.2304],           //Products-2
                  [66.0000,50.6400],           //Prodcut-3
                  [164.0000,102.5600]];         //Product-4

secondary_demand = [
    [137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704],  //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;

```

```

T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.0502],           //Product-1
                  [35.7600,30.2304,30.0092],           //Products-2
                  [66.0000,50.6400,50.0256],           //Prodcut-3
                  [164.0000,102.5600,100.1024]]];       //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594],           //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348],           //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280],           //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594],           //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942],           //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628]]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};

```

```

allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1
                  [35.7600,30.2304,30.0092,30.0004], //Products-2
                  [66.0000,50.6400,50.0256,50.0010], //Prodcut-3
                  [164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Test Instance-9: TGS2C1D9 (Test General Setup-Profile_2 Capacity-Profile_1 Demand-Series_9)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};

```



```

allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400], //Product-1
                  [47.6400], //Products-2
                  [99.0000], //Prodcut-3
                  [296.0000]]; //Product-4

secondary_demand = [
    [213.6800], //Product-5 (Sum of Product-1 & 2)
    [146.6400], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800], //Product-8 (equal to Prodcut-5)
    [360.3200], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};

```

```

family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416],           //Product-1
                  [47.6400,30.7056],           //Products-2
                  [99.0000,51.9600],           //Prodcut-3
                  [296.0000,107.8400]];        //Product-4

secondary_demand = [
    [213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656],  //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};

```

```

family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537],      //Product-1
                  [47.6400,30.7056,30.0282],      //Products-2
                  [99.0000,51.9600,50.0784],      //Prodcut-3
                  [296.0000,107.8400,100.3136]]];

secondary_demand = [
    [213.6800,104.5472,100.1819],      //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066],      //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920],      //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819],      //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885],      //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986]]];

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

```

```

microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1
                  [47.6400,30.7056,30.0282,30.0011], //Products-2
                  [99.0000,51.9600,50.0784,50.0031], //Prodcut-3
                  [296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary_demand = [
    [213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)
productstagecapacity = [122.2222,355.5556,755.5556];

```

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

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;

```

```

production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900],           //Product-1
                  [30.0900],           //Products-2
                  [50.2500],           //Prodcut-3
                  [101.0000]];          //Product-4

secondary_demand = [
    [100.5800], //Product-5 (Sum of Product-1 & 2)
    [80.3400],  //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800], //Product-8 (equal to Prodcut-5)
    [180.9200], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

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

```

```

BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049],           //Product-1
                  [30.0900,30.0009],           //Products-2
                  [50.2500,50.0025],           //Prodcut-3
                  [101.0000,100.0100]];         //Product-4

secondary_demand = [
    [100.5800,100.0058],           //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034],             //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125],           //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058],           //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092],           //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000],           //Product-1
                  [30.0900,30.0009,30.0000],           //Products-2
                  [50.2500,50.0025,50.0000],           //Prodcut-3
                  [101.0000,100.0100,100.0001]];        //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000],    //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000], //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1

```

```

[30.0900,30.0009,30.0000,30.0000],      //Products-2
[50.2500,50.0025,50.0000,50.0000],      //Prodcut-3
[101.0000,100.0100,100.0001,100.0000]];  //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000,80.0000],    //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

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

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400],           //Product-1
                  [31.4400],           //Products-2
                  [54.0000],           //Prodcut-3
                  [116.0000]];         //Product-4

```



```

secondary_demand = [
    [109.2800], //Product-5 (Sum of Product-1 & 2)
    [85.4400], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800], //Product-8 (equal to Prodcut-5)
    [194.7200], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

```

// Setup Profile - II

```

setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

// Capacity Utilization Profile - II (70%)

```

productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

// Product Demand - Series# 2

```

primary_demand = [[77.8400,70.0784], //Product-1
                  [31.4400,30.0144], //Products-2
                  [54.0000,50.0040], //Prodcut-3
                  [116.0000,100.1600]]; //Product-4

```

```

secondary_demand = [
    [109.2800,100.0928], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

```

```

[109.2800,100.0928], //Product-8 (equal to Prodcut-5)
[194.7200,180.1472], //Product-9 (Sum of Prodcut-5 & 6)
[255.4400,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

```

// Setup Profile - II

```

setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

// Capacity Utilization Profile - II (70%)

```

productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

// Product Demand - Series# 2

```

primary_demand = [[77.8400,70.0784,70.0008], //Product-1
                  [31.4400,30.0144,30.0001], //Products-2
                  [54.0000,50.0040,50.0004], //Prodcut-3
                  [116.0000,100.1600,100.0016]]; //Product-4

```

secondary_demand = [

```

[109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)
[85.4400,80.0544,80.0005], //Product-6 (Sum of Prodcut-2 & 3)
[170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)
[109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)
[194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)
[255.4400,230.2544,230.0025]]; //Product-10 (Sum of Prodcut-6 & 7)

```

```
// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
```

```
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];
```

// Product Demand - Series# 2

```
primary_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1
                  [31.4400,30.0144,30.0001,30.0000], //Products-2
                  [54.0000,50.0040,50.0004,50.0000], //Prodcut-3
                  [116.0000,100.1600,100.0016,100.0000]]; //Product-4

secondary_demand = [
    [109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000,150.0020,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928,100.0009,100.0000], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472,180.0015,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544,230.0025,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)
```

```
// Setup Profile - II
```

```

setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

```

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Test Instance-12: TGS2C2D3 (Test General Setup-Profile_2 Capacity-Profile_2 Demand-Series_3)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 3
primary_demand = [[94.0100],      //Product-1
                  [34.4100],      //Products-2
                  [62.2500],      //Prodcut-3
                  [149.0000]];    //Product-4

```

```

secondary_demand = [
    [128.4200], //Product-5 (Sum of Product-1 & 2)
    [96.6600],  //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200], //Product-8 (equal to Prodcut-5)
    [225.0800], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100]]; //Product-10 (Sum of Prodcut-6 & 7)

```

```

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

```

// Capacity Utilization Profile - II (70%)

```

```
productstagecapacity = [157.1429,457.1429,971.4286];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401],           //Product-1
                  [34.4100,30.0441],           //Products-2
                  [62.2500,50.1225],           //Prodcut-3
                  [149.0000,100.4900]];         //Product-4

secondary_demand = [
    [128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666],   //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842], //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];
```

Model-3 Data:

```
FP = 4;
```

```

RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401,70.0024],           //Product-1
                  [34.4100,30.0441,30.0004],           //Products-2
                  [62.2500,50.1225,50.0012],           //Prodcut-3
                  [149.0000,100.4900,100.0049]];        //Product-4

secondary_demand = [
                  [128.4200,100.2842,100.0028],         //Product-5 (Sum of Product-1 & 2)
                  [96.6600,80.1666,80.0017],           //Product-6 (Sum of Prodcut-2 & 3)
                  [211.2500,150.6125,150.0061],         //Product-7 (Sum of Prodcut-3 & 4)
                  [128.4200,100.2842,100.0028],         //Product-8 (equal to Prodcut-5)
                  [225.0800,180.4508,180.0045],         //Product-9 (Sum of Prodcut-5 & 6)
                  [307.9100,230.7791,230.0078]];        //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;

```

```

T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1
                  [34.4100,30.0441,30.0004,30.0000], //Products-2
                  [62.2500,50.1225,50.0012,50.0000], //Prodcut-3
                  [149.0000,100.4900,100.0049,100.0000]]; //Product-4

secondary_demand = [
    [128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Test Instance-13: TGS2C2D4 (Test General Setup-Profile_2 Capacity-Profile_2 Demand-Series_4)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;

```

```

S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025],      //Product-1
                  [30.2025],      //Products-2
                  [50.5625],      //Prodcut-3
                  [102.2500]];    //Product-4

secondary_demand = [
    [101.3050], //Product-5 (Sum of Product-1 & 2)
    [80.7650],  //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050], //Product-8 (equal to Prodcut-5)
    [182.0700], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};

```



```

family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048],      //Product-1
                  [30.2025,30.0046],      //Products-2
                  [50.5625,50.0127],      //Prodcut-3
                  [102.2500,100.0506]];    //Product-4

secondary_demand = [
    [101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172],   //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294], //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};

```

```

family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006],           //Product-1
                  [30.2025,30.0046,30.0001],         //Products-2
                  [50.5625,50.0127,50.0003],         //Prodcut-3
                  [102.2500,100.0506,100.0011]];      //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007],           //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004],             //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014],          //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007],          //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010],          //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};

```

```

family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006,70.0000], //Product-1
                  [30.2025,30.0046,30.0001,30.0000], //Products-2
                  [50.5625,50.0127,50.0003,50.0000], //Prodcut-3
                  [102.2500,100.0506,100.0011,100.0000]]; //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007,100.0000], //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Test Instance-14: TGS2C2D5 (Test General Setup-Profile_2 Capacity-Profile_2 Demand-Series_5)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};

```

```

microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400],      //Product-1
                  [33.2400],      //Products-2
                  [59.0000],      //Prodcut-3
                  [136.0000]];    //Product-4

secondary_demand = [
    [120.8800], //Product-5 (Sum of Product-1 & 2)
    [92.2400],  //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800], //Product-8 (equal to Prodcut-5)
    [213.1200], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;

```

```

production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969],           //Product-1
                  [33.2400,30.0729],           //Products-2
                  [59.0000,50.2025],           //Prodcut-3
                  [136.0000,100.8100]];         //Product-4

secondary_demand = [
    [120.8800,100.4698],           //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754],           //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125],          //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698],          //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452],          //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

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

```

```

BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969,70.0089],           //Product-1
                  [33.2400,30.0729,30.0016],           //Products-2
                  [59.0000,50.2025,50.0046],           //Prodcut-3
                  [136.0000,100.8100,100.0182]];        //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062],    //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969,70.0089,70.0002],      //Product-1
                  [33.2400,30.0729,30.0016,30.0000],      //Products-2
                  [59.0000,50.2025,50.0046,50.0001],      //Prodcut-3
                  [136.0000,100.8100,100.0182,100.0004]];  //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106,100.0002],      //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062,80.0001],         //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228,150.0005],     //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106,100.0002],     //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168,180.0004],     //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290,230.0007]];    //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Test Instance-15: TGS2C2D6 (Test General Setup-Profile_2 Capacity-Profile_2 Demand-Series_6)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225],      //Product-1
                  [39.9225],       //Products-2

```

```

                [77.5625],          //Prodcut-3
                [210.2500]];        //Product-4

secondary_demand = [
    [163.9450], //Product-5 (Sum of Product-1 & 2)
    [117.4850], //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450], //Product-8 (equal to Prodcut-5)
    [281.4300], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155], //Product-1
                  [39.9225,30.2233],   //Products-2
                  [77.5625,50.6202],   //Prodcut-3
                  [210.2500,102.4806]]; //Product-4

secondary_demand = [

```



```

[163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)
[117.4850,80.8434], //Product-6 (Sum of Prodcut-2 & 3)
[287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)
[163.9450,101.4388], //Product-8 (equal to Prodcut-5)
[281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)
[405.2975,233.9442]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155,70.0273], //Product-1
[39.9225,30.2233,30.0050], //Products-2
[77.5625,50.6202,50.0140], //Prodcut-3
[210.2500,102.4806,100.0558]]; //Product-4

secondary_demand = [
[163.9450,101.4388,100.0324], //Product-5 (Sum of Product-1 & 2)
[117.4850,80.8434,80.0190], //Product-6 (Sum of Prodcut-2 & 3)
[287.8125,153.1008,150.0698], //Product-7 (Sum of Prodcut-3 & 4)

```

```

[163.9450,101.4388,100.0324], //Product-8 (equal to Prodcut-5)
[281.4300,182.2822,180.0513], //Product-9 (Sum of Prodcut-5 & 6)
[405.2975,233.9442,230.0887]]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155,70.0273,70.0006], //Product-1
[39.9225,30.2233,30.0050,30.0001], //Products-2
[77.5625,50.6202,50.0140,50.0003], //Prodcut-3
[210.2500,102.4806,100.0558,100.0013]]]; //Product-4

secondary_demand = [
[163.9450,101.4388,100.0324,100.0007], //Product-5 (Sum of Product-1 & 2)
[117.4850,80.8434,80.0190,80.0004], //Product-6 (Sum of Prodcut-2 & 3)
[287.8125,153.1008,150.0698,150.0016], //Product-7 (Sum of Prodcut-3 & 4)
[163.9450,101.4388,100.0324,100.0007], //Product-8 (equal to Prodcut-5)
[281.4300,182.2822,180.0513,180.0012], //Product-9 (Sum of Prodcut-5 & 6)

```

```
[405.2975,233.9442,230.0887,230.0020]]]; //Product-10 (Sum of Prodcut-6 & 7)
```

```
// Setup Profile - II
```

```
setuptime = [10,10,5,5,10,10,15,15,15,15];  
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - II (70%)
```

```
productstagecapacity = [157.1429,457.1429,971.4286];
```

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

Model-1 Data:

```
FP = 4;  
RP = 10;  
J = 10;  
L = 3;  
T = 1;  
S = 3;  
allproductsonstage1 = {8,9,10};  
allproductsonstage2 = {5,6,7};  
allproductsonstage3 = {1,2,3,4};  
family1stage1 = {8,9};  
family2stage1 = {9,10};  
family3stage1 = {10};  
family1stage2 = {5};  
family2stage2 = {6};  
family3stage2 = {7};  
family1stage3 = {1,2};  
family2stage3 = {2,3};  
family3stage3 = {3,4};  
microperiodstomacroperiod = {1,2,3};
```

```
min_lotsize = 1;  
production_cost = 1;  
production_time = 1;  
standby_cost = 1;  
BOM = 1;  
BigM = 10000;  
holdingcost = [4,7,6,3,3,3,2,1,1,1];
```

```
// Product Demand - Series# 7
```

```
primary_demand = [[71.9600], //Product-1  
[30.3600], //Products-2  
[51.0000], //Prodcut-3  
[104.0000]]; //Product-4
```

```
secondary_demand = [  
[102.3200], //Product-5 (Sum of Product-1 & 2)  
[81.3600], //Product-6 (Sum of Prodcut-2 & 3)  
[155.0000], //Product-7 (Sum of Prodcut-3 & 4)  
[102.3200], //Product-8 (equal to Prodcut-5)  
[183.6800], //Product-9 (Sum of Prodcut-5 & 6)  
[236.3600]]; //Product-10 (Sum of Prodcut-6 & 7)
```

```
// Setup Profile - II
```

```
setuptime = [10,10,5,5,10,10,15,15,15,15];
```

```
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - II (70%)
```

```
productstagecapacity = [157.1429,457.1429,971.4286];
```

Model-2 Data:

```
FP = 4;
```

```
RP = 10;
```

```
J = 10;
```

```
L = 3;
```

```
T = 2;
```

```
S = 6;
```

```
allproductsonstage1 = {8,9,10};
```

```
allproductsonstage2 = {5,6,7};
```

```
allproductsonstage3 = {1,2,3,4};
```

```
family1stage1 = {8,9};
```

```
family2stage1 = {9,10};
```

```
family3stage1 = {10};
```

```
family1stage2 = {5};
```

```
family2stage2 = {6};
```

```
family3stage2 = {7};
```

```
family1stage3 = {1,2};
```

```
family2stage3 = {2,3};
```

```
family3stage3 = {3,4};
```

```
microperiods1tomacroperiod = {1,2,3};
```

```
microperiods2tomacroperiod = {4,5,6};
```

```
min_lotsize = 1;
```

```
production_cost = 1;
```

```
production_time = 1;
```

```
standby_cost = 1;
```

```
BOM = 1;
```

```
BigM = 10000;
```

```
holdingcost = [4,7,6,3,3,3,2,1,1,1];
```

```
// Product Demand - Series# 7
```

```
primary_demand = [[71.9600,70.0784],           //Product-1  
                  [30.3600,30.0144],           //Products-2  
                  [51.0000,50.0400],           //Prodcut-3  
                  [104.0000,100.1600]];        //Product-4
```

```
secondary_demand = [  
    [102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)  
    [81.3600,80.0544],   //Product-6 (Sum of Prodcut-2 & 3)  
    [155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)  
    [102.3200,100.0928], //Product-8 (equal to Prodcut-5)  
    [183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)  
    [236.3600,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)
```

```
// Setup Profile - II
```

```
setuptime = [10,10,5,5,10,10,15,15,15,15];
```

```
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - II (70%)
```

```
productstagecapacity = [157.1429,457.1429,971.4286];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600,70.0784,70.0031],           //Product-1
                  [30.3600,30.0144,30.0006],           //Products-2
                  [51.0000,50.0400,50.0016],           //Prodcut-3
                  [104.0000,100.1600,100.0064]];        //Product-4

secondary_demand = [
    [102.3200,100.0928,100.0037],           //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544,80.0022],             //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000,150.0080],           //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928,100.0037],           //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472,180.0059],           //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544,230.0102]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600,70.0784,70.0031,70.0001], //Product-1
                  [30.3600,30.0144,30.0006,30.0000], //Products-2
                  [51.0000,50.0400,50.0016,50.0001], //Prodcut-3
                  [104.0000,100.1600,100.0064,100.0003]]; //Product-4

secondary_demand = [
    [102.3200,100.0928,100.0037,100.0001], //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544,80.0022,80.0001], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000,150.0080,150.0003], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928,100.0037,100.0001], //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472,180.0059,180.0002], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544,230.0102,230.0004]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];
```

Test Instance-17: TGS2C2D8 (Test General Setup-Profile_2 Capacity-Profile_2 Demand-Series_8)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600], //Product-1
                  [35.7600],   //Products-2
                  [66.0000],   //Prodcut-3
                  [164.0000]]; //Product-4

secondary_demand = [
    [137.1200], //Product-5 (Sum of Product-1 & 2)
    [101.7600], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200], //Product-8 (equal to Prodcut-5)
    [238.8800], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
```

```

L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544], //Product-1
                  [35.7600,30.2304], //Products-2
                  [66.0000,50.6400], //Prodcut-3
                  [164.0000,102.5600]]; //Product-4

secondary_demand = [
    [137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};

```



```

allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.0502],      //Product-1
                  [35.7600,30.2304,30.0092],      //Products-2
                  [66.0000,50.6400,50.0256],      //Prodcut-3
                  [164.0000,102.5600,100.1024]];   //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594],      //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348],      //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280],      //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594],      //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942],      //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628]];   //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};

```

```

family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1
                  [35.7600,30.2304,30.0092,30.0004], //Products-2
                  [66.0000,50.6400,50.0256,50.0010], //Prodcut-3
                  [164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Test Instance-18: TGS2C2D9 (Test General Setup-Profile_2 Capacity-Profile_2 Demand-Series_9)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};

```

```

family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400], //Product-1
                  [47.6400],   //Products-2
                  [99.0000],   //Prodcut-3
                  [296.0000]]; //Product-4

secondary_demand = [
    [213.6800], //Product-5 (Sum of Product-1 & 2)
    [146.6400], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800], //Product-8 (equal to Prodcut-5)
    [360.3200], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};

```

```

family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416],           //Product-1
                  [47.6400,30.7056],           //Products-2
                  [99.0000,51.9600],           //Prodcut-3
                  [296.0000,107.8400]];        //Product-4

secondary_demand = [
    [213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656],  //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

```

```

microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537],      //Product-1
                  [47.6400,30.7056,30.0282],      //Products-2
                  [99.0000,51.9600,50.0784],      //Prodcut-3
                  [296.0000,107.8400,100.3136]];    //Product-4

secondary_demand = [
    [213.6800,104.5472,100.1819],    //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066],      //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920],    //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819],    //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885],    //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986]];   //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1
                  [47.6400,30.7056,30.0282,30.0011], //Products-2
                  [99.0000,51.9600,50.0784,50.0031], //Prodcut-3
                  [296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary_demand = [
    [213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)
productstagecapacity = [157.1429,457.1429,971.4286];

```

Test Instance-19: TGS2C3D1 (Test General Setup-Profile_2 Capacity-Profile_3 Demand-Series_1)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

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

```

```

BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900], //Product-1
                  [30.0900], //Products-2
                  [50.2500], //Prodcut-3
                  [101.0000]]; //Product-4

secondary_demand = [
    [100.5800], //Product-5 (Sum of Product-1 & 2)
    [80.3400], //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800], //Product-8 (equal to Prodcut-5)
    [180.9200], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049],           //Product-1
                  [30.0900,30.0009],           //Products-2
                  [50.2500,50.0025],           //Prodcut-3
                  [101.0000,100.0100]];         //Product-4

secondary_demand = [
    [100.5800,100.0058], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034],   //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058], //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000], //Product-1
                  [30.0900,30.0009,30.0000], //Products-2

```



```

                [50.2500,50.0025,50.0000],           //Prodcut-3
                [101.0000,100.0100,100.0001]];        //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000],    //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000], //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1
                  [30.0900,30.0009,30.0000,30.0000], //Products-2
                  [50.2500,50.0025,50.0000,50.0000], //Prodcut-3
                  [101.0000,100.0100,100.0001,100.0000]]; //Product-4

```

```

secondary_demand = [
    [100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];

```

Test Instance-20: TGS2C3D2 (Test General Setup-Profile_2 Capacity-Profile_3 Demand-Series_2)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400], //Product-1
                  [31.4400], //Products-2
                  [54.0000], //Prodcut-3
                  [116.0000]]; //Product-4

secondary_demand = [
    [109.2800], //Product-5 (Sum of Product-1 & 2)
    [85.4400], //Product-6 (Sum of Prodcut-2 & 3)

```

```

[170.0000], //Product-7 (Sum of Prodcut-3 & 4)
[109.2800], //Product-8 (equal to Prodcut-5)
[194.7200], //Product-9 (Sum of Prodcut-5 & 6)
[255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

```

// Setup Profile - II

```

setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

// Capacity Utilization Profile - III (50%)

```

productstagecapacity = [220.0000,640.0000,1360.0000];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

// Product Demand - Series# 2

```

primary_demand = [[77.8400,70.0784], //Product-1
                  [31.4400,30.0144], //Products-2
                  [54.0000,50.0040], //Prodcut-3
                  [116.0000,100.1600]]; //Product-4

```

```

secondary_demand = [
    [109.2800,100.0928], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

```

```
// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784,70.0008], //Product-1
                  [31.4400,30.0144,30.0001], //Products-2
                  [54.0000,50.0040,50.0004], //Prodcut-3
                  [116.0000,100.1600,100.0016]]; //Product-4

secondary_demand = [
    [109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544,80.0005], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544,230.0025]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
```

```

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

// Product Demand - Series# 2

```

primary_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1
                  [31.4400,30.0144,30.0001,30.0000], //Products-2
                  [54.0000,50.0040,50.0004,50.0000], //Prodcut-3
                  [116.0000,100.1600,100.0016,100.0000]]; //Product-4

secondary_demand = [
    [109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000,150.0020,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928,100.0009,100.0000], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472,180.0015,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544,230.0025,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

```

// Setup Profile - II

```

setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

```
// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];
```

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

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];
```

```
// Product Demand - Series# 3
primary_demand = [[94.0100],      //Product-1
                  [34.4100],      //Products-2
                  [62.2500],      //Prodcut-3
                  [149.0000]];     //Product-4
```

```
secondary_demand = [
    [128.4200], //Product-5 (Sum of Product-1 & 2)
    [96.6600],  //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200], //Product-8 (equal to Prodcut-5)
    [225.0800], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100]]; //Product-10 (Sum of Prodcut-6 & 7)
```

```
// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401],           //Product-1
                  [34.4100,30.0441],           //Products-2
                  [62.2500,50.1225],           //Prodcut-3
                  [149.0000,100.4900]];        //Product-4

secondary_demand = [
    [128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666],   //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842], //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
```

```

L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401,70.0024],           //Product-1
                  [34.4100,30.0441,30.0004],           //Products-2
                  [62.2500,50.1225,50.0012],           //Prodcut-3
                  [149.0000,100.4900,100.0049]]];       //Product-4

secondary_demand = [
    [128.4200,100.2842,100.0028],           //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666,80.0017],             //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125,150.0061],           //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842,100.0028],           //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508,180.0045],           //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791,230.0078]]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;

```



```

allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1
                  [34.4100,30.0441,30.0004,30.0000], //Products-2
                  [62.2500,50.1225,50.0012,50.0000], //Prodcut-3
                  [149.0000,100.4900,100.0049,100.0000]]; //Product-4

secondary_demand = [
    [128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];

```

Test Instance-22: TGS2C3D4 (Test General Setup-Profile_2 Capacity-Profile_3 Demand-Series_4)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};

```

```

allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025],      //Product-1
                  [30.2025],      //Products-2
                  [50.5625],      //Prodcut-3
                  [102.2500]];    //Product-4

secondary_demand = [
    [101.3050], //Product-5 (Sum of Product-1 & 2)
    [80.7650],  //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050], //Product-8 (equal to Prodcut-5)
    [182.0700], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};

```

```

family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048], //Product-1
                  [30.2025,30.0046], //Products-2
                  [50.5625,50.0127], //Prodcut-3
                  [102.2500,100.0506]]; //Product-4

secondary_demand = [
    [101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172], //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294], //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};

```

```

family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006],           //Product-1
                  [30.2025,30.0046,30.0001],         //Products-2
                  [50.5625,50.0127,50.0003],         //Prodcut-3
                  [102.2500,100.0506,100.0011]];      //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007],           //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004],             //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014],          //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007],          //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010],          //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

```

```

microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006,70.0000], //Product-1
                  [30.2025,30.0046,30.0001,30.0000], //Products-2
                  [50.5625,50.0127,50.0003,50.0000], //Prodcut-3
                  [102.2500,100.0506,100.0011,100.0000]]; //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007,100.0000], //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];

```

Test Instance-23: TGS2C3D5 (Test General Setup-Profile_2 Capacity-Profile_3 Demand-Series_5)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400],      //Product-1
                  [33.2400],      //Products-2
                  [59.0000],      //Prodcut-3
                  [136.0000]];    //Product-4

secondary_demand = [
    [120.8800], //Product-5 (Sum of Product-1 & 2)
    [92.2400],  //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800], //Product-8 (equal to Prodcut-5)
    [213.1200], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

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

```

```

BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969],           //Product-1
                  [33.2400,30.0729],           //Products-2
                  [59.0000,50.2025],           //Prodcut-3
                  [136.0000,100.8100]];         //Product-4

secondary_demand = [
    [120.8800,100.4698],           //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754],           //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125],          //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698],          //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452],          //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969,70.0089],           //Product-1
                  [33.2400,30.0729,30.0016],           //Products-2
                  [59.0000,50.2025,50.0046],           //Prodcut-3
                  [136.0000,100.8100,100.0182]];         //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062],    //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 5

```



```

primary_demand = [[87.6400,70.3969,70.0089,70.0002],      //Product-1
                  [33.2400,30.0729,30.0016,30.0000],      //Products-2
                  [59.0000,50.2025,50.0046,50.0001],      //Prodcut-3
                  [136.0000,100.8100,100.0182,100.0004]];  //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106,100.0002],      //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062,80.0001],         //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228,150.0005],     //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106,100.0002],     //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168,180.0004],     //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290,230.0007]];     //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];

```

Test Instance-24: TGS2C3D6 (Test General Setup-Profile_2 Capacity-Profile_3 Demand-Series_6)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225],      //Product-1
                  [39.9225],       //Products-2
                  [77.5625],       //Prodcut-3
                  [210.2500]];     //Product-4

```

```

secondary_demand = [
    [163.9450], //Product-5 (Sum of Product-1 & 2)
    [117.4850], //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450], //Product-8 (equal to Prodcut-5)
    [281.4300], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

```

// Setup Profile - II

```

setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

// Capacity Utilization Profile - III (50%)

```

productstagecapacity = [220.0000,640.0000,1360.0000];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

// Product Demand - Series# 6

```

primary_demand = [[124.0225,71.2155], //Product-1
    [39.9225,30.2233], //Products-2
    [77.5625,50.6202], //Prodcut-3
    [210.2500,102.4806]]; //Product-4

```

```

secondary_demand = [
    [163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434], //Product-6 (Sum of Prodcut-2 & 3)

```

```

[287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)
[163.9450,101.4388], //Product-8 (equal to Prodcut-5)
[281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)
[405.2975,233.9442]]]; //Product-10 (Sum of Prodcut-6 & 7)

```

// Setup Profile - II

```

setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

// Capacity Utilization Profile - III (50%)

```

productstagecapacity = [220.0000,640.0000,1360.0000];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

// Product Demand - Series# 6

```

primary_demand = [[124.0225,71.2155,70.0273], //Product-1
                  [39.9225,30.2233,30.0050], //Products-2
                  [77.5625,50.6202,50.0140], //Prodcut-3
                  [210.2500,102.4806,100.0558]]]; //Product-4

```

```

secondary_demand = [
    [163.9450,101.4388,100.0324], //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434,80.0190], //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008,150.0698], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388,100.0324], //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822,180.0513], //Product-9 (Sum of Prodcut-5 & 6)

```

```
[405.2975,233.9442,230.0887]]]; //Product-10 (Sum of Prodcut-6 & 7)
```

```
// Setup Profile - II
```

```
setuptime = [10,10,5,5,10,10,15,15,15,15];  
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - III (50%)
```

```
productstagecapacity = [220.0000,640.0000,1360.0000];
```

Model-4 Data:

```
FP = 4;  
RP = 10;  
J = 10;  
L = 3;  
T = 4;  
S = 12;  
allproductsonstage1 = {8,9,10};  
allproductsonstage2 = {5,6,7};  
allproductsonstage3 = {1,2,3,4};  
family1stage1 = {8,9};  
family2stage1 = {9,10};  
family3stage1 = {10};  
family1stage2 = {5};  
family2stage2 = {6};  
family3stage2 = {7};  
family1stage3 = {1,2};  
family2stage3 = {2,3};  
family3stage3 = {3,4};  
microperiods1tomacroperiod = {1,2,3};  
microperiods2tomacroperiod = {4,5,6};  
microperiods3tomacroperiod = {7,8,9};  
microperiods4tomacroperiod = {10,11,12};
```

```
min_lotsize = 1;  
production_cost = 1;  
production_time = 1;  
standby_cost = 1;  
BOM = 1;  
BigM = 10000;  
holdingcost = [4,7,6,3,3,3,2,1,1,1];
```

```
// Product Demand - Series# 6
```

```
primary_demand = [[124.0225,71.2155,70.0273,70.0006], //Product-1  
[39.9225,30.2233,30.0050,30.0001], //Products-2  
[77.5625,50.6202,50.0140,50.0003], //Prodcut-3  
[210.2500,102.4806,100.0558,100.0013]]]; //Product-4
```

```
secondary_demand = [  
[163.9450,101.4388,100.0324,100.0007], //Product-5 (Sum of Product-1 & 2)  
[117.4850,80.8434,80.0190,80.0004], //Product-6 (Sum of Prodcut-2 & 3)  
[287.8125,153.1008,150.0698,150.0016], //Product-7 (Sum of Prodcut-3 & 4)  
[163.9450,101.4388,100.0324,100.0007], //Product-8 (equal to Prodcut-5)  
[281.4300,182.2822,180.0513,180.0012], //Product-9 (Sum of Prodcut-5 & 6)  
[405.2975,233.9442,230.0887,230.0020]]]; //Product-10 (Sum of Prodcut-6 & 7)
```

```
// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];
```

Test Instance-25: TGS2C3D7 (Test General Setup-Profile_2 Capacity-Profile_3 Demand-Series_7)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600], //Product-1
                  [30.3600], //Products-2
                  [51.0000], //Prodcut-3
                  [104.0000]]; //Product-4

secondary_demand = [
    [102.3200], //Product-5 (Sum of Product-1 & 2)
    [81.3600], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200], //Product-8 (equal to Prodcut-5)
    [183.6800], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
```

```
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];
```

// Product Demand - Series# 7

```
primary_demand = [[71.9600,70.0784], //Product-1
                  [30.3600,30.0144], //Products-2
                  [51.0000,50.0400], //Prodcut-3
                  [104.0000,100.1600]]; //Product-4

secondary_demand = [
    [102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928], //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)
```

// Setup Profile - II

```
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

// Capacity Utilization Profile - III (50%)

```
productstagecapacity = [220.0000,640.0000,1360.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600,70.0784,70.0031],           //Product-1
                  [30.3600,30.0144,30.0006],           //Products-2
                  [51.0000,50.0400,50.0016],           //Prodcut-3
                  [104.0000,100.1600,100.0064]];        //Product-4

secondary_demand = [
    [102.3200,100.0928,100.0037],           //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544,80.0022],             //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000,150.0080],           //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928,100.0037],           //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472,180.0059],           //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544,230.0102]];          //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];
```

Model-4 Data:

```
FP = 4;
RP = 10;
```

```

J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600,70.0784,70.0031,70.0001],           //Product-1
                  [30.3600,30.0144,30.0006,30.0000],           //Products-2
                  [51.0000,50.0400,50.0016,50.0001],           //Prodcut-3
                  [104.0000,100.1600,100.0064,100.0003]];       //Product-4

secondary_demand = [
    [102.3200,100.0928,100.0037,100.0001],           //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544,80.0022,80.0001],               //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000,150.0080,150.0003],           //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928,100.0037,100.0001],           //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472,180.0059,180.0002],           //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544,230.0102,230.0004]];           //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];

```


Test Instance-26: TGS2C3D8 (Test General Setup-Profile_2 Capacity-Profile_3 Demand-Series_8)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600], //Product-1
                  [35.7600],   //Products-2
                  [66.0000],   //Prodcut-3
                  [164.0000]]; //Product-4

secondary_demand = [
    [137.1200], //Product-5 (Sum of Product-1 & 2)
    [101.7600], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200], //Product-8 (equal to Prodcut-5)
    [238.8800], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544],           //Product-1
                  [35.7600,30.2304],           //Products-2
                  [66.0000,50.6400],           //Prodcut-3
                  [164.0000,102.5600]];        //Product-4

secondary_demand = [
    [137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704],  //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.0502],           //Product-1
                  [35.7600,30.2304,30.0092],           //Products-2
                  [66.0000,50.6400,50.0256],           //Prodcut-3
                  [164.0000,102.5600,100.1024]];        //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594],           //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348],           //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280],           //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594],           //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942],           //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1
                  [35.7600,30.2304,30.0092,30.0004], //Products-2
                  [66.0000,50.6400,50.0256,50.0010], //Prodcut-3
                  [164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];
```

Test Instance-27: TGS2C3D9 (Test General Setup-Profile_2 Capacity-Profile_3 Demand-Series_9)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400], //Product-1
                  [47.6400], //Products-2
                  [99.0000], //Prodcut-3
                  [296.0000]]; //Product-4

secondary_demand = [
    [213.6800], //Product-5 (Sum of Product-1 & 2)
    [146.6400], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800], //Product-8 (equal to Prodcut-5)
    [360.3200], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
```

```

L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416], //Product-1
                  [47.6400,30.7056], //Products-2
                  [99.0000,51.9600], //Prodcut-3
                  [296.0000,107.8400]]; //Product-4

secondary_demand = [
    [213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};

```

```

allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537],      //Product-1
                  [47.6400,30.7056,30.0282],      //Products-2
                  [99.0000,51.9600,50.0784],      //Prodcut-3
                  [296.0000,107.8400,100.3136]];    //Product-4

secondary_demand = [
    [213.6800,104.5472,100.1819],    //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066],      //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920],    //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819],    //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885],    //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986]];    //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};

```

```

family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1
                  [47.6400,30.7056,30.0282,30.0011], //Products-2
                  [99.0000,51.9600,50.0784,50.0031], //Prodcut-3
                  [296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary_demand = [
    [213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)
productstagecapacity = [220.0000,640.0000,1360.0000];

```

Test Instance-28: TGS2C4D1 (Test General Setup-Profile_2 Capacity-Profile_4 Demand-Series_1)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};

```



```

family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900], //Product-1
                  [30.0900], //Products-2
                  [50.2500], //Prodcut-3
                  [101.0000]]; //Product-4

secondary_demand = [
    [100.5800], //Product-5 (Sum of Product-1 & 2)
    [80.3400], //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800], //Product-8 (equal to Prodcut-5)
    [180.9200], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};

```

```

family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049],           //Product-1
                  [30.0900,30.0009],           //Products-2
                  [50.2500,50.0025],           //Prodcut-3
                  [101.0000,100.0100]];         //Product-4

secondary_demand = [
    [100.5800,100.0058],           //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034],             //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125],           //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058],           //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092],           //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

```

```

microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000],           //Product-1
                  [30.0900,30.0009,30.0000],           //Products-2
                  [50.2500,50.0025,50.0000],           //Prodcut-3
                  [101.0000,100.0100,100.0001]];        //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000],    //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000], //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1
                  [30.0900,30.0009,30.0000,30.0000], //Products-2
                  [50.2500,50.0025,50.0000,50.0000], //Prodcut-3
                  [101.0000,100.0100,100.0001,100.0000]]; //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Test Instance-29: TGS2C4D2 (Test General Setup-Profile_2 Capacity-Profile_4 Demand-Series_2)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

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

```

```

standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400], //Product-1
                  [31.4400], //Products-2
                  [54.0000], //Prodcut-3
                  [116.0000]]; //Product-4

secondary_demand = [
    [109.2800], //Product-5 (Sum of Product-1 & 2)
    [85.4400], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800], //Product-8 (equal to Prodcut-5)
    [194.7200], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784],           //Product-1
                  [31.4400,30.0144],           //Products-2
                  [54.0000,50.0040],           //Prodcut-3
                  [116.0000,100.1600]];         //Product-4

secondary_demand = [
    [109.2800,100.0928], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544],   //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784,70.0008],           //Product-1

```

```

[31.4400,30.0144,30.0001],           //Products-2
[54.0000,50.0040,50.0004],           //Prodcut-3
[116.0000,100.1600,100.0016]];        //Product-4

secondary_demand = [
    [109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544,80.0005],    //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544,230.0025]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1
                  [31.4400,30.0144,30.0001,30.0000], //Products-2
                  [54.0000,50.0040,50.0004,50.0000], //Prodcut-3

```

```

[116.0000,100.1600,100.0016,100.0000]]; //Product-4

secondary_demand = [
    [109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of Product-2 & 3)
    [170.0000,150.2000,150.0020,150.0000], //Product-7 (Sum of Product-3 & 4)
    [109.2800,100.0928,100.0009,100.0000], //Product-8 (equal to Product-5)
    [194.7200,180.1472,180.0015,180.0000], //Product-9 (Sum of Product-5 & 6)
    [255.4400,230.2544,230.0025,230.0000]]; //Product-10 (Sum of Product-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Test Instance-30: TGS2C4D3 (Test General Setup-Profile_2 Capacity-Profile_4 Demand-Series_3)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100], //Product-1
                  [34.4100], //Products-2
                  [62.2500], //Product-3
                  [149.0000]]; //Product-4

secondary_demand = [
    [128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)

```



```

[96.6600],          //Product-6 (Sum of Prodcut-2 & 3)
[211.2500],        //Product-7 (Sum of Prodcut-3 & 4)
[128.4200],        //Product-8 (equal to Prodcut-5)
[225.0800],        //Product-9 (Sum of Prodcut-5 & 6)
[307.9100]];      //Product-10 (Sum of Prodcut-6 & 7)

```

// Setup Profile - II

```

setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

// Capacity Utilization Profile - IV (90%, 70%, 50%)

```

productstagecapacity = [122.2222,457.1429,1360.0000];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

// Product Demand - Series# 3

```

primary_demand = [[94.0100,70.2401],          //Product-1
                  [34.4100,30.0441],          //Products-2
                  [62.2500,50.1225],          //Prodcut-3
                  [149.0000,100.4900]];      //Product-4

```

```

secondary_demand = [
    [128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666],   //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842], //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)

```

```

[307.9100,230.7791]]];          //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401,70.0024],          //Product-1
                  [34.4100,30.0441,30.0004],          //Products-2
                  [62.2500,50.1225,50.0012],          //Prodcut-3
                  [149.0000,100.4900,100.0049]]];      //Product-4

secondary_demand = [
    [128.4200,100.2842,100.0028],          //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666,80.0017],            //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125,150.0061],          //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842,100.0028],          //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508,180.0045],          //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791,230.0078]]];        //Product-10 (Sum of Prodcut-6 & 7)

```

```
// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};
```

```
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];
```

// Product Demand - Series# 3

```
primary_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1
                  [34.4100,30.0441,30.0004,30.0000], //Products-2
                  [62.2500,50.1225,50.0012,50.0000], //Prodcut-3
                  [149.0000,100.4900,100.0049,100.0000]]; //Product-4

secondary_demand = [
    [128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)
```

```
// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
```

```
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - IV (90%, 70%, 50%)
```

```
productstagecapacity = [122.2222,457.1429,1360.0000];
```

Test Instance-31: TGS2C4D4 (Test General Setup-Profile_2 Capacity-Profile_4 Demand-Series_4)

Model-1 Data:

```
FP = 4;
```

```
RP = 10;
```

```
J = 10;
```

```
L = 3;
```

```
T = 1;
```

```
S = 3;
```

```
allproductsonstage1 = {8,9,10};
```

```
allproductsonstage2 = {5,6,7};
```

```
allproductsonstage3 = {1,2,3,4};
```

```
family1stage1 = {8,9};
```

```
family2stage1 = {9,10};
```

```
family3stage1 = {10};
```

```
family1stage2 = {5};
```

```
family2stage2 = {6};
```

```
family3stage2 = {7};
```

```
family1stage3 = {1,2};
```

```
family2stage3 = {2,3};
```

```
family3stage3 = {3,4};
```

```
microperiods1tomacroperiod = {1,2,3};
```

```
min_lotsize = 1;
```

```
production_cost = 1;
```

```
production_time = 1;
```

```
standby_cost = 1;
```

```
BOM = 1;
```

```
BigM = 10000;
```

```
holdingcost = [4,7,6,3,3,3,2,1,1,1];
```

```
// Product Demand - Series# 4
```

```
primary_demand = [[71.1025],           //Product-1  
                  [30.2025],           //Products-2  
                  [50.5625],           //Prodcut-3  
                  [102.2500]];          //Product-4
```

```
secondary_demand = [  
    [101.3050], //Product-5 (Sum of Product-1 & 2)  
    [80.7650],  //Product-6 (Sum of Prodcut-2 & 3)  
    [152.8125], //Product-7 (Sum of Prodcut-3 & 4)  
    [101.3050], //Product-8 (equal to Prodcut-5)  
    [182.0700], //Product-9 (Sum of Prodcut-5 & 6)  
    [233.5775]]; //Product-10 (Sum of Prodcut-6 & 7)
```

```
// Setup Profile - II
```

```
setuptime = [10,10,5,5,10,10,15,15,15,15];
```

```
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - IV (90%, 70%, 50%)
```

```
productstagecapacity = [122.2222,457.1429,1360.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048], //Product-1
                  [30.2025,30.0046], //Products-2
                  [50.5625,50.0127], //Prodcut-3
                  [102.2500,100.0506]]; //Product-4

secondary_demand = [
    [101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172], //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294], //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
```

```

L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006],           //Product-1
                  [30.2025,30.0046,30.0001],         //Products-2
                  [50.5625,50.0127,50.0003],         //Prodcut-3
                  [102.2500,100.0506,100.0011]];      //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007],           //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004],             //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014],          //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007],          //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010],          //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;

```

```

allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006,70.0000], //Product-1
                  [30.2025,30.0046,30.0001,30.0000], //Products-2
                  [50.5625,50.0127,50.0003,50.0000], //Prodcut-3
                  [102.2500,100.0506,100.0011,100.0000]]; //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007,100.0000], //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Test Instance-32: TGS2C4D5 (Test General Setup-Profile_2 Capacity-Profile_4 Demand-Series_5)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};

```

```

allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400],      //Product-1
                  [33.2400],      //Products-2
                  [59.0000],      //Prodcut-3
                  [136.0000]];    //Product-4

secondary_demand = [
    [120.8800], //Product-5 (Sum of Product-1 & 2)
    [92.2400],  //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800], //Product-8 (equal to Prodcut-5)
    [213.1200], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};

```



```

family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969],           //Product-1
                  [33.2400,30.0729],           //Products-2
                  [59.0000,50.2025],           //Prodcut-3
                  [136.0000,100.8100]];         //Product-4

secondary_demand = [
    [120.8800,100.4698],           //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754],             //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125],           //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698],           //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452],           //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};

```

```

family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969,70.0089], //Product-1
                  [33.2400,30.0729,30.0016], //Products-2
                  [59.0000,50.2025,50.0046], //Prodcut-3
                  [136.0000,100.8100,100.0182]]; //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062], //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

```

```

microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969,70.0089,70.0002],      //Product-1
                  [33.2400,30.0729,30.0016,30.0000],      //Products-2
                  [59.0000,50.2025,50.0046,50.0001],      //Prodcut-3
                  [136.0000,100.8100,100.0182,100.0004]];  //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106,100.0002],      //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062,80.0001],          //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228,150.0005],      //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106,100.0002],      //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168,180.0004],      //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290,230.0007]];      //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Test Instance-33: TGS2C4D6 (Test General Setup-Profile_2 Capacity-Profile_4 Demand-Series_6)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225], //Product-1
                  [39.9225],   //Products-2
                  [77.5625],   //Prodcut-3
                  [210.2500]]; //Product-4

secondary_demand = [
    [163.9450], //Product-5 (Sum of Product-1 & 2)
    [117.4850], //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450], //Product-8 (equal to Prodcut-5)
    [281.4300], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

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

```

```

BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155],           //Product-1
                  [39.9225,30.2233],           //Products-2
                  [77.5625,50.6202],           //Prodcut-3
                  [210.2500,102.4806]];         //Product-4

secondary_demand = [
    [163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434], //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388], //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155,70.0273],      //Product-1
                  [39.9225,30.2233,30.0050],      //Products-2
                  [77.5625,50.6202,50.0140],      //Prodcut-3
                  [210.2500,102.4806,100.0558]];    //Product-4

secondary_demand = [
    [163.9450,101.4388,100.0324],    //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434,80.0190],      //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008,150.0698],    //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388,100.0324],    //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822,180.0513],    //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442,230.0887]];    //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 6

```

```

primary_demand = [[124.0225,71.2155,70.0273,70.0006],      //Product-1
                  [39.9225,30.2233,30.0050,30.0001],      //Products-2
                  [77.5625,50.6202,50.0140,50.0003],      //Prodcut-3
                  [210.2500,102.4806,100.0558,100.0013]];  //Product-4

secondary_demand = [
    [163.9450,101.4388,100.0324,100.0007],      //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434,80.0190,80.0004],      //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008,150.0698,150.0016],      //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388,100.0324,100.0007],      //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822,180.0513,180.0012],      //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442,230.0887,230.0020]];      //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Test Instance-34: TGS2C4D7 (Test General Setup-Profile_2 Capacity-Profile_4 Demand-Series_7)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600],      //Product-1
                  [30.3600],      //Products-2
                  [51.0000],      //Prodcut-3
                  [104.0000]];    //Product-4

```

```

secondary_demand = [
    [102.3200], //Product-5 (Sum of Product-1 & 2)
    [81.3600], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200], //Product-8 (equal to Prodcut-5)
    [183.6800], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600]]; //Product-10 (Sum of Prodcut-6 & 7)

```

// Setup Profile - II

```

setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

// Capacity Utilization Profile - IV (90%, 70%, 50%)

```

productstagecapacity = [122.2222,457.1429,1360.0000];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

// Product Demand - Series# 7

```

primary_demand = [[71.9600,70.0784], //Product-1
    [30.3600,30.0144], //Products-2
    [51.0000,50.0400], //Prodcut-3
    [104.0000,100.1600]]; //Product-4

```

```

secondary_demand = [
    [102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

```



```

[155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)
[102.3200,100.0928], //Product-8 (equal to Prodcut-5)
[183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)
[236.3600,230.2544]]]; //Product-10 (Sum of Prodcut-6 & 7)

```

// Setup Profile - II

```

setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

// Capacity Utilization Profile - IV (90%, 70%, 50%)

```

productstagecapacity = [122.2222,457.1429,1360.0000];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

// Product Demand - Series# 7

```

primary_demand = [[71.9600,70.0784,70.0031], //Product-1
                  [30.3600,30.0144,30.0006], //Products-2
                  [51.0000,50.0400,50.0016], //Prodcut-3
                  [104.0000,100.1600,100.0064]]]; //Product-4

```

```

secondary_demand = [
    [102.3200,100.0928,100.0037], //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544,80.0022], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000,150.0080], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928,100.0037], //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472,180.0059], //Product-9 (Sum of Prodcut-5 & 6)

```

```
[236.3600,230.2544,230.0102]]]; //Product-10 (Sum of Prodcut-6 & 7)
```

```
// Setup Profile - II
```

```
setuptime = [10,10,5,5,10,10,15,15,15,15];
```

```
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - IV (90%, 70%, 50%)
```

```
productstagecapacity = [122.2222,457.1429,1360.0000];
```

Model-4 Data:

```
FP = 4;
```

```
RP = 10;
```

```
J = 10;
```

```
L = 3;
```

```
T = 4;
```

```
S = 12;
```

```
allproductsonstage1 = {8,9,10};
```

```
allproductsonstage2 = {5,6,7};
```

```
allproductsonstage3 = {1,2,3,4};
```

```
family1stage1 = {8,9};
```

```
family2stage1 = {9,10};
```

```
family3stage1 = {10};
```

```
family1stage2 = {5};
```

```
family2stage2 = {6};
```

```
family3stage2 = {7};
```

```
family1stage3 = {1,2};
```

```
family2stage3 = {2,3};
```

```
family3stage3 = {3,4};
```

```
microperiods1tomacroperiod = {1,2,3};
```

```
microperiods2tomacroperiod = {4,5,6};
```

```
microperiods3tomacroperiod = {7,8,9};
```

```
microperiods4tomacroperiod = {10,11,12};
```

```
min_lotsize = 1;
```

```
production_cost = 1;
```

```
production_time = 1;
```

```
standby_cost = 1;
```

```
BOM = 1;
```

```
BigM = 10000;
```

```
holdingcost = [4,7,6,3,3,3,2,1,1,1];
```

```
// Product Demand - Series# 7
```

```
primary_demand = [[71.9600,70.0784,70.0031,70.0001], //Product-1  
[30.3600,30.0144,30.0006,30.0000], //Products-2  
[51.0000,50.0400,50.0016,50.0001], //Prodcut-3  
[104.0000,100.1600,100.0064,100.0003]]]; //Product-4
```

```
secondary_demand = [  
[102.3200,100.0928,100.0037,100.0001], //Product-5 (Sum of Product-1 & 2)  
[81.3600,80.0544,80.0022,80.0001], //Product-6 (Sum of Prodcut-2 & 3)  
[155.0000,150.2000,150.0080,150.0003], //Product-7 (Sum of Prodcut-3 & 4)  
[102.3200,100.0928,100.0037,100.0001], //Product-8 (equal to Prodcut-5)  
[183.6800,180.1472,180.0059,180.0002], //Product-9 (Sum of Prodcut-5 & 6)  
[236.3600,230.2544,230.0102,230.0004]]]; //Product-10 (Sum of Prodcut-6 & 7)
```

```
// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];
```

Test Instance-35: TGS2C4D8 (Test General Setup-Profile_2 Capacity-Profile_4 Demand-Series_8)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600], //Product-1
                  [35.7600],   //Products-2
                  [66.0000],   //Prodcut-3
                  [164.0000]]; //Product-4

secondary_demand = [
    [137.1200], //Product-5 (Sum of Product-1 & 2)
    [101.7600], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200], //Product-8 (equal to Prodcut-5)
    [238.8800], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
```

```
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];
```

// Product Demand - Series# 8

```
primary_demand = [[101.3600,71.2544], //Product-1
                  [35.7600,30.2304], //Products-2
                  [66.0000,50.6400], //Prodcut-3
                  [164.0000,102.5600]]; //Product-4

secondary_demand = [
    [137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704]]; //Product-10 (Sum of Prodcut-6 & 7)
```

// Setup Profile - II

```
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.0502],           //Product-1
                  [35.7600,30.2304,30.0092],           //Products-2
                  [66.0000,50.6400,50.0256],           //Prodcut-3
                  [164.0000,102.5600,100.1024]]];       //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594],           //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348],           //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280],           //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594],           //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942],           //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628]]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1
                  [35.7600,30.2304,30.0092,30.0004], //Products-2
                  [66.0000,50.6400,50.0256,50.0010], //Prodcut-3
                  [164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];
```

Test Instance-36: TGS2C4D9 (Test General Setup-Profile_2 Capacity-Profile_4 Demand-Series_9)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400], //Product-1
                  [47.6400],   //Products-2
                  [99.0000],   //Prodcut-3
                  [296.0000]]; //Product-4

secondary_demand = [
    [213.6800], //Product-5 (Sum of Product-1 & 2)
    [146.6400], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800], //Product-8 (equal to Prodcut-5)
    [360.3200], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
```

```

L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416], //Product-1
                  [47.6400,30.7056], //Products-2
                  [99.0000,51.9600], //Prodcut-3
                  [296.0000,107.8400]]; //Product-4

secondary_demand = [
    [213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};

```



```

allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537],      //Product-1
                  [47.6400,30.7056,30.0282],      //Products-2
                  [99.0000,51.9600,50.0784],      //Prodcut-3
                  [296.0000,107.8400,100.3136]];   //Product-4

secondary_demand = [
    [213.6800,104.5472,100.1819],      //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066],      //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920],      //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819],      //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885],      //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986]];   //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};

```

```

family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1
                  [47.6400,30.7056,30.0282,30.0011], //Products-2
                  [99.0000,51.9600,50.0784,50.0031], //Prodcut-3
                  [296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary_demand = [
    [213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)
productstagecapacity = [122.2222,457.1429,1360.0000];

```

Test Instance-37: TGS2C5D1 (Test General Setup-Profile_2 Capacity-Profile_5 Demand-Series_1)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};

```

```

family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900],      //Product-1
                  [30.0900],      //Products-2
                  [50.2500],      //Prodcut-3
                  [101.0000]];    //Product-4

secondary_demand = [
    [100.5800], //Product-5 (Sum of Product-1 & 2)
    [80.3400],  //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800], //Product-8 (equal to Prodcut-5)
    [180.9200], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};

```

```

family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049],           //Product-1
                  [30.0900,30.0009],           //Products-2
                  [50.2500,50.0025],           //Prodcut-3
                  [101.0000,100.0100]];         //Product-4

secondary_demand = [
    [100.5800,100.0058],           //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034],             //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125],           //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058],           //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092],           //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

```

```

microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000],           //Product-1
                  [30.0900,30.0009,30.0000],           //Products-2
                  [50.2500,50.0025,50.0000],           //Prodcut-3
                  [101.0000,100.0100,100.0001]];        //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000],    //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000], //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1
primary_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1
                  [30.0900,30.0009,30.0000,30.0000], //Products-2
                  [50.2500,50.0025,50.0000,50.0000], //Prodcut-3
                  [101.0000,100.0100,100.0001,100.0000]]; //Product-4

secondary_demand = [
    [100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.3400,80.0034,80.0000,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)
    [180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Test Instance-38: TGS2C5D2 (Test General Setup-Profile_2 Capacity-Profile_5 Demand-Series_2)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

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

```

```

BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400], //Product-1
                  [31.4400], //Products-2
                  [54.0000], //Prodcut-3
                  [116.0000]]; //Product-4

secondary_demand = [
    [109.2800], //Product-5 (Sum of Product-1 & 2)
    [85.4400], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800], //Product-8 (equal to Prodcut-5)
    [194.7200], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784],           //Product-1
                  [31.4400,30.0144],           //Products-2
                  [54.0000,50.0040],           //Prodcut-3
                  [116.0000,100.1600]];         //Product-4

secondary_demand = [
    [109.2800,100.0928], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544],   //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784,70.0008], //Product-1
                  [31.4400,30.0144,30.0001], //Products-2

```



```

[54.0000,50.0040,50.0004],          //Prodcut-3
[116.0000,100.1600,100.0016]];      //Product-4

secondary_demand = [
    [109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544,80.0005],    //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544,230.0025]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2
primary_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1
                  [31.4400,30.0144,30.0001,30.0000], //Products-2
                  [54.0000,50.0040,50.0004,50.0000], //Prodcut-3
                  [116.0000,100.1600,100.0016,100.0000]]; //Product-4

```

```

secondary_demand = [
    [109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)
    [85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [170.0000,150.2000,150.0020,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [109.2800,100.0928,100.0009,100.0000], //Product-8 (equal to Prodcut-5)
    [194.7200,180.1472,180.0015,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [255.4400,230.2544,230.0025,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Test Instance-39: TGS2C5D3 (Test General Setup-Profile_2 Capacity-Profile_5 Demand-Series_3)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100], //Product-1
                  [34.4100], //Products-2
                  [62.2500], //Prodcut-3
                  [149.0000]]; //Product-4

secondary_demand = [
    [128.4200], //Product-5 (Sum of Product-1 & 2)
    [96.6600], //Product-6 (Sum of Prodcut-2 & 3)

```

```

[211.2500], //Product-7 (Sum of Prodcut-3 & 4)
[128.4200], //Product-8 (equal to Prodcut-5)
[225.0800], //Product-9 (Sum of Prodcut-5 & 6)
[307.9100]]; //Product-10 (Sum of Prodcut-6 & 7)

```

// Setup Profile - II

```

setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

// Capacity Utilization Profile - V (50%, 70%, 90%)

```

productstagecapacity = [220.0000,457.1429,755.5556];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

// Product Demand - Series# 3

```

primary_demand = [[94.0100,70.2401], //Product-1
                  [34.4100,30.0441], //Products-2
                  [62.2500,50.1225], //Prodcut-3
                  [149.0000,100.4900]]; //Product-4

```

secondary_demand = [

```

[128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)
[96.6600,80.1666], //Product-6 (Sum of Prodcut-2 & 3)
[211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)
[128.4200,100.2842], //Product-8 (equal to Prodcut-5)
[225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)
[307.9100,230.7791]]; //Product-10 (Sum of Prodcut-6 & 7)

```

```
// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3
primary_demand = [[94.0100,70.2401,70.0024], //Product-1
                  [34.4100,30.0441,30.0004], //Products-2
                  [62.2500,50.1225,50.0012], //Prodcut-3
                  [149.0000,100.4900,100.0049]]; //Product-4

secondary_demand = [
    [128.4200,100.2842,100.0028], //Product-5 (Sum of Product-1 & 2)
    [96.6600,80.1666,80.0017], //Product-6 (Sum of Prodcut-2 & 3)
    [211.2500,150.6125,150.0061], //Product-7 (Sum of Prodcut-3 & 4)
    [128.4200,100.2842,100.0028], //Product-8 (equal to Prodcut-5)
    [225.0800,180.4508,180.0045], //Product-9 (Sum of Prodcut-5 & 6)
    [307.9100,230.7791,230.0078]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
```

```
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - V (50%, 70%, 90%)
```

```
productstagecapacity = [220.0000,457.1429,755.5556];
```

Model-4 Data:

```
FP = 4;
```

```
RP = 10;
```

```
J = 10;
```

```
L = 3;
```

```
T = 4;
```

```
S = 12;
```

```
allproductsonstage1 = {8,9,10};
```

```
allproductsonstage2 = {5,6,7};
```

```
allproductsonstage3 = {1,2,3,4};
```

```
family1stage1 = {8,9};
```

```
family2stage1 = {9,10};
```

```
family3stage1 = {10};
```

```
family1stage2 = {5};
```

```
family2stage2 = {6};
```

```
family3stage2 = {7};
```

```
family1stage3 = {1,2};
```

```
family2stage3 = {2,3};
```

```
family3stage3 = {3,4};
```

```
microperiods1tomacroperiod = {1,2,3};
```

```
microperiods2tomacroperiod = {4,5,6};
```

```
microperiods3tomacroperiod = {7,8,9};
```

```
microperiods4tomacroperiod = {10,11,12};
```

```
min_lotsize = 1;
```

```
production_cost = 1;
```

```
production_time = 1;
```

```
standby_cost = 1;
```

```
BOM = 1;
```

```
BigM = 10000;
```

```
holdingcost = [4,7,6,3,3,3,2,1,1,1];
```

```
// Product Demand - Series# 3
```

```
primary_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1  
[34.4100,30.0441,30.0004,30.0000], //Products-2  
[62.2500,50.1225,50.0012,50.0000], //Prodcut-3  
[149.0000,100.4900,100.0049,100.0000]]; //Product-4
```

```
secondary_demand = [  
[128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)  
[96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)  
[211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)  
[128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)  
[225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)  
[307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)
```

```
// Setup Profile - II
```

```
setuptime = [10,10,5,5,10,10,15,15,15,15];
```

```
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];
```

Test Instance-40: TGS2C5D4 (Test General Setup-Profile_2 Capacity-Profile_5 Demand-Series_4)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025],      //Product-1
                  [30.2025],      //Products-2
                  [50.5625],      //Prodcut-3
                  [102.2500]];    //Product-4

secondary_demand = [
    [101.3050], //Product-5 (Sum of Product-1 & 2)
    [80.7650],  //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050], //Product-8 (equal to Prodcut-5)
    [182.0700], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048], //Product-1
                  [30.2025,30.0046], //Products-2
                  [50.5625,50.0127], //Prodcut-3
                  [102.2500,100.0506]]; //Product-4

secondary_demand = [
    [101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172], //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294], //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
```

```

L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006],           //Product-1
                  [30.2025,30.0046,30.0001],         //Products-2
                  [50.5625,50.0127,50.0003],         //Prodcut-3
                  [102.2500,100.0506,100.0011]];      //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007],           //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004],             //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014],          //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007],          //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010],          //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;

```



```

allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4
primary_demand = [[71.1025,70.048,70.0006,70.0000], //Product-1
                  [30.2025,30.0046,30.0001,30.0000], //Products-2
                  [50.5625,50.0127,50.0003,50.0000], //Prodcut-3
                  [102.2500,100.0506,100.0011,100.0000]]; //Product-4

secondary_demand = [
    [101.3050,100.0294,100.0007,100.0000], //Product-5 (Sum of Product-1 & 2)
    [80.7650,80.0172,80.0004,80.0000], //Product-6 (Sum of Prodcut-2 & 3)
    [152.8125,150.0633,150.0014,150.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [101.3050,100.0294,100.0007,100.0000], //Product-8 (equal to Prodcut-5)
    [182.0700,180.0466,180.0010,180.0000], //Product-9 (Sum of Prodcut-5 & 6)
    [233.5775,230.0805,230.0018,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Test Instance-41: TGS2C5D5 (Test General Setup-Profile_2 Capacity-Profile_5 Demand-Series_5)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};

```

```

allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400],      //Product-1
                  [33.2400],      //Products-2
                  [59.0000],      //Prodcut-3
                  [136.0000]];    //Product-4

secondary_demand = [
    [120.8800], //Product-5 (Sum of Product-1 & 2)
    [92.2400],  //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800], //Product-8 (equal to Prodcut-5)
    [213.1200], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};

```

```

family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969],           //Product-1
                  [33.2400,30.0729],           //Products-2
                  [59.0000,50.2025],           //Prodcut-3
                  [136.0000,100.8100]];         //Product-4

secondary_demand = [
    [120.8800,100.4698],           //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754],             //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125],           //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698],           //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452],           //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};

```

```

family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969,70.0089], //Product-1
                  [33.2400,30.0729,30.0016], //Products-2
                  [59.0000,50.2025,50.0046], //Prodcut-3
                  [136.0000,100.8100,100.0182]]; //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062], //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

```

```

microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5
primary_demand = [[87.6400,70.3969,70.0089,70.0002],      //Product-1
                  [33.2400,30.0729,30.0016,30.0000],      //Products-2
                  [59.0000,50.2025,50.0046,50.0001],      //Prodcut-3
                  [136.0000,100.8100,100.0182,100.0004]];  //Product-4

secondary_demand = [
    [120.8800,100.4698,100.0106,100.0002],      //Product-5 (Sum of Product-1 & 2)
    [92.2400,80.2754,80.0062,80.0001],          //Product-6 (Sum of Prodcut-2 & 3)
    [195.0000,151.0125,150.0228,150.0005],      //Product-7 (Sum of Prodcut-3 & 4)
    [120.8800,100.4698,100.0106,100.0002],      //Product-8 (equal to Prodcut-5)
    [213.1200,180.7452,180.0168,180.0004],      //Product-9 (Sum of Prodcut-5 & 6)
    [287.2400,231.2879,230.0290,230.0007]];      //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Test Instance-42: TGS2C5D6 (Test General Setup-Profile_2 Capacity-Profile_5 Demand-Series_6)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225], //Product-1
                  [39.9225],   //Products-2
                  [77.5625],   //Prodcut-3
                  [210.2500]]; //Product-4

secondary_demand = [
    [163.9450], //Product-5 (Sum of Product-1 & 2)
    [117.4850], //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450], //Product-8 (equal to Prodcut-5)
    [281.4300], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

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

```

```

BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155],           //Product-1
                  [39.9225,30.2233],           //Products-2
                  [77.5625,50.6202],           //Prodcut-3
                  [210.2500,102.4806]];         //Product-4

secondary_demand = [
    [163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434],  //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388], //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 6
primary_demand = [[124.0225,71.2155,70.0273],      //Product-1
                  [39.9225,30.2233,30.0050],      //Products-2
                  [77.5625,50.6202,50.0140],      //Prodcut-3
                  [210.2500,102.4806,100.0558]];    //Product-4

secondary_demand = [
    [163.9450,101.4388,100.0324],    //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434,80.0190],      //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008,150.0698],    //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388,100.0324],    //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822,180.0513],    //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442,230.0887]];   //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

```

// Product Demand - Series# 6

```



```

primary_demand = [[124.0225,71.2155,70.0273,70.0006],      //Product-1
                  [39.9225,30.2233,30.0050,30.0001],      //Products-2
                  [77.5625,50.6202,50.0140,50.0003],      //Prodcut-3
                  [210.2500,102.4806,100.0558,100.0013]];  //Product-4

secondary_demand = [
    [163.9450,101.4388,100.0324,100.0007],      //Product-5 (Sum of Product-1 & 2)
    [117.4850,80.8434,80.0190,80.0004],      //Product-6 (Sum of Prodcut-2 & 3)
    [287.8125,153.1008,150.0698,150.0016],      //Product-7 (Sum of Prodcut-3 & 4)
    [163.9450,101.4388,100.0324,100.0007],      //Product-8 (equal to Prodcut-5)
    [281.4300,182.2822,180.0513,180.0012],      //Product-9 (Sum of Prodcut-5 & 6)
    [405.2975,233.9442,230.0887,230.0020]];      //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Test Instance-43: TGS2C5D7 (Test General Setup-Profile_2 Capacity-Profile_5 Demand-Series_7)

Model-1 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600],      //Product-1
                  [30.3600],      //Products-2
                  [51.0000],      //Prodcut-3
                  [104.0000]];    //Product-4

```

```

secondary_demand = [
    [102.3200], //Product-5 (Sum of Product-1 & 2)
    [81.3600], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200], //Product-8 (equal to Prodcut-5)
    [183.6800], //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600]]; //Product-10 (Sum of Prodcut-6 & 7)

```

// Setup Profile - II

```

setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

// Capacity Utilization Profile - V (50%, 70%, 90%)

```

productstagecapacity = [220.0000,457.1429,755.5556];

```

Model-2 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

```

```

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

// Product Demand - Series# 7

```

primary_demand = [[71.9600,70.0784], //Product-1
    [30.3600,30.0144], //Products-2
    [51.0000,50.0400], //Prodcut-3
    [104.0000,100.1600]]; //Product-4

```

```

secondary_demand = [
    [102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

```

```

[155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)
[102.3200,100.0928], //Product-8 (equal to Prodcut-5)
[183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)
[236.3600,230.2544]]]; //Product-10 (Sum of Prodcut-6 & 7)

```

// Setup Profile - II

```

setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

```

// Capacity Utilization Profile - V (50%, 70%, 90%)

```

productstagecapacity = [220.0000,457.1429,755.5556];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

```

// Product Demand - Series# 7

```

primary_demand = [[71.9600,70.0784,70.0031], //Product-1
                  [30.3600,30.0144,30.0006], //Products-2
                  [51.0000,50.0400,50.0016], //Prodcut-3
                  [104.0000,100.1600,100.0064]]]; //Product-4

```

```

secondary_demand = [
    [102.3200,100.0928,100.0037], //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544,80.0022], //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000,150.0080], //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928,100.0037], //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472,180.0059], //Product-9 (Sum of Prodcut-5 & 6)

```

```

[236.3600,230.2544,230.0102]]];    //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7
primary_demand = [[71.9600,70.0784,70.0031,70.0001],    //Product-1
                  [30.3600,30.0144,30.0006,30.0000],    //Products-2
                  [51.0000,50.0400,50.0016,50.0001],    //Prodcut-3
                  [104.0000,100.1600,100.0064,100.0003]]]; //Product-4

secondary_demand = [
    [102.3200,100.0928,100.0037,100.0001],    //Product-5 (Sum of Product-1 & 2)
    [81.3600,80.0544,80.0022,80.0001],    //Product-6 (Sum of Prodcut-2 & 3)
    [155.0000,150.2000,150.0080,150.0003],    //Product-7 (Sum of Prodcut-3 & 4)
    [102.3200,100.0928,100.0037,100.0001],    //Product-8 (equal to Prodcut-5)
    [183.6800,180.1472,180.0059,180.0002],    //Product-9 (Sum of Prodcut-5 & 6)
    [236.3600,230.2544,230.0102,230.0004]]]; //Product-10 (Sum of Prodcut-6 & 7)

```

```
// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];
```

Test Instance-44: TGS2C5D8 (Test General Setup-Profile_2 Capacity-Profile_5 Demand-Series_8)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600], //Product-1
                  [35.7600], //Products-2
                  [66.0000], //Prodcut-3
                  [164.0000]]; //Product-4

secondary_demand = [
    [137.1200], //Product-5 (Sum of Product-1 & 2)
    [101.7600], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200], //Product-8 (equal to Prodcut-5)
    [238.8800], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
```

```
min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];
```

// Product Demand - Series# 8

```
primary_demand = [[101.3600,71.2544], //Product-1
                  [35.7600,30.2304], //Products-2
                  [66.0000,50.6400], //Prodcut-3
                  [164.0000,102.5600]; //Product-4

secondary_demand = [
    [137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704]; //Product-10 (Sum of Prodcut-6 & 7)
```

// Setup Profile - II

```
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];
```

```
// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];
```

Model-3 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.0502],           //Product-1
                  [35.7600,30.2304,30.0092],           //Products-2
                  [66.0000,50.6400,50.0256],           //Prodcut-3
                  [164.0000,102.5600,100.1024]];        //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594],           //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348],           //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280],           //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594],           //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942],           //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628]];         //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];
```

Model-4 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8
primary_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1
                  [35.7600,30.2304,30.0092,30.0004], //Products-2
                  [66.0000,50.6400,50.0256,50.0010], //Prodcut-3
                  [164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary_demand = [
    [137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)
    [101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)
    [230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)
    [137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)
    [238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)
    [331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];
```


Test Instance-45: TGS2C5D9 (Test General Setup-Profile_2 Capacity-Profile_5 Demand-Series_9)

Model-1 Data:

```
FP = 4;
RP = 10;
J = 10;
L = 3;
T = 1;
S = 3;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400], //Product-1
                  [47.6400],   //Products-2
                  [99.0000],   //Prodcut-3
                  [296.0000]]; //Product-4

secondary_demand = [
    [213.6800], //Product-5 (Sum of Product-1 & 2)
    [146.6400], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800], //Product-8 (equal to Prodcut-5)
    [360.3200], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];
```

Model-2 Data:

```
FP = 4;
RP = 10;
J = 10;
```

```

L = 3;
T = 2;
S = 6;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416],           //Product-1
                  [47.6400,30.7056],           //Products-2
                  [99.0000,51.9600],           //Prodcut-3
                  [296.0000,107.8400]];         //Product-4

secondary_demand = [
    [213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Model-3 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 3;
S = 9;
allproductsonstage1 = {8,9,10};

```

```

allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};
family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537],      //Product-1
                  [47.6400,30.7056,30.0282],      //Products-2
                  [99.0000,51.9600,50.0784],      //Prodcut-3
                  [296.0000,107.8400,100.3136]];    //Product-4

secondary_demand = [
    [213.6800,104.5472,100.1819],    //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066],      //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920],    //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819],    //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885],    //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986]];   //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```

Model-4 Data:

```

FP = 4;
RP = 10;
J = 10;
L = 3;
T = 4;
S = 12;
allproductsonstage1 = {8,9,10};
allproductsonstage2 = {5,6,7};
allproductsonstage3 = {1,2,3,4};
family1stage1 = {8,9};

```

```

family2stage1 = {9,10};
family3stage1 = {10};
family1stage2 = {5};
family2stage2 = {6};
family3stage2 = {7};
family1stage3 = {1,2};
family2stage3 = {2,3};
family3stage3 = {3,4};
microperiods1tomacroperiod = {1,2,3};
microperiods2tomacroperiod = {4,5,6};
microperiods3tomacroperiod = {7,8,9};
microperiods4tomacroperiod = {10,11,12};

min_lotsize = 1;
production_cost = 1;
production_time = 1;
standby_cost = 1;
BOM = 1;
BigM = 10000;
holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9
primary_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1
                  [47.6400,30.7056,30.0282,30.0011], //Products-2
                  [99.0000,51.9600,50.0784,50.0031], //Prodcut-3
                  [296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary_demand = [
    [213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)
    [146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)
    [395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)
    [213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)
    [360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)
    [541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II
setuptime = [10,10,5,5,10,10,15,15,15,15];
setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)
productstagecapacity = [220.0000,457.1429,755.5556];

```