# Problem – B (General) $\rightarrow$ 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)
                        //Product-6 (Sum of Prodcut-2 & 3)
      [80.3400],
      [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 = [
                              //Product-5 (Sum of Product-1 & 2)
      [100.5800,100.0058],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [80.3400,80.0034],
                              //Product-7 (Sum of Prodcut-3 & 4)
      [151.2500,150.0125],
      [100.5800,100.0058],
                              //Product-8 (equal to Prodcut-5)
      [180.9200,180.0092],
                              //Product-9 (Sum of Prodcut-5 & 6)
                              //Product-10 (Sum of Prodcut-6 & 7)
      [231.5900,230.0159]];
// 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)
                                      //Product-10 (Sum of Prodcut-6 & 7)
      [231.5900,230.0159,230.0000]];
// 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 = [
                                                 //Product-5 (Sum of Product-1 & 2)
      [100.5800,100.0058,100.0000,100.0000],
      [80.3400,80.0034,80.0000,80.0000],
                                                 //Product-6 (Sum of Prodcut-2 & 3)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
      [151.2500,150.0125,150.0001,150.0000],
      [100.5800,100.0058,100.0000,100.0000],
                                                 //Product-8 (equal to Prodcut-5)
                                                 //Product-9 (Sum of Prodcut-5 & 6)
      [180.9200,180.0092,180.0000,180.0000],
      [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
                               //Products-2
//Prodcut-3
//Product-4
                  [31.4400],
                  [54.0000],
                  [116.0000]];
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 = [
                              //Product-5 (Sum of Product-1 & 2)
      [109.2800,100.0928],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [85.4400,80.0544],
      [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)
                              //Product-10 (Sum of Prodcut-6 & 7)
      [255.4400,230.2544]];
// 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)
                                      //Product-10 (Sum of Prodcut-6 & 7)
      [255.4400,230.2544,230.0025]];
// 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 = [
                                                 //Product-5 (Sum of Product-1 & 2)
      [109.2800,100.0928,100.0009,100.0000],
      [85.4400,80.0544,80.0005,80.0000],
                                                 //Product-6 (Sum of Prodcut-2 & 3)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
      [170.0000,150.2000,150.0020,150.0000],
      [109.2800,100.0928,100.0009,100.0000],
                                                 //Product-8 (equal to Prodcut-5)
                                                 //Product-9 (Sum of Prodcut-5 & 6)
      [194.7200,180.1472,180.0015,180.0000],
      [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
                                    //Product-1
primary_demand = [[94.0100],
                  [34.4100], //Products-2
[62.2500], //Product-3
[149.0000]]; //Product-4
secondary_demand = [
            [128.4200], //Product-5 (Sum of Product-1 & 2)
                               //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600],
            [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)
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600,80.1666,80.0017],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [211.2500,150.6125,150.0061],
            [128.4200,100.2842,100.0028],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [225.0800,180.4508,180.0045],
            [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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [128.4200,100.2842,100.0028,100.0000],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600,80.1666,80.0017,80.0000],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [211.2500,150.6125,150.0061,150.0001],
                                                  //Product-8 (equal to Prodcut-5)
            [128.4200,100.2842,100.0028,100.0000],
            [225.0800,180.4508,180.0045,180.0000],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [307.9100,230.7791,230.0078,230.0001]];
// 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
                                    //Product-1
primary_demand = [[71.1025],
                   [30.2025], //Products-2
[50.5625], //Prodcut-3
[102.2500]]; //Product-4
secondary_demand = [
             [101.3050], //Product-5 (Sum of Product-1 & 2)
                                //Product-6 (Sum of Prodcut-2 & 3)
             [80.7650],
             [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)
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [80.7650,80.0172,80.0004],
            [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)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [182.0700,180.0466,180.0010],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [233.5775,230.0805,230.0018]];
// 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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [101.3050,100.0294,100.0007,100.0000],
            [80.7650,80.0172,80.0004,80.0000],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [152.8125,150.0633,150.0014,150.0000],
                                                  //Product-8 (equal to Prodcut-5)
            [101.3050,100.0294,100.0007,100.0000],
            [182.0700,180.0466,180.0010,180.0000],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [233.5775,230.0805,230.0018,230.0000]];
// 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
                               //Products-2
//Prodcut-3
//Product-4
                  [33.2400],
                  [59.0000],
                  [136.0000]];
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 = [
                              //Product-5 (Sum of Product-1 & 2)
      [120.8800,100.4698],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [92.2400,80.2754],
      [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)
                              //Product-10 (Sum of Prodcut-6 & 7)
      [287.2400,231.2879]];
// 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)
                                      //Product-10 (Sum of Prodcut-6 & 7)
      [287.2400,231.2879,230.0290]];
// 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 = [
                                                //Product-5 (Sum of Product-1 & 2)
      [120.8800,100.4698,100.0106,100.0002],
      [92.2400,80.2754,80.0062,80.0001],
                                                 //Product-6 (Sum of Prodcut-2 & 3)
                                                //Product-7 (Sum of Prodcut-3 & 4)
      [195.0000,151.0125,150.0228,150.0005],
      [120.8800,100.4698,100.0106,100.0002],
                                                //Product-8 (equal to Prodcut-5)
                                                //Product-9 (Sum of Prodcut-5 & 6)
      [213.1200,180.7452,180.0168,180.0004],
      [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
                                   //Product-1
primary_demand = [[124.0225],
                  [39.9225], //Products-2
[77.5625], //Prodcut-3
[210.2500]]; //Product-4
secondary_demand = [
            [163.9450], //Product-5 (Sum of Product-1 & 2)
                               //Product-6 (Sum of Prodcut-2 & 3)
            [117.4850],
            [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)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [281.4300,182.2822,180.0513],
            [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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [163.9450,101.4388,100.0324,100.0007],
            [117.4850,80.8434,80.0190,80.0004],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [287.8125,153.1008,150.0698,150.0016],
                                                  //Product-8 (equal to Prodcut-5)
            [163.9450,101.4388,100.0324,100.0007],
            [281.4300,182.2822,180.0513,180.0012],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [405.2975,233.9442,230.0887,230.0020]];
// 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
                                    //Product-1
primary_demand = [[71.9600],
                   [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)
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [81.3600,80.0544,80.0022],
            [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)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [183.6800,180.1472,180.0059],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [236.3600,230.2544,230.0102]];
// 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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [102.3200,100.0928,100.0037,100.0001],
            [81.3600,80.0544,80.0022,80.0001],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [155.0000,150.2000,150.0080,150.0003],
                                                  //Product-8 (equal to Prodcut-5)
            [102.3200,100.0928,100.0037,100.0001],
            [183.6800,180.1472,180.0059,180.0002],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [236.3600,230.2544,230.0102,230.0004]];
// 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], //Product-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)
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [230.0000,153.2000,150.1280],
            [137.1200,101.4848,100.0594],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [238.8800,182.3552,180.0942],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [331.7600,234.0704,230.1628]];
// 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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [137.1200,101.4848,100.0594,100.0024],
            [101.7600,80.8704,80.0348,80.0014],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [230.0000,153.2000,150.1280,150.0051],
                                                  //Product-8 (equal to Prodcut-5)
            [137.1200,101.4848,100.0594,100.0024],
            [238.8800,182.3552,180.0942,180.0038],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [331.7600,234.0704,230.1628,230.0065]];
// 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], //Product-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)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [360.3200,187.2128,180.2885],
            [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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [213.6800,104.5472,100.1819,100.0073],
            [146.6400,82.6656,80.1066,80.0043],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [395.0000,159.8000,150.3920,150.0157],
                                                  //Product-8 (equal to Prodcut-5)
            [213.6800,104.5472,100.1819,100.0073],
            [360.3200,187.2128,180.2885,180.0115],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [541.6400,242.4656,230.4986,230.0199]];
// 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
                               //Products-2
//Prodcut-3
//Product-4
                  [30.0900],
                  [50.2500],
                  [101.0000]];
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 = [
                              //Product-5 (Sum of Product-1 & 2)
      [100.5800,100.0058],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [80.3400,80.0034],
                              //Product-7 (Sum of Prodcut-3 & 4)
      [151.2500,150.0125],
      [100.5800,100.0058],
                              //Product-8 (equal to Prodcut-5)
      [180.9200,180.0092],
                              //Product-9 (Sum of Prodcut-5 & 6)
                              //Product-10 (Sum of Prodcut-6 & 7)
      [231.5900,230.0159]];
// 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)
                                      //Product-10 (Sum of Prodcut-6 & 7)
      [231.5900,230.0159,230.0000]];
// 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)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
      [151.2500,150.0125,150.0001,150.0000],
      [100.5800,100.0058,100.0000,100.0000],
                                                 //Product-8 (equal to Prodcut-5)
                                                 //Product-9 (Sum of Prodcut-5 & 6)
      [180.9200,180.0092,180.0000,180.0000],
      [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
                               //Products-2
//Prodcut-3
//Product-4
                  [31.4400],
                  [54.0000],
                  [116.0000]];
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 = [
                              //Product-5 (Sum of Product-1 & 2)
      [109.2800,100.0928],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [85.4400,80.0544],
      [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)
                              //Product-10 (Sum of Prodcut-6 & 7)
      [255.4400,230.2544]];
// 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)
                                      //Product-10 (Sum of Prodcut-6 & 7)
      [255.4400,230.2544,230.0025]];
// 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)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
      [170.0000,150.2000,150.0020,150.0000],
      [109.2800,100.0928,100.0009,100.0000],
                                                 //Product-8 (equal to Prodcut-5)
                                                 //Product-9 (Sum of Prodcut-5 & 6)
      [194.7200,180.1472,180.0015,180.0000],
      [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
                                    //Product-1
primary_demand = [[94.0100],
                   [34.4100], //Products-2
[62.2500], //Product-3
[149.0000]]; //Product-4
secondary_demand = [
            [128.4200], //Product-5 (Sum of Product-1 & 2)
                               //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600],
            [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)
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600,80.1666,80.0017],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [211.2500,150.6125,150.0061],
            [128.4200,100.2842,100.0028],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [225.0800,180.4508,180.0045],
            [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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [128.4200,100.2842,100.0028,100.0000],
            [96.6600,80.1666,80.0017,80.0000],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [211.2500,150.6125,150.0061,150.0001],
                                                  //Product-8 (equal to Prodcut-5)
            [128.4200,100.2842,100.0028,100.0000],
            [225.0800,180.4508,180.0045,180.0000],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [307.9100,230.7791,230.0078,230.0001]];
// 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
                                    //Product-1
primary_demand = [[71.1025],
                   [30.2025], //Products-2
[50.5625], //Prodcut-3
[102.2500]]; //Product-4
secondary_demand = [
            [101.3050], //Product-5 (Sum of Product-1 & 2)
                               //Product-6 (Sum of Prodcut-2 & 3)
            [80.7650],
            [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)
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [80.7650,80.0172,80.0004],
            [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)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [182.0700,180.0466,180.0010],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [233.5775,230.0805,230.0018]];
// 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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [101.3050,100.0294,100.0007,100.0000],
            [80.7650,80.0172,80.0004,80.0000],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [152.8125,150.0633,150.0014,150.0000],
                                                  //Product-8 (equal to Prodcut-5)
            [101.3050,100.0294,100.0007,100.0000],
            [182.0700,180.0466,180.0010,180.0000],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [233.5775,230.0805,230.0018,230.0000]];
// 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
                               //Products-2
//Prodcut-3
//Product-4
                  [33.2400],
                  [59.0000],
                  [136.0000]];
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 = [
                              //Product-5 (Sum of Product-1 & 2)
      [120.8800,100.4698],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [92.2400,80.2754],
      [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)
                              //Product-10 (Sum of Prodcut-6 & 7)
      [287.2400,231.2879]];
// 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)
                                      //Product-10 (Sum of Prodcut-6 & 7)
      [287.2400,231.2879,230.0290]];
// 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 = [
                                                 //Product-5 (Sum of Product-1 & 2)
      [120.8800,100.4698,100.0106,100.0002],
      [92.2400,80.2754,80.0062,80.0001],
                                                 //Product-6 (Sum of Prodcut-2 & 3)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
      [195.0000,151.0125,150.0228,150.0005],
      [120.8800,100.4698,100.0106,100.0002],
                                                 //Product-8 (equal to Prodcut-5)
                                                 //Product-9 (Sum of Prodcut-5 & 6)
      [213.1200,180.7452,180.0168,180.0004],
      [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)
                               //Product-6 (Sum of Prodcut-2 & 3)
            [117.4850],
            [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)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [281.4300,182.2822,180.0513],
            [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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [163.9450,101.4388,100.0324,100.0007],
            [117.4850,80.8434,80.0190,80.0004],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [287.8125,153.1008,150.0698,150.0016],
                                                  //Product-8 (equal to Prodcut-5)
            [163.9450,101.4388,100.0324,100.0007],
            [281.4300,182.2822,180.0513,180.0012],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [405.2975,233.9442,230.0887,230.0020]];
// 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
                                    //Product-1
primary_demand = [[71.9600],
                   [30.3600], //Products-2
[51.0000], //Product-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)
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [81.3600,80.0544,80.0022],
            [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)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [183.6800,180.1472,180.0059],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [236.3600,230.2544,230.0102]];
// 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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [102.3200,100.0928,100.0037,100.0001],
            [81.3600,80.0544,80.0022,80.0001],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [155.0000,150.2000,150.0080,150.0003],
                                                  //Product-8 (equal to Prodcut-5)
            [102.3200,100.0928,100.0037,100.0001],
            [183.6800,180.1472,180.0059,180.0002],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [236.3600,230.2544,230.0102,230.0004]];
// 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], //Product-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)
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [230.0000,153.2000,150.1280],
            [137.1200,101.4848,100.0594],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [238.8800,182.3552,180.0942],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [331.7600,234.0704,230.1628]];
// 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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [137.1200,101.4848,100.0594,100.0024],
            [101.7600,80.8704,80.0348,80.0014],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [230.0000,153.2000,150.1280,150.0051],
                                                  //Product-8 (equal to Prodcut-5)
            [137.1200,101.4848,100.0594,100.0024],
            [238.8800,182.3552,180.0942,180.0038],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [331.7600,234.0704,230.1628,230.0065]];
// 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], //Product-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)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [360.3200,187.2128,180.2885],
            [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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [213.6800,104.5472,100.1819,100.0073],
            [146.6400,82.6656,80.1066,80.0043],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [395.0000,159.8000,150.3920,150.0157],
                                                  //Product-8 (equal to Prodcut-5)
            [213.6800,104.5472,100.1819,100.0073],
            [360.3200,187.2128,180.2885,180.0115],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [541.6400,242.4656,230.4986,230.0199]];
// 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
                               //Products-2
//Prodcut-3
//Product-4
                  [30.0900],
                  [50.2500],
                  [101.0000]];
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 = [
                              //Product-5 (Sum of Product-1 & 2)
      [100.5800,100.0058],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [80.3400,80.0034],
                              //Product-7 (Sum of Prodcut-3 & 4)
      [151.2500,150.0125],
      [100.5800,100.0058],
                              //Product-8 (equal to Prodcut-5)
                              //Product-9 (Sum of Prodcut-5 & 6)
      [180.9200,180.0092],
                              //Product-10 (Sum of Prodcut-6 & 7)
      [231.5900,230.0159]];
// 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)
                                      //Product-10 (Sum of Prodcut-6 & 7)
      [231.5900,230.0159,230.0000]];
// 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)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
      [151.2500,150.0125,150.0001,150.0000],
      [100.5800,100.0058,100.0000,100.0000],
                                                 //Product-8 (equal to Prodcut-5)
                                                 //Product-9 (Sum of Prodcut-5 & 6)
      [180.9200,180.0092,180.0000,180.0000],
      [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
                               //Products-2
//Prodcut-3
//Product-4
                  [31.4400],
                  [54.0000],
                  [116.0000]];
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 = [
                              //Product-5 (Sum of Product-1 & 2)
      [109.2800,100.0928],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [85.4400,80.0544],
      [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)
                              //Product-10 (Sum of Prodcut-6 & 7)
      [255.4400,230.2544]];
// 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)
                                      //Product-10 (Sum of Prodcut-6 & 7)
      [255.4400,230.2544,230.0025]];
// 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)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
      [170.0000,150.2000,150.0020,150.0000],
      [109.2800,100.0928,100.0009,100.0000],
                                                 //Product-8 (equal to Prodcut-5)
                                                 //Product-9 (Sum of Prodcut-5 & 6)
      [194.7200,180.1472,180.0015,180.0000],
      [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
                                    //Product-1
primary_demand = [[94.0100],
                   [34.4100], //Products-2
[62.2500], //Product-3
[149.0000]]; //Product-4
secondary_demand = [
            [128.4200], //Product-5 (Sum of Product-1 & 2)
                               //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600],
            [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)
                                    //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600,80.1666],
            [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)
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [211.2500,150.6125,150.0061],
            [128.4200,100.2842,100.0028],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [225.0800,180.4508,180.0045],
            [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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [128.4200,100.2842,100.0028,100.0000],
            [96.6600,80.1666,80.0017,80.0000],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [211.2500,150.6125,150.0061,150.0001],
                                                  //Product-8 (equal to Prodcut-5)
            [128.4200,100.2842,100.0028,100.0000],
            [225.0800,180.4508,180.0045,180.0000],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [307.9100,230.7791,230.0078,230.0001]];
// 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
                                    //Product-1
primary_demand = [[71.1025],
                  [30.2025], //Products-2
[50.5625], //Prodcut-3
[102.2500]]; //Product-4
secondary_demand = [
            [101.3050], //Product-5 (Sum of Product-1 & 2)
                               //Product-6 (Sum of Prodcut-2 & 3)
            [80.7650],
            [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)
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [152.8125,150.0633,150.0014],
            [101.3050,100.0294,100.0007],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [182.0700,180.0466,180.0010],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [233.5775,230.0805,230.0018]];
// 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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [101.3050,100.0294,100.0007,100.0000],
            [80.7650,80.0172,80.0004,80.0000],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [152.8125,150.0633,150.0014,150.0000],
                                                  //Product-8 (equal to Prodcut-5)
            [101.3050,100.0294,100.0007,100.0000],
            [182.0700,180.0466,180.0010,180.0000],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [233.5775,230.0805,230.0018,230.0000]];
// 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 = [
                              //Product-5 (Sum of Product-1 & 2)
      [120.8800,100.4698],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [92.2400,80.2754],
      [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)
                              //Product-10 (Sum of Prodcut-6 & 7)
      [287.2400,231.2879]];
// 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)
                                      //Product-10 (Sum of Prodcut-6 & 7)
      [287.2400,231.2879,230.0290]];
// 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)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
      [195.0000,151.0125,150.0228,150.0005],
      [120.8800,100.4698,100.0106,100.0002],
                                                 //Product-8 (equal to Prodcut-5)
                                                 //Product-9 (Sum of Prodcut-5 & 6)
      [213.1200,180.7452,180.0168,180.0004],
      [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
                                   //Product-1
primary_demand = [[124.0225],
                  [39.9225], //Products-2
[77.5625], //Prodcut-3
[210.2500]]; //Product-4
secondary_demand = [
            [163.9450], //Product-5 (Sum of Product-1 & 2)
                               //Product-6 (Sum of Prodcut-2 & 3)
            [117.4850],
            [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)
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [287.8125,153.1008,150.0698],
            [163.9450,101.4388,100.0324],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [281.4300,182.2822,180.0513],
            [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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [163.9450,101.4388,100.0324,100.0007],
            [117.4850,80.8434,80.0190,80.0004],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [287.8125,153.1008,150.0698,150.0016],
                                                  //Product-8 (equal to Prodcut-5)
            [163.9450,101.4388,100.0324,100.0007],
            [281.4300,182.2822,180.0513,180.0012],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [405.2975,233.9442,230.0887,230.0020]];
// 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
                                    //Product-1
primary_demand = [[71.9600],
                   [30.3600], //Products-2
[51.0000], //Product-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)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [183.6800,180.1472,180.0059],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [236.3600,230.2544,230.0102]];
// 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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [102.3200,100.0928,100.0037,100.0001],
            [81.3600,80.0544,80.0022,80.0001],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [155.0000,150.2000,150.0080,150.0003],
                                                  //Product-8 (equal to Prodcut-5)
            [102.3200,100.0928,100.0037,100.0001],
            [183.6800,180.1472,180.0059,180.0002],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [236.3600,230.2544,230.0102,230.0004]];
// 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], //Product-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)
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [230.0000,153.2000,150.1280],
            [137.1200,101.4848,100.0594],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [238.8800,182.3552,180.0942],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [331.7600,234.0704,230.1628]];
// 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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [137.1200,101.4848,100.0594,100.0024],
            [101.7600,80.8704,80.0348,80.0014],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [230.0000,153.2000,150.1280,150.0051],
                                                  //Product-8 (equal to Prodcut-5)
            [137.1200,101.4848,100.0594,100.0024],
            [238.8800,182.3552,180.0942,180.0038],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [331.7600,234.0704,230.1628,230.0065]];
// 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
                                   //Product-1
primary_demand = [[166.0400],
                   [47.6400], //Products-2
[99.0000], //Product-3
[296.0000]]; //Product-4
secondary_demand = [
            [213.6800], //Product-5 (Sum of Product-1 & 2)
                               //Product-6 (Sum of Prodcut-2 & 3)
            [146.6400],
            [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)
                                    //Product-6 (Sum of Prodcut-2 & 3)
            [146.6400,82.6656],
            [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)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [360.3200,187.2128,180.2885],
            [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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [213.6800,104.5472,100.1819,100.0073],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [146.6400,82.6656,80.1066,80.0043],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [395.0000,159.8000,150.3920,150.0157],
                                                  //Product-8 (equal to Prodcut-5)
            [213.6800,104.5472,100.1819,100.0073],
            [360.3200,187.2128,180.2885,180.0115],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [541.6400,242.4656,230.4986,230.0199]];
// 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
                               //Products-2
//Prodcut-3
//Product-4
                  [30.0900],
                  [50.2500],
                  [101.0000]];
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 = [
                              //Product-5 (Sum of Product-1 & 2)
      [100.5800,100.0058],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [80.3400,80.0034],
                              //Product-7 (Sum of Prodcut-3 & 4)
      [151.2500,150.0125],
      [100.5800,100.0058],
                              //Product-8 (equal to Prodcut-5)
                              //Product-9 (Sum of Prodcut-5 & 6)
      [180.9200,180.0092],
                              //Product-10 (Sum of Prodcut-6 & 7)
      [231.5900,230.0159]];
// 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)
                                       //Product-10 (Sum of Prodcut-6 & 7)
      [231.5900,230.0159,230.0000]];
// 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)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
      [151.2500,150.0125,150.0001,150.0000],
      [100.5800,100.0058,100.0000,100.0000],
                                                 //Product-8 (equal to Prodcut-5)
                                                 //Product-9 (Sum of Prodcut-5 & 6)
      [180.9200,180.0092,180.0000,180.0000],
      [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
                               //Products-2
//Prodcut-3
//Product-4
                  [31.4400],
                  [54.0000],
                  [116.0000]];
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 = [
                              //Product-5 (Sum of Product-1 & 2)
      [109.2800,100.0928],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [85.4400,80.0544],
      [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)
                              //Product-10 (Sum of Prodcut-6 & 7)
      [255.4400,230.2544]];
// 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
                                                      //Product-4
                  [116.0000,100.1600,100.0016]];
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)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
      [170.0000,150.2000,150.0020,150.0000],
      [109.2800,100.0928,100.0009,100.0000],
                                                 //Product-8 (equal to Prodcut-5)
                                                 //Product-9 (Sum of Prodcut-5 & 6)
      [194.7200,180.1472,180.0015,180.0000],
      [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
                                    //Product-1
primary_demand = [[94.0100],
                  [34.4100], //Products-2
[62.2500], //Product-3
[149.0000]]; //Product-4
secondary_demand = [
            [128.4200], //Product-5 (Sum of Product-1 & 2)
                               //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600],
            [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)
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [211.2500,150.6125,150.0061],
            [128.4200,100.2842,100.0028],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [225.0800,180.4508,180.0045],
            [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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [128.4200,100.2842,100.0028,100.0000],
            [96.6600,80.1666,80.0017,80.0000],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [211.2500,150.6125,150.0061,150.0001],
                                                  //Product-8 (equal to Prodcut-5)
            [128.4200,100.2842,100.0028,100.0000],
            [225.0800,180.4508,180.0045,180.0000],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [307.9100,230.7791,230.0078,230.0001]];
// 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
                                   //Product-1
primary_demand = [[71.1025],
                               //Products-2
//Prodcut-3
//Product-4
                  [30.2025],
                  [50.5625],
                  [102.2500]];
secondary_demand = [
            [101.3050], //Product-5 (Sum of Product-1 & 2)
                               //Product-6 (Sum of Prodcut-2 & 3)
            [80.7650],
            [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)
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [80.7650,80.0172,80.0004],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [152.8125,150.0633,150.0014],
            [101.3050,100.0294,100.0007],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [182.0700,180.0466,180.0010],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [233.5775,230.0805,230.0018]];
// 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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [101.3050,100.0294,100.0007,100.0000],
            [80.7650,80.0172,80.0004,80.0000],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [152.8125,150.0633,150.0014,150.0000],
                                                  //Product-8 (equal to Prodcut-5)
            [101.3050,100.0294,100.0007,100.0000],
            [182.0700,180.0466,180.0010,180.0000],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [233.5775,230.0805,230.0018,230.0000]];
// 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
                               //Products-2
//Prodcut-3
//Product-4
                  [33.2400],
                  [59.0000],
                  [136.0000]];
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 = [
                              //Product-5 (Sum of Product-1 & 2)
      [120.8800,100.4698],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [92.2400,80.2754],
      [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)
                              //Product-10 (Sum of Prodcut-6 & 7)
      [287.2400,231.2879]];
// 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)
                                      //Product-10 (Sum of Prodcut-6 & 7)
      [287.2400,231.2879,230.0290]];
// 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 = [
                                                 //Product-5 (Sum of Product-1 & 2)
      [120.8800,100.4698,100.0106,100.0002],
      [92.2400,80.2754,80.0062,80.0001],
                                                 //Product-6 (Sum of Prodcut-2 & 3)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
      [195.0000,151.0125,150.0228,150.0005],
      [120.8800,100.4698,100.0106,100.0002],
                                                 //Product-8 (equal to Prodcut-5)
                                                 //Product-9 (Sum of Prodcut-5 & 6)
      [213.1200,180.7452,180.0168,180.0004],
      [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)
                               //Product-6 (Sum of Prodcut-2 & 3)
            [117.4850],
            [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)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [281.4300,182.2822,180.0513],
            [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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [163.9450,101.4388,100.0324,100.0007],
            [117.4850,80.8434,80.0190,80.0004],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [287.8125,153.1008,150.0698,150.0016],
                                                  //Product-8 (equal to Prodcut-5)
            [163.9450,101.4388,100.0324,100.0007],
            [281.4300,182.2822,180.0513,180.0012],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [405.2975,233.9442,230.0887,230.0020]];
// 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
                                   //Product-1
primary_demand = [[71.9600],
                   [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
                                                       //Products-2
                  [30.3600,30.0144,30.0006],
                  [51.0000,50.0400,50.0016],
                                                       //Prodcut-3
                  [104.0000,100.1600,100.0064]];
                                                        //Product-4
secondary demand = [
                                           //Product-5 (Sum of Product-1 & 2)
            [102.3200,100.0928,100.0037],
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [81.3600,80.0544,80.0022],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [155.0000,150.2000,150.0080],
                                           //Product-8 (equal to Prodcut-5)
            [102.3200,100.0928,100.0037],
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [183.6800,180.1472,180.0059],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [236.3600,230.2544,230.0102]];
// 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)
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [81.3600,80.0544,80.0022,80.0001],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [155.0000,150.2000,150.0080,150.0003],
                                                  //Product-8 (equal to Prodcut-5)
            [102.3200,100.0928,100.0037,100.0001],
            [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)
                                    //Product-6 (Sum of Prodcut-2 & 3)
            [101.7600,80.8704],
            [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)
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [230.0000,153.2000,150.1280],
            [137.1200,101.4848,100.0594],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [238.8800,182.3552,180.0942],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [331.7600,234.0704,230.1628]];
// 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)
                                                 //Product-8 (equal to Prodcut-5)
            [137.1200,101.4848,100.0594,100.0024],
                                                 //Product-9 (Sum of Prodcut-5 & 6)
            [238.8800,182.3552,180.0942,180.0038],
            [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], //Product-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)
                                //Product-10 (Sum of Prodcut-6 & 7)
            [541.6400,242.4656]];
// 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
                                                       //Products-2
                  [47.6400,30.7056,30.0282],
                  [99.0000,51.9600,50.0784],
                                                       //Prodcut-3
                  [296.0000,107.8400,100.3136]];
                                                        //Product-4
secondary demand = [
                                           //Product-5 (Sum of Product-1 & 2)
            [213.6800,104.5472,100.1819],
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [146.6400,82.6656,80.1066],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [395.0000,159.8000,150.3920],
                                           //Product-8 (equal to Prodcut-5)
            [213.6800,104.5472,100.1819],
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [360.3200,187.2128,180.2885],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [541.6400,242.4656,230.4986]];
// 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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [213.6800,104.5472,100.1819,100.0073],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [146.6400,82.6656,80.1066,80.0043],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [395.0000,159.8000,150.3920,150.0157],
                                                  //Product-8 (equal to Prodcut-5)
            [213.6800,104.5472,100.1819,100.0073],
            [360.3200,187.2128,180.2885,180.0115],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [541.6400,242.4656,230.4986,230.0199]];
// 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
                                  //Prodcut-3
//Product-4
                  [50.2500],
                  [101.0000]];
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
                                                 //Prodcut-3
                  [50.2500,50.0025],
                  [101.0000,100.0100]]; //Product-4
secondary demand = [
                              //Product-5 (Sum of Product-1 & 2)
      [100.5800,100.0058],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [80.3400,80.0034],
      [151.2500,150.0125],
                              //Product-7 (Sum of Prodcut-3 & 4)
                              //Product-8 (equal to Prodcut-5)
      [100.5800,100.0058],
                              //Product-9 (Sum of Prodcut-5 & 6)
      [180.9200,180.0092],
      [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
                                                      //Product-4
                  [101.0000,100.0100,100.0001]];
secondary_demand = [
      [100.5800,100.0058,100.0000], //Product-5 (Sum of Product-1 & 2)
                                          //Product-6 (Sum of Prodcut-2 & 3)
      [80.3400,80.0034,80.0000],
      [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)
                                                 //Product-6 (Sum of Prodcut-2 & 3)
      [80.3400,80.0034,80.0000,80.0000],
      [151.2500,150.0125,150.0001,150.0000],
                                                 //Product-7 (Sum of Prodcut-3 & 4)
                                                 //Product-8 (equal to Prodcut-5)
      [100.5800,100.0058,100.0000,100.0000],
                                                 //Product-9 (Sum of Prodcut-5 & 6)
      [180.9200,180.0092,180.0000,180.0000],
                                                 //Product-10 (Sum of Prodcut-6 & 7)
      [231.5900,230.0159,230.0000,230.0000]];
// 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
                                   //Prodcut-3
                  [54.0000],
                  [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 = [
                              //Product-5 (Sum of Product-1 & 2)
      [109.2800,100.0928],
     [85.4400,80.0544],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [170.0000,150.2000],
                              //Product-7 (Sum of Prodcut-3 & 4)
                              //Product-8 (equal to Prodcut-5)
      [109.2800,100.0928],
      [194.7200,180.1472],
                              //Product-9 (Sum of Prodcut-5 & 6)
                              //Product-10 (Sum of Prodcut-6 & 7)
      [255.4400,230.2544]];
// 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)
                                          //Product-6 (Sum of Prodcut-2 & 3)
      [85.4400,80.0544,80.0005],
      [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)
                                                 //Product-8 (equal to Prodcut-5)
      [109.2800,100.0928,100.0009,100.0000],
      [194.7200,180.1472,180.0015,180.0000],
                                                 //Product-9 (Sum of Prodcut-5 & 6)
                                                 //Product-10 (Sum of Prodcut-6 & 7)
      [255.4400,230.2544,230.0025,230.0000]];
// 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
                                   //Prodcut-3
                  [62.2500],
                  [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)
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600,80.1666,80.0017],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [211.2500,150.6125,150.0061],
                                           //Product-8 (equal to Prodcut-5)
            [128.4200,100.2842,100.0028],
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [225.0800,180.4508,180.0045],
            [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)
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600,80.1666,80.0017,80.0000],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [211.2500,150.6125,150.0061,150.0001],
            [128.4200,100.2842,100.0028,100.0000],
                                                  //Product-8 (equal to Prodcut-5)
                                                  //Product-9 (Sum of Prodcut-5 & 6)
            [225.0800,180.4508,180.0045,180.0000],
            [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
                                   //Prodcut-3
                   [50.5625],
                  [102.2500]]; //Product-4
secondary_demand = [
            [101.3050,100.0294,100.0007,100.0000],
                                                  //Product-5 (Sum of Product-1 & 2)
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [80.7650,80.0172,80.0004,80.0000],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [152.8125,150.0633,150.0014,150.0000],
            [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];
```

```
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
                                                 //Prodcut-3
                  [50.5625,50.0127],
                  [102.2500,100.0506]]; //Product-4
secondary_demand = [
            [101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)
                                    //Product-6 (Sum of Prodcut-2 & 3)
            [80.7650,80.0172],
            [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 = [
                                           //Product-5 (Sum of Product-1 & 2)
            [101.3050,100.0294,100.0007],
            [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)
                                           //Product-8 (equal to Prodcut-5)
            [101.3050,100.0294,100.0007],
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [182.0700,180.0466,180.0010],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [233.5775,230.0805,230.0018]];
// 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# 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)
                                                  //Product-8 (equal to Prodcut-5)
            [101.3050,100.0294,100.0007,100.0000],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
            [182.0700,180.0466,180.0010,180.0000],
            [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)
                       //Product-6 (Sum of Prodcut-2 & 3)
      [92.2400],
      [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)
                        //Product-10 (Sum of Prodcut-6 & 7)
      [287.2400]];
// 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 = [
                              //Product-5 (Sum of Product-1 & 2)
      [120.8800,100.4698],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [92.2400,80.2754],
                              //Product-7 (Sum of Prodcut-3 & 4)
      [195.0000,151.0125],
                              //Product-8 (equal to Prodcut-5)
      [120.8800,100.4698],
                              //Product-9 (Sum of Prodcut-5 & 6)
      [213.1200,180.7452],
                              //Product-10 (Sum of Prodcut-6 & 7)
      [287.2400,231.2879]];
// 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)
                                          //Product-6 (Sum of Prodcut-2 & 3)
      [92.2400,80.2754,80.0062],
      [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)
                                                 //Product-6 (Sum of Prodcut-2 & 3)
      [92.2400,80.2754,80.0062,80.0001],
      [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)
                                                 //Product-10 (Sum of Prodcut-6 & 7)
      [287.2400,231.2879,230.0290,230.0007]];
// 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)
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [117.4850,80.8434,80.0190],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [287.8125,153.1008,150.0698],
                                           //Product-8 (equal to Prodcut-5)
            [163.9450,101.4388,100.0324],
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [281.4300,182.2822,180.0513],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [405.2975,233.9442,230.0887]];
// 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)
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [117.4850,80.8434,80.0190,80.0004],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [287.8125,153.1008,150.0698,150.0016],
                                                  //Product-8 (equal to Prodcut-5)
            [163.9450,101.4388,100.0324,100.0007],
            [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
                                   //Prodcut-3
                   [51.0000],
                                  //Product-4
                   [104.0000]];
```

```
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)
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [81.3600,80.0544,80.0022],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [155.0000,150.2000,150.0080],
            [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)
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [236.3600,230.2544,230.0102]];
```

```
// 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)
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [81.3600,80.0544,80.0022,80.0001],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [155.0000,150.2000,150.0080,150.0003],
                                                  //Product-8 (equal to Prodcut-5)
            [102.3200,100.0928,100.0037,100.0001],
            [183.6800,180.1472,180.0059,180.0002],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [236.3600,230.2544,230.0102,230.0004]];
// 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
                                    //Products-2
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)
                                   //Product-6 (Sum of Prodcut-2 & 3)
            [101.7600,80.8704],
            [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)
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [101.7600,80.8704,80.0348],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [230.0000,153.2000,150.1280],
            [137.1200,101.4848,100.0594],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [238.8800,182.3552,180.0942],
            [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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [137.1200,101.4848,100.0594,100.0024],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [101.7600,80.8704,80.0348,80.0014],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [230.0000,153.2000,150.1280,150.0051],
            [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)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [331.7600,234.0704,230.1628,230.0065]];
// 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
                                   //Products-2
                  [47.6400],
                                  //Prodcut-3
                  [99.0000],
                  [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)
                                   //Product-6 (Sum of Prodcut-2 & 3)
            [146.6400,82.6656],
            [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)
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [395.0000,159.8000,150.3920],
            [213.6800,104.5472,100.1819],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [360.3200,187.2128,180.2885],
            [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)
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [146.6400,82.6656,80.1066,80.0043],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [395.0000,159.8000,150.3920,150.0157],
                                                  //Product-8 (equal to Prodcut-5)
            [213.6800,104.5472,100.1819,100.0073],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
            [360.3200,187.2128,180.2885,180.0115],
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [541.6400,242.4656,230.4986,230.0199]];
// 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
                                  //Prodcut-3
//Product-4
                  [50.2500],
                  [101.0000]];
secondary demand = [
      [100.5800], //Product-5 (Sum of Product-1 & 2)
                        //Product-6 (Sum of Prodcut-2 & 3)
      [80.3400],
      [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)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
      [151.2500,150.0125,150.0001,150.0000],
                                                 //Product-8 (equal to Prodcut-5)
      [100.5800,100.0058,100.0000,100.0000],
      [180.9200,180.0092,180.0000,180.0000],
                                                 //Product-9 (Sum of Prodcut-5 & 6)
                                                 //Product-10 (Sum of Prodcut-6 & 7)
      [231.5900,230.0159,230.0000,230.0000]];
// 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)
                                                 //Product-10 (Sum of Prodcut-6 & 7)
      [231.5900,230.0159,230.0000,230.0000]];
// 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 = [
                                                 //Product-5 (Sum of Product-1 & 2)
      [100.5800,100.0058,100.0000,100.0000],
                                                 //Product-6 (Sum of Prodcut-2 & 3)
      [80.3400,80.0034,80.0000,80.0000],
      [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
                                   //Product-1
primary_demand = [[77.8400],
                  [31.4400],
                                   //Products-2
                                  //Prodcut-3
                  [54.0000],
                  [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)
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [85.4400,80.0544],
      [170.0000,150.2000],
                              //Product-7 (Sum of Prodcut-3 & 4)
                              //Product-8 (equal to Prodcut-5)
      [109.2800,100.0928],
      [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)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
      [170.0000,150.2000,150.0020,150.0000],
                                                 //Product-8 (equal to Prodcut-5)
      [109.2800,100.0928,100.0009,100.0000],
      [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
                                   //Products-2
                  [34.4100],
                                  //Prodcut-3
//Product-4
                  [62.2500],
                  [149.0000]];
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
                                                 //Products-2
                  [34.4100,30.0441],
                  [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)
                                    //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600,80.1666],
            [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)
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600,80.1666,80.0017],
            [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)
                                                  //Product-8 (equal to Prodcut-5)
            [128.4200,100.2842,100.0028,100.0000],
            [225.0800,180.4508,180.0045,180.0000],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [307.9100,230.7791,230.0078,230.0001]];
// 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
                                   //Product-1
primary_demand = [[71.1025],
                   [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
                                                       //Products-2
                  [30.2025,30.0046,30.0001],
                  [50.5625,50.0127,50.0003],
                                                       //Prodcut-3
                  [102.2500,100.0506,100.0011]];
                                                       //Product-4
secondary demand = [
                                           //Product-5 (Sum of Product-1 & 2)
            [101.3050,100.0294,100.0007],
            [80.7650,80.0172,80.0004],
                                           //Product-6 (Sum of Prodcut-2 & 3)
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [152.8125,150.0633,150.0014],
                                           //Product-8 (equal to Prodcut-5)
            [101.3050,100.0294,100.0007],
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [182.0700,180.0466,180.0010],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [233.5775,230.0805,230.0018]];
// 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)
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [80.7650,80.0172,80.0004,80.0000],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [152.8125,150.0633,150.0014,150.0000],
                                                  //Product-8 (equal to Prodcut-5)
            [101.3050,100.0294,100.0007,100.0000],
            [182.0700,180.0466,180.0010,180.0000],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [233.5775,230.0805,230.0018,230.0000]];
// 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
                                  //Prodcut-3
//Product-4
                  [59.0000],
                  [136.0000]];
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
                                                 //Prodcut-3
                  [59.0000,50.2025],
                  [136.0000,100.8100]]; //Product-4
secondary demand = [
                              //Product-5 (Sum of Product-1 & 2)
      [120.8800,100.4698],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [92.2400,80.2754],
      [195.0000,151.0125],
                              //Product-7 (Sum of Prodcut-3 & 4)
                              //Product-8 (equal to Prodcut-5)
      [120.8800,100.4698],
                              //Product-9 (Sum of Prodcut-5 & 6)
      [213.1200,180.7452],
      [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
                                                      //Product-4
                  [136.0000,100.8100,100.0182]];
secondary_demand = [
      [120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)
                                          //Product-6 (Sum of Prodcut-2 & 3)
      [92.2400,80.2754,80.0062],
      [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 = [
                                                 //Product-5 (Sum of Product-1 & 2)
      [120.8800,100.4698,100.0106,100.0002],
      [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)
                                                 //Product-8 (equal to Prodcut-5)
      [120.8800,100.4698,100.0106,100.0002],
                                                 //Product-9 (Sum of Prodcut-5 & 6)
      [213.1200,180.7452,180.0168,180.0004],
                                                 //Product-10 (Sum of Prodcut-6 & 7)
      [287.2400,231.2879,230.0290,230.0007]];
// 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
                                   //Prodcut-3
                  [77.5625],
                  [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)
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [117.4850,80.8434,80.0190],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [287.8125,153.1008,150.0698],
            [163.9450,101.4388,100.0324],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [281.4300,182.2822,180.0513],
            [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
                                                              //Prodcut-3
                  [77.5625,50.6202,50.0140,50.0003],
                  [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)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [287.8125,153.1008,150.0698,150.0016],
            [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)
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [81.3600,80.0544,80.0022],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [155.0000,150.2000,150.0080],
                                           //Product-8 (equal to Prodcut-5)
            [102.3200,100.0928,100.0037],
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [183.6800,180.1472,180.0059],
            [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)
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [81.3600,80.0544,80.0022,80.0001],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [155.0000,150.2000,150.0080,150.0003],
            [102.3200,100.0928,100.0037,100.0001],
                                                  //Product-8 (equal to Prodcut-5)
                                                  //Product-9 (Sum of Prodcut-5 & 6)
            [183.6800,180.1472,180.0059,180.0002],
            [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
                                    //Products-2
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];
```

```
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
                                                 //Prodcut-3
                  [66.0000,50.6400],
                  [164.0000,102.5600]]; //Product-4
secondary_demand = [
            [137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)
                                    //Product-6 (Sum of Prodcut-2 & 3)
            [101.7600,80.8704],
            [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 = [
                                           //Product-5 (Sum of Product-1 & 2)
            [137.1200,101.4848,100.0594],
            [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)
                                           //Product-8 (equal to Prodcut-5)
            [137.1200,101.4848,100.0594],
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [238.8800,182.3552,180.0942],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [331.7600,234.0704,230.1628]];
// 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)
                                                  //Product-8 (equal to Prodcut-5)
            [137.1200,101.4848,100.0594,100.0024],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
            [238.8800,182.3552,180.0942,180.0038],
            [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]];
                                                       //Product-4
secondary demand = [
                                           //Product-5 (Sum of Product-1 & 2)
            [213.6800,104.5472,100.1819],
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [146.6400,82.6656,80.1066],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [395.0000,159.8000,150.3920],
            [213.6800,104.5472,100.1819],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [360.3200,187.2128,180.2885],
            [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 - 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)
                                                  //Product-9 (Sum of Prodcut-5 & 6)
            [360.3200,187.2128,180.2885,180.0115],
            [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
[151.2500], //Product-7 (Sum of Prodcut-3 & 4)
                         //Product-6 (Sum of Prodcut-2 & 3)
      [100.5800], //Product-8 (equal to Prodcut-5)
      [180.9200], //Product-9 (Sum of Prodcut-5 & 6)
                         //Product-10 (Sum of Prodcut-6 & 7)
      [231.5900]];
// 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)
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [80.3400,80.0034],
                              //Product-7 (Sum of Prodcut-3 & 4)
      [151.2500,150.0125],
      [100.5800,100.0058],
                              //Product-8 (equal to Prodcut-5)
                              //Product-9 (Sum of Prodcut-5 & 6)
      [180.9200,180.0092],
      [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)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
      [151.2500,150.0125,150.0001,150.0000],
      [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
                                    //Product-4
                  [116.0000]];
```

```
secondary demand = [
      [109.2800], //Product-5 (Sum of Product-1 & 2)
                        //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)
                             //Product-10 (Sum of Prodcut-6 & 7)
      [255.4400,230.2544]];
// 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)
                                         //Product-6 (Sum of Prodcut-2 & 3)
      [85.4400,80.0544,80.0005],
      [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)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
      [170.0000,150.2000,150.0020,150.0000],
      [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
                                  //Product-1
primary_demand = [[94.0100],
                                   //Products-2
                  [34.4100],
                  [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
                                                 //Products-2
                  [34.4100,30.0441],
                  [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)
                                    //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600,80.1666],
            [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 = [
                                           //Product-5 (Sum of Product-1 & 2)
            [128.4200,100.2842,100.0028],
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600,80.1666,80.0017],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [211.2500,150.6125,150.0061],
            [128.4200,100.2842,100.0028],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [225.0800,180.4508,180.0045],
            [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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [128.4200,100.2842,100.0028,100.0000],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600,80.1666,80.0017,80.0000],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [211.2500,150.6125,150.0061,150.0001],
            [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)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [307.9100,230.7791,230.0078,230.0001]];
// 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
                                   //Products-2
                  [30.2025],
                  [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
                                                 //Products-2
                  [30.2025,30.0046],
                  [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)
                                    //Product-6 (Sum of Prodcut-2 & 3)
            [80.7650,80.0172],
            [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
                                                        //Product-4
                  [102.2500,100.0506,100.0011]];
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)
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [152.8125,150.0633,150.0014],
                                           //Product-8 (equal to Prodcut-5)
            [101.3050,100.0294,100.0007],
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [182.0700,180.0466,180.0010],
            [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)
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [80.7650,80.0172,80.0004,80.0000],
            [152.8125,150.0633,150.0014,150.0000],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
                                                  //Product-8 (equal to Prodcut-5)
            [101.3050,100.0294,100.0007,100.0000],
            [182.0700,180.0466,180.0010,180.0000],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [233.5775,230.0805,230.0018,230.0000]];
// 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)
                        //Product-6 (Sum of Prodcut-2 & 3)
      [92.2400],
      [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
                                                //Prodcut-3
                  [59.0000,50.2025],
                  [136.0000,100.8100]]; //Product-4
secondary demand = [
      [120.8800,100.4698],
                              //Product-5 (Sum of Product-1 & 2)
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [92.2400,80.2754],
                              //Product-7 (Sum of Prodcut-3 & 4)
      [195.0000,151.0125],
                              //Product-8 (equal to Prodcut-5)
      [120.8800,100.4698],
      [213.1200,180.7452],
                              //Product-9 (Sum of Prodcut-5 & 6)
                              //Product-10 (Sum of Prodcut-6 & 7)
      [287.2400,231.2879]];
// 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)
                                                 //Product-9 (Sum of Prodcut-5 & 6)
      [213.1200,180.7452,180.0168,180.0004],
      [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
                                   //Product-1
primary demand = [[124.0225],
                  [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)
                                          //Product-7 (Sum of Prodcut-3 & 4)
            [287.8125,153.1008,150.0698],
```

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

```
[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\};
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
                   [[71.9600], //Product-1
[30.3600], //Products-2
[51.0000], //Product-3
[104.0000]]; //Product-4
primary_demand = [[71.9600],
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
                                                 //Prodcut-3
                  [51.0000,50.0400],
                  [104.0000,100.1600]]; //Product-4
secondary_demand = [
            [102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)
                                    //Product-6 (Sum of Prodcut-2 & 3)
            [81.3600,80.0544],
            [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
                                                        //Products-2
                  [30.3600,30.0144,30.0006],
                  [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)
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [81.3600,80.0544,80.0022],
            [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)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [183.6800,180.1472,180.0059],
            [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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [102.3200,100.0928,100.0037,100.0001],
            [81.3600,80.0544,80.0022,80.0001],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [155.0000,150.2000,150.0080,150.0003],
                                                  //Product-8 (equal to Prodcut-5)
            [102.3200,100.0928,100.0037,100.0001],
            [183.6800,180.1472,180.0059,180.0002],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [236.3600,230.2544,230.0102,230.0004]];
// 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
                                                       //Products-2
                  [35.7600,30.2304,30.0092],
                  [66.0000,50.6400,50.0256],
                                                       //Prodcut-3
                  [164.0000,102.5600,100.1024]];
                                                        //Product-4
secondary demand = [
                                           //Product-5 (Sum of Product-1 & 2)
            [137.1200,101.4848,100.0594],
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [101.7600,80.8704,80.0348],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [230.0000,153.2000,150.1280],
                                           //Product-8 (equal to Prodcut-5)
            [137.1200,101.4848,100.0594],
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [238.8800,182.3552,180.0942],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [331.7600,234.0704,230.1628]];
// 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)
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [101.7600,80.8704,80.0348,80.0014],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [230.0000,153.2000,150.1280,150.0051],
                                                  //Product-8 (equal to Prodcut-5)
            [137.1200,101.4848,100.0594,100.0024],
            [238.8800,182.3552,180.0942,180.0038],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [331.7600,234.0704,230.1628,230.0065]];
// 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
                  [296.0000];
                                  //Prodcut-3
//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)
                                    //Product-6 (Sum of Prodcut-2 & 3)
            [146.6400,82.6656],
            [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)
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [146.6400,82.6656,80.1066],
            [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)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [360.3200,187.2128,180.2885],
            [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)
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [146.6400,82.6656,80.1066,80.0043],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [395.0000,159.8000,150.3920,150.0157],
                                                  //Product-8 (equal to Prodcut-5)
            [213.6800,104.5472,100.1819,100.0073],
            [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
                                  //Prodcut-3
                  [50.2500],
                  [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)
                        //Product-10 (Sum of Prodcut-6 & 7)
      [231.5900]];
// 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
                                                //Prodcut-3
                  [50.2500,50.0025],
                  [101.0000,100.0100]]; //Product-4
secondary demand = [
                              //Product-5 (Sum of Product-1 & 2)
      [100.5800,100.0058],
      [80.3400,80.0034],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [151.2500,150.0125],
                              //Product-7 (Sum of Prodcut-3 & 4)
                              //Product-8 (equal to Prodcut-5)
      [100.5800,100.0058],
      [180.9200,180.0092],
                              //Product-9 (Sum of Prodcut-5 & 6)
                              //Product-10 (Sum of Prodcut-6 & 7)
      [231.5900,230.0159]];
// 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)
                                          //Product-6 (Sum of Prodcut-2 & 3)
      [80.3400,80.0034,80.0000],
      [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)
                                                 //Product-8 (equal to Prodcut-5)
      [100.5800,100.0058,100.0000,100.0000],
      [180.9200,180.0092,180.0000,180.0000],
                                                 //Product-9 (Sum of Prodcut-5 & 6)
                                                 //Product-10 (Sum of Prodcut-6 & 7)
      [231.5900,230.0159,230.0000,230.0000]];
// 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
                                   //Prodcut-3
                  [54.0000],
                  [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)
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [85.4400,80.0544],
      [170.0000,150.2000],
                              //Product-7 (Sum of Prodcut-3 & 4)
                              //Product-8 (equal to Prodcut-5)
      [109.2800,100.0928],
      [194.7200,180.1472],
                              //Product-9 (Sum of Prodcut-5 & 6)
                              //Product-10 (Sum of Prodcut-6 & 7)
      [255.4400,230.2544]];
```

```
// 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 = [
                                                 //Product-5 (Sum of Product-1 & 2)
      [109.2800,100.0928,100.0009,100.0000],
      [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
                                   //Products-2
                  [34.4100],
                  [62.2500], //Product-3
[149.0000]]; //Product-4
secondary_demand = [
            [128.4200], //Product-5 (Sum of Product-1 & 2)
                               //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600],
            [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)
                                     //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600,80.1666],
            [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 = [
                                           //Product-5 (Sum of Product-1 & 2)
            [128.4200,100.2842,100.0028],
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600,80.1666,80.0017],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [211.2500,150.6125,150.0061],
            [128.4200,100.2842,100.0028],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [225.0800,180.4508,180.0045],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [307.9100,230.7791,230.0078]];
// 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)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [211.2500,150.6125,150.0061,150.0001],
            [128.4200,100.2842,100.0028,100.0000],
                                                  //Product-8 (equal to Prodcut-5)
                                                  //Product-9 (Sum of Prodcut-5 & 6)
            [225.0800,180.4508,180.0045,180.0000],
            [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
                                    //Product-1
primary demand = [[71.1025],
                  [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)
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [80.7650,80.0172,80.0004],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [152.8125,150.0633,150.0014],
                                           //Product-8 (equal to Prodcut-5)
            [101.3050,100.0294,100.0007],
            [182.0700,180.0466,180.0010],
                                           //Product-9 (Sum of Prodcut-5 & 6)
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [233.5775,230.0805,230.0018]];
// 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)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [152.8125,150.0633,150.0014,150.0000],
            [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)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [233.5775,230.0805,230.0018,230.0000]];
// 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
                                  //Product-3
//Product-4
                  [59.0000],
                  [136.0000]];
secondary_demand = [
      [120.8800], //Product-5 (Sum of Product-1 & 2)
                        //Product-6 (Sum of Prodcut-2 & 3)
      [92.2400],
      [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 = [
                              //Product-5 (Sum of Product-1 & 2)
      [120.8800,100.4698],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [92.2400,80.2754],
      [195.0000,151.0125],
                              //Product-7 (Sum of Prodcut-3 & 4)
                              //Product-8 (equal to Prodcut-5)
      [120.8800,100.4698],
      [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
```

```
//Product-1
primary_demand = [[87.6400,70.3969,70.0089,70.0002],
                  [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)
                                                 //Product-6 (Sum of Prodcut-2 & 3)
      [92.2400,80.2754,80.0062,80.0001],
      [195.0000,151.0125,150.0228,150.0005],
                                                //Product-7 (Sum of Prodcut-3 & 4)
                                                //Product-8 (equal to Prodcut-5)
      [120.8800,100.4698,100.0106,100.0002],
                                              //Product-9 (Sum of Prodcut-5 & 6)
      [213.1200,180.7452,180.0168,180.0004],
                                                 //Product-10 (Sum of Prodcut-6 & 7)
      [287.2400,231.2879,230.0290,230.0007]];
// 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
                                   //Prodcut-3
                  [77.5625],
                                 //Product-4
                  [210.2500]];
```

```
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)
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [287.8125,153.1008,150.0698],
            [163.9450,101.4388,100.0324],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [281.4300,182.2822,180.0513],
```

```
[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
                                                              //Product-4
                  [210.2500,102.4806,100.0558,100.0013]];
secondary_demand = [
                                                 //Product-5 (Sum of Product-1 & 2)
            [163.9450,101.4388,100.0324,100.0007],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [117.4850,80.8434,80.0190,80.0004],
                                                 //Product-7 (Sum of Prodcut-3 & 4)
            [287.8125,153.1008,150.0698,150.0016],
                                                 //Product-8 (equal to Prodcut-5)
            [163.9450,101.4388,100.0324,100.0007],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
            [281.4300,182.2822,180.0513,180.0012],
            [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
                                   //Product-1
primary demand = [[71.9600],
                   [30.3600], //Products-2
[51.0000], //Prodcut-3
[104.0000]]; //Product-4
secondary_demand = [
             [102.3200], //Product-5 (Sum of Product-1 & 2)
                                //Product-6 (Sum of Prodcut-2 & 3)
             [81.3600],
             [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)
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [155.0000,150.2000,150.0080],
            [102.3200,100.0928,100.0037],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [183.6800,180.1472,180.0059],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [236.3600,230.2544,230.0102]];
// 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)
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [81.3600,80.0544,80.0022,80.0001],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [155.0000,150.2000,150.0080,150.0003],
            [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], //Product-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)
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [230.0000,153.2000,150.1280],
            [137.1200,101.4848,100.0594],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [238.8800,182.3552,180.0942],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [331.7600,234.0704,230.1628]];
// 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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [137.1200,101.4848,100.0594,100.0024],
            [101.7600,80.8704,80.0348,80.0014],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [230.0000,153.2000,150.1280,150.0051],
                                                  //Product-8 (equal to Prodcut-5)
            [137.1200,101.4848,100.0594,100.0024],
            [238.8800,182.3552,180.0942,180.0038],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [331.7600,234.0704,230.1628,230.0065]];
// 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], //Product-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)
                                //Product-10 (Sum of Prodcut-6 & 7)
            [541.6400,242.4656]];
// 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
                                                       //Products-2
                  [47.6400,30.7056,30.0282],
                  [99.0000,51.9600,50.0784],
                                                       //Prodcut-3
                  [296.0000,107.8400,100.3136]];
                                                        //Product-4
secondary demand = [
                                           //Product-5 (Sum of Product-1 & 2)
            [213.6800,104.5472,100.1819],
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [146.6400,82.6656,80.1066],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [395.0000,159.8000,150.3920],
                                           //Product-8 (equal to Prodcut-5)
            [213.6800,104.5472,100.1819],
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [360.3200,187.2128,180.2885],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [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 - 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)
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [146.6400,82.6656,80.1066,80.0043],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [395.0000,159.8000,150.3920,150.0157],
                                                  //Product-8 (equal to Prodcut-5)
            [213.6800,104.5472,100.1819,100.0073],
            [360.3200,187.2128,180.2885,180.0115],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [541.6400,242.4656,230.4986,230.0199]];
// 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
                                  //Prodcut-3
                  [50.2500],
                  [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)
                        //Product-10 (Sum of Prodcut-6 & 7)
      [231.5900]];
// 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)
                              //Product-7 (Sum of Prodcut-3 & 4)
      [151.2500,150.0125],
                              //Product-8 (equal to Prodcut-5)
      [100.5800,100.0058],
                              //Product-9 (Sum of Prodcut-5 & 6)
      [180.9200,180.0092],
                              //Product-10 (Sum of Prodcut-6 & 7)
      [231.5900,230.0159]];
// 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)
                                         //Product-6 (Sum of Prodcut-2 & 3)
      [80.3400,80.0034,80.0000],
      [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)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
      [151.2500,150.0125,150.0001,150.0000],
                                                 //Product-8 (equal to Prodcut-5)
      [100.5800,100.0058,100.0000,100.0000],
      [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)
                              //Product-7 (Sum of Prodcut-3 & 4)
      [170.0000,150.2000],
      [109.2800,100.0928],
                              //Product-8 (equal to Prodcut-5)
                              //Product-9 (Sum of Prodcut-5 & 6)
      [194.7200,180.1472],
      [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 Prodcut-2 & 3)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
      [170.0000,150.2000,150.0020,150.0000],
      [109.2800,100.0928,100.0009,100.0000],
                                                 //Product-8 (equal to Prodcut-5)
                                                 //Product-9 (Sum of Prodcut-5 & 6)
      [194.7200,180.1472,180.0015,180.0000],
      [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 - 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],
                                   //Prodcut-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)
                                           //Product-8 (equal to Prodcut-5)
            [128.4200,100.2842,100.0028],
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [225.0800,180.4508,180.0045],
            [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)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
            [211.2500,150.6125,150.0061,150.0001],
                                                 //Product-8 (equal to Prodcut-5)
            [128.4200,100.2842,100.0028,100.0000],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
            [225.0800,180.4508,180.0045,180.0000],
            [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
                                   //Product-1
//Products-2
//Prodcut-3
//Product-4
primary_demand = [[71.1025],
                   [30.2025],
                   [50.5625],
                   [102.2500]];
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)
                                     //Product-6 (Sum of Prodcut-2 & 3)
            [80.7650,80.0172],
            [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 = [
                                           //Product-5 (Sum of Product-1 & 2)
            [101.3050,100.0294,100.0007],
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [80.7650,80.0172,80.0004],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [152.8125,150.0633,150.0014],
            [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)
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [233.5775,230.0805,230.0018]];
// 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)
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [80.7650,80.0172,80.0004,80.0000],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [152.8125,150.0633,150.0014,150.0000],
            [101.3050,100.0294,100.0007,100.0000],
                                                  //Product-8 (equal to Prodcut-5)
                                                  //Product-9 (Sum of Prodcut-5 & 6)
            [182.0700,180.0466,180.0010,180.0000],
            [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
                                    //Product-1
primary demand = [[87.6400],
                  [33.2400], //Products-2
[59.0000], //Product-3
[136.0000]]; //Product-4
                  [33.2400],
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)
                              //Product-7 (Sum of Prodcut-3 & 4)
      [195.0000,151.0125],
      [120.8800,100.4698],
                              //Product-8 (equal to Prodcut-5)
                              //Product-9 (Sum of Prodcut-5 & 6)
      [213.1200,180.7452],
      [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 = [
                                                 //Product-5 (Sum of Product-1 & 2)
      [120.8800,100.4698,100.0106,100.0002],
      [92.2400,80.2754,80.0062,80.0001],
                                                 //Product-6 (Sum of Prodcut-2 & 3)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
      [195.0000,151.0125,150.0228,150.0005],
      [120.8800,100.4698,100.0106,100.0002],
                                                 //Product-8 (equal to Prodcut-5)
                                                 //Product-9 (Sum of Prodcut-5 & 6)
      [213.1200,180.7452,180.0168,180.0004],
      [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
                                  //Prodcut-3
//Product-4
                  [77.5625],
                  [210.2500]];
secondary_demand = [
            [163.9450], //Product-5 (Sum of Product-1 & 2)
                              //Product-6 (Sum of Prodcut-2 & 3)
            [117.4850],
            [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)
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [287.8125,153.1008,150.0698],
            [163.9450,101.4388,100.0324],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [281.4300,182.2822,180.0513],
            [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)
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [117.4850,80.8434,80.0190,80.0004],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [287.8125,153.1008,150.0698,150.0016],
                                                  //Product-8 (equal to Prodcut-5)
            [163.9450,101.4388,100.0324,100.0007],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
            [281.4300,182.2822,180.0513,180.0012],
            [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
                                 //Product-4
                   [104.0000]];
```

```
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)
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [81.3600,80.0544,80.0022],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [155.0000,150.2000,150.0080],
            [102.3200,100.0928,100.0037],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [183.6800,180.1472,180.0059],
```

```
[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
                                                              //Product-4
                  [104.0000,100.1600,100.0064,100.0003]];
secondary_demand = [
                                                 //Product-5 (Sum of Product-1 & 2)
            [102.3200,100.0928,100.0037,100.0001],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [81.3600,80.0544,80.0022,80.0001],
                                                 //Product-7 (Sum of Prodcut-3 & 4)
            [155.0000,150.2000,150.0080,150.0003],
                                                 //Product-8 (equal to Prodcut-5)
            [102.3200,100.0928,100.0037,100.0001],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
            [183.6800,180.1472,180.0059,180.0002],
            [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],
                   [35.7600], //Products-2
[66.0000], //Prodcut-3
[164.0000]]; //Product-4
secondary_demand = [
             [137.1200], //Product-5 (Sum of Product-1 & 2)
                               //Product-6 (Sum of Prodcut-2 & 3)
             [101.7600],
             [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)
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [230.0000,153.2000,150.1280],
            [137.1200,101.4848,100.0594],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [238.8800,182.3552,180.0942],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [331.7600,234.0704,230.1628]];
// 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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [137.1200,101.4848,100.0594,100.0024],
            [101.7600,80.8704,80.0348,80.0014],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [230.0000,153.2000,150.1280,150.0051],
                                                  //Product-8 (equal to Prodcut-5)
            [137.1200,101.4848,100.0594,100.0024],
            [238.8800,182.3552,180.0942,180.0038],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [331.7600,234.0704,230.1628,230.0065]];
// 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], //Product-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)
                                //Product-10 (Sum of Prodcut-6 & 7)
            [541.6400,242.4656]];
// 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
                                                       //Products-2
                  [47.6400,30.7056,30.0282],
                  [99.0000,51.9600,50.0784],
                                                       //Prodcut-3
                  [296.0000,107.8400,100.3136]];
                                                       //Product-4
secondary demand = [
                                           //Product-5 (Sum of Product-1 & 2)
            [213.6800,104.5472,100.1819],
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [146.6400,82.6656,80.1066],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [395.0000,159.8000,150.3920],
                                           //Product-8 (equal to Prodcut-5)
            [213.6800,104.5472,100.1819],
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [360.3200,187.2128,180.2885],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [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 - 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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [213.6800,104.5472,100.1819,100.0073],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [146.6400,82.6656,80.1066,80.0043],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [395.0000,159.8000,150.3920,150.0157],
                                                  //Product-8 (equal to Prodcut-5)
            [213.6800,104.5472,100.1819,100.0073],
            [360.3200,187.2128,180.2885,180.0115],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [541.6400,242.4656,230.4986,230.0199]];
// 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
                                  //Prodcut-3
//Product-4
                  [50.2500],
                  [101.0000]];
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
                                                 //Prodcut-3
                  [50.2500,50.0025],
                  [101.0000,100.0100]]; //Product-4
secondary demand = [
                              //Product-5 (Sum of Product-1 & 2)
      [100.5800,100.0058],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [80.3400,80.0034],
      [151.2500,150.0125],
                              //Product-7 (Sum of Prodcut-3 & 4)
                              //Product-8 (equal to Prodcut-5)
      [100.5800,100.0058],
                              //Product-9 (Sum of Prodcut-5 & 6)
      [180.9200,180.0092],
      [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)
                                          //Product-6 (Sum of Prodcut-2 & 3)
      [80.3400,80.0034,80.0000],
      [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)
                                                 //Product-6 (Sum of Prodcut-2 & 3)
      [80.3400,80.0034,80.0000,80.0000],
      [151.2500,150.0125,150.0001,150.0000],
                                                 //Product-7 (Sum of Prodcut-3 & 4)
                                                 //Product-8 (equal to Prodcut-5)
      [100.5800,100.0058,100.0000,100.0000],
                                                //Product-9 (Sum of Prodcut-5 & 6)
      [180.9200,180.0092,180.0000,180.0000],
                                                 //Product-10 (Sum of Prodcut-6 & 7)
      [231.5900,230.0159,230.0000,230.0000]];
// 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
                                   //Prodcut-3
                  [54.0000],
                  [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 = [
                              //Product-5 (Sum of Product-1 & 2)
      [109.2800,100.0928],
     [85.4400,80.0544],
                                    //Product-6 (Sum of Prodcut-2 & 3)
      [170.0000,150.2000],
                              //Product-7 (Sum of Prodcut-3 & 4)
                              //Product-8 (equal to Prodcut-5)
      [109.2800,100.0928],
      [194.7200,180.1472],
                              //Product-9 (Sum of Prodcut-5 & 6)
                              //Product-10 (Sum of Prodcut-6 & 7)
      [255.4400,230.2544]];
// 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)
                                          //Product-6 (Sum of Prodcut-2 & 3)
      [85.4400,80.0544,80.0005],
      [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)
                                                 //Product-6 (Sum of Prodcut-2 & 3)
      [85.4400,80.0544,80.0005,80.0000],
      [170.0000,150.2000,150.0020,150.0000],
                                                 //Product-7 (Sum of Prodcut-3 & 4)
                                                 //Product-8 (equal to Prodcut-5)
      [109.2800,100.0928,100.0009,100.0000],
      [194.7200,180.1472,180.0015,180.0000],
                                                 //Product-9 (Sum of Prodcut-5 & 6)
                                                 //Product-10 (Sum of Prodcut-6 & 7)
      [255.4400,230.2544,230.0025,230.0000]];
// 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
                                   //Prodcut-3
                  [62.2500],
                  [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)
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600,80.1666,80.0017],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [211.2500,150.6125,150.0061],
                                           //Product-8 (equal to Prodcut-5)
            [128.4200,100.2842,100.0028],
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [225.0800,180.4508,180.0045],
            [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)
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [96.6600,80.1666,80.0017,80.0000],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [211.2500,150.6125,150.0061,150.0001],
            [128.4200,100.2842,100.0028,100.0000],
                                                  //Product-8 (equal to Prodcut-5)
                                                  //Product-9 (Sum of Prodcut-5 & 6)
            [225.0800,180.4508,180.0045,180.0000],
            [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
                                   //Products-2
                  [30.2025],
                  [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)
                                     //Product-6 (Sum of Prodcut-2 & 3)
            [80.7650,80.0172],
            [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 = [
                                           //Product-5 (Sum of Product-1 & 2)
            [101.3050,100.0294,100.0007],
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [80.7650,80.0172,80.0004],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [152.8125,150.0633,150.0014],
            [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)
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [233.5775,230.0805,230.0018]];
// 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)
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [80.7650,80.0172,80.0004,80.0000],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [152.8125,150.0633,150.0014,150.0000],
            [101.3050,100.0294,100.0007,100.0000],
                                                  //Product-8 (equal to Prodcut-5)
                                                  //Product-9 (Sum of Prodcut-5 & 6)
            [182.0700,180.0466,180.0010,180.0000],
            [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
                                    //Product-1
primary demand = [[87.6400],
                  [33.2400], //Products-2
[59.0000], //Product-3
[136.0000]]; //Product-4
                  [33.2400],
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)
                              //Product-7 (Sum of Prodcut-3 & 4)
      [195.0000,151.0125],
      [120.8800,100.4698],
                              //Product-8 (equal to Prodcut-5)
                              //Product-9 (Sum of Prodcut-5 & 6)
      [213.1200,180.7452],
      [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 = [
                                                 //Product-5 (Sum of Product-1 & 2)
      [120.8800,100.4698,100.0106,100.0002],
      [92.2400,80.2754,80.0062,80.0001],
                                                 //Product-6 (Sum of Prodcut-2 & 3)
                                                 //Product-7 (Sum of Prodcut-3 & 4)
      [195.0000,151.0125,150.0228,150.0005],
      [120.8800,100.4698,100.0106,100.0002],
                                                 //Product-8 (equal to Prodcut-5)
                                                 //Product-9 (Sum of Prodcut-5 & 6)
      [213.1200,180.7452,180.0168,180.0004],
      [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
                                  //Prodcut-3
//Product-4
                  [77.5625],
                  [210.2500]];
secondary_demand = [
            [163.9450], //Product-5 (Sum of Product-1 & 2)
                              //Product-6 (Sum of Prodcut-2 & 3)
            [117.4850],
            [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)
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [287.8125,153.1008,150.0698],
            [163.9450,101.4388,100.0324],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [281.4300,182.2822,180.0513],
            [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)
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [117.4850,80.8434,80.0190,80.0004],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [287.8125,153.1008,150.0698,150.0016],
                                                  //Product-8 (equal to Prodcut-5)
            [163.9450,101.4388,100.0324,100.0007],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
            [281.4300,182.2822,180.0513,180.0012],
            [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
                                    //Products-2
                   [30.3600],
                                //Prodcut-3
//Product-4
                   [51.0000],
                   [104.0000]];
```

```
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
                                                 //Products-2
                  [30.3600,30.0144],
                  [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 = [
                                           //Product-5 (Sum of Product-1 & 2)
            [102.3200,100.0928,100.0037],
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [81.3600,80.0544,80.0022],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [155.0000,150.2000,150.0080],
            [102.3200,100.0928,100.0037],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [183.6800,180.1472,180.0059],
```

```
[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
                                                              //Product-4
                  [104.0000,100.1600,100.0064,100.0003]];
secondary_demand = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [102.3200,100.0928,100.0037,100.0001],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [81.3600,80.0544,80.0022,80.0001],
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [155.0000,150.2000,150.0080,150.0003],
                                                  //Product-8 (equal to Prodcut-5)
            [102.3200,100.0928,100.0037,100.0001],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
            [183.6800,180.1472,180.0059,180.0002],
            [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], //Product-3
[164.0000]]; //Product-4
secondary_demand = [
             [137.1200], //Product-5 (Sum of Product-1 & 2)
                                //Product-6 (Sum of Prodcut-2 & 3)
             [101.7600],
             [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)
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [230.0000,153.2000,150.1280],
            [137.1200,101.4848,100.0594],
                                           //Product-8 (equal to Prodcut-5)
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [238.8800,182.3552,180.0942],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [331.7600,234.0704,230.1628]];
// 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 = [
                                                  //Product-5 (Sum of Product-1 & 2)
            [137.1200,101.4848,100.0594,100.0024],
            [101.7600,80.8704,80.0348,80.0014],
                                                  //Product-6 (Sum of Prodcut-2 & 3)
                                                  //Product-7 (Sum of Prodcut-3 & 4)
            [230.0000,153.2000,150.1280,150.0051],
                                                  //Product-8 (equal to Prodcut-5)
            [137.1200,101.4848,100.0594,100.0024],
            [238.8800,182.3552,180.0942,180.0038],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [331.7600,234.0704,230.1628,230.0065]];
// 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], //Product-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)
                                //Product-10 (Sum of Prodcut-6 & 7)
            [541.6400,242.4656]];
// 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
                                                       //Products-2
                  [47.6400,30.7056,30.0282],
                  [99.0000,51.9600,50.0784],
                                                       //Prodcut-3
                  [296.0000,107.8400,100.3136]];
                                                        //Product-4
secondary demand = [
                                           //Product-5 (Sum of Product-1 & 2)
            [213.6800,104.5472,100.1819],
                                           //Product-6 (Sum of Prodcut-2 & 3)
            [146.6400,82.6656,80.1066],
                                           //Product-7 (Sum of Prodcut-3 & 4)
            [395.0000,159.8000,150.3920],
                                           //Product-8 (equal to Prodcut-5)
            [213.6800,104.5472,100.1819],
                                           //Product-9 (Sum of Prodcut-5 & 6)
            [360.3200,187.2128,180.2885],
                                           //Product-10 (Sum of Prodcut-6 & 7)
            [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 - 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)
                                                  //Product-6 (Sum of Prodcut-2 & 3)
            [146.6400,82.6656,80.1066,80.0043],
                                                 //Product-7 (Sum of Prodcut-3 & 4)
            [395.0000,159.8000,150.3920,150.0157],
                                                  //Product-8 (equal to Prodcut-5)
            [213.6800,104.5472,100.1819,100.0073],
            [360.3200,187.2128,180.2885,180.0115],
                                                  //Product-9 (Sum of Prodcut-5 & 6)
                                                  //Product-10 (Sum of Prodcut-6 & 7)
            [541.6400,242.4656,230.4986,230.0199]];
// 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];
```