**Problem – B (General) 🡪 DATA**

**Test Instance-1:** TGS1C1D1 (Test General Setup-Profile\_1 Capacity-Profile\_1 Demand-Series\_1)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900], //Product-1

[30.0900], //Products-2

[50.2500], //Prodcut-3

[101.0000]]; //Product-4

secondary\_demand = [

[100.5800], //Product-5 (Sum of Product-1 & 2)

[80.3400], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800], //Product-8 (equal to Prodcut-5)

[180.9200], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049], //Product-1

[30.0900,30.0009], //Products-2

[50.2500,50.0025], //Prodcut-3

[101.0000,100.0100]]; //Product-4

secondary\_demand = [

[100.5800,100.0058], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049,70.0000], //Product-1

[30.0900,30.0009,30.0000], //Products-2

[50.2500,50.0025,50.0000], //Prodcut-3

[101.0000,100.0100,100.0001]]; //Product-4

secondary\_demand = [

[100.5800,100.0058,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125,150.0001], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058,100.0000], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1

[30.0900,30.0009,30.0000,30.0000], //Products-2

[50.2500,50.0025,50.0000,50.0000], //Prodcut-3

[101.0000,100.0100,100.0001,100.0000]]; //Product-4

secondary\_demand = [

[100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034,80.0000,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Test Instance-2:** TGS1C1D2 (Test General Setup-Profile\_1 Capacity-Profile\_1 Demand-Series\_2)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400], //Product-1

[31.4400], //Products-2

[54.0000], //Prodcut-3

[116.0000]]; //Product-4

secondary\_demand = [

[109.2800], //Product-5 (Sum of Product-1 & 2)

[85.4400], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800], //Product-8 (equal to Prodcut-5)

[194.7200], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784], //Product-1

[31.4400,30.0144], //Products-2

[54.0000,50.0040], //Prodcut-3

[116.0000,100.1600]]; //Product-4

secondary\_demand = [

[109.2800,100.0928], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008], //Product-1

[31.4400,30.0144,30.0001], //Products-2

[54.0000,50.0040,50.0004], //Prodcut-3

[116.0000,100.1600,100.0016]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544,230.0025]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1

[31.4400,30.0144,30.0001,30.0000], //Products-2

[54.0000,50.0040,50.0004,50.0000], //Prodcut-3

[116.0000,100.1600,100.0016,100.0000]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000,150.0020,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928,100.0009,100.0000], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472,180.0015,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544,230.0025,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Test Instance-3:** TGS1C1D3 (Test General Setup-Profile\_1 Capacity-Profile\_1 Demand-Series\_3)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100], //Product-1

[34.4100], //Products-2

[62.2500], //Prodcut-3

[149.0000]]; //Product-4

secondary\_demand = [

[128.4200], //Product-5 (Sum of Product-1 & 2)

[96.6600], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200], //Product-8 (equal to Prodcut-5)

[225.0800], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401], //Product-1

[34.4100,30.0441], //Products-2

[62.2500,50.1225], //Prodcut-3

[149.0000,100.4900]]; //Product-4

secondary\_demand = [

[128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024], //Product-1

[34.4100,30.0441,30.0004], //Products-2

[62.2500,50.1225,50.0012], //Prodcut-3

[149.0000,100.4900,100.0049]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1

[34.4100,30.0441,30.0004,30.0000], //Products-2

[62.2500,50.1225,50.0012,50.0000], //Prodcut-3

[149.0000,100.4900,100.0049,100.0000]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Test Instance-4:** TGS1C1D4 (Test General Setup-Profile\_1 Capacity-Profile\_1 Demand-Series\_4)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025], //Product-1

[30.2025], //Products-2

[50.5625], //Prodcut-3

[102.2500]]; //Product-4

secondary\_demand = [

[101.3050], //Product-5 (Sum of Product-1 & 2)

[80.7650], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050], //Product-8 (equal to Prodcut-5)

[182.0700], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048], //Product-1

[30.2025,30.0046], //Products-2

[50.5625,50.0127], //Prodcut-3

[102.2500,100.0506]]; //Product-4

secondary\_demand = [

[101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006], //Product-1

[30.2025,30.0046,30.0001], //Products-2

[50.5625,50.0127,50.0003], //Prodcut-3

[102.2500,100.0506,100.0011]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006,70.0000], //Product-1

[30.2025,30.0046,30.0001,30.0000], //Products-2

[50.5625,50.0127,50.0003,50.0000], //Prodcut-3

[102.2500,100.0506,100.0011,100.0000]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007,100.0000], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Test Instance-5:** TGS1C1D5 (Test General Setup-Profile\_1 Capacity-Profile\_1 Demand-Series\_5)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400], //Product-1

[33.2400], //Products-2

[59.0000], //Prodcut-3

[136.0000]]; //Product-4

secondary\_demand = [

[120.8800], //Product-5 (Sum of Product-1 & 2)

[92.2400], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800], //Product-8 (equal to Prodcut-5)

[213.1200], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969], //Product-1

[33.2400,30.0729], //Products-2

[59.0000,50.2025], //Prodcut-3

[136.0000,100.8100]]; //Product-4

secondary\_demand = [

[120.8800,100.4698], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089], //Product-1

[33.2400,30.0729,30.0016], //Products-2

[59.0000,50.2025,50.0046], //Prodcut-3

[136.0000,100.8100,100.0182]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089,70.0002], //Product-1

[33.2400,30.0729,30.0016,30.0000], //Products-2

[59.0000,50.2025,50.0046,50.0001], //Prodcut-3

[136.0000,100.8100,100.0182,100.0004]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106,100.0002], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228,150.0005], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106,100.0002], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168,180.0004], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290,230.0007]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Test Instance-6:** TGS1C1D6 (Test General Setup-Profile\_1 Capacity-Profile\_1 Demand-Series\_6)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225], //Product-1

[39.9225], //Products-2

[77.5625], //Prodcut-3

[210.2500]]; //Product-4

secondary\_demand = [

[163.9450], //Product-5 (Sum of Product-1 & 2)

[117.4850], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450], //Product-8 (equal to Prodcut-5)

[281.4300], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155], //Product-1

[39.9225,30.2233], //Products-2

[77.5625,50.6202], //Prodcut-3

[210.2500,102.4806]]; //Product-4

secondary\_demand = [

[163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273], //Product-1

[39.9225,30.2233,30.0050], //Products-2

[77.5625,50.6202,50.0140], //Prodcut-3

[210.2500,102.4806,100.0558]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273,70.0006], //Product-1

[39.9225,30.2233,30.0050,30.0001], //Products-2

[77.5625,50.6202,50.0140,50.0003], //Prodcut-3

[210.2500,102.4806,100.0558,100.0013]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324,100.0007], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698,150.0016], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324,100.0007], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513,180.0012], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887,230.0020]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Test Instance-7:** TGS1C1D7 (Test General Setup-Profile\_1 Capacity-Profile\_1 Demand-Series\_7)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600], //Product-1

[30.3600], //Products-2

[51.0000], //Prodcut-3

[104.0000]]; //Product-4

secondary\_demand = [

[102.3200], //Product-5 (Sum of Product-1 & 2)

[81.3600], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200], //Product-8 (equal to Prodcut-5)

[183.6800], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784], //Product-1

[30.3600,30.0144], //Products-2

[51.0000,50.0400], //Prodcut-3

[104.0000,100.1600]]; //Product-4

secondary\_demand = [

[102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031], //Product-1

[30.3600,30.0144,30.0006], //Products-2

[51.0000,50.0400,50.0016], //Prodcut-3

[104.0000,100.1600,100.0064]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031,70.0001], //Product-1

[30.3600,30.0144,30.0006,30.0000], //Products-2

[51.0000,50.0400,50.0016,50.0001], //Prodcut-3

[104.0000,100.1600,100.0064,100.0003]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037,100.0001], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080,150.0003], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037,100.0001], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059,180.0002], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102,230.0004]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Test Instance-8:** TGS1C1D8 (Test General Setup-Profile\_1 Capacity-Profile\_1 Demand-Series\_8)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600], //Product-1

[35.7600], //Products-2

[66.0000], //Prodcut-3

[164.0000]]; //Product-4

secondary\_demand = [

[137.1200], //Product-5 (Sum of Product-1 & 2)

[101.7600], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200], //Product-8 (equal to Prodcut-5)

[238.8800], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544], //Product-1

[35.7600,30.2304], //Products-2

[66.0000,50.6400], //Prodcut-3

[164.0000,102.5600]]; //Product-4

secondary\_demand = [

[137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.0502], //Product-1

[35.7600,30.2304,30.0092], //Products-2

[66.0000,50.6400,50.0256], //Prodcut-3

[164.0000,102.5600,100.1024]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1

[35.7600,30.2304,30.0092,30.0004], //Products-2

[66.0000,50.6400,50.0256,50.0010], //Prodcut-3

[164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Test Instance-9:** TGS1C1D9 (Test General Setup-Profile\_1 Capacity-Profile\_1 Demand-Series\_9)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400], //Product-1

[47.6400], //Products-2

[99.0000], //Prodcut-3

[296.0000]]; //Product-4

secondary\_demand = [

[213.6800], //Product-5 (Sum of Product-1 & 2)

[146.6400], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800], //Product-8 (equal to Prodcut-5)

[360.3200], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416], //Product-1

[47.6400,30.7056], //Products-2

[99.0000,51.9600], //Prodcut-3

[296.0000,107.8400]]; //Product-4

secondary\_demand = [

[213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537], //Product-1

[47.6400,30.7056,30.0282], //Products-2

[99.0000,51.9600,50.0784], //Prodcut-3

[296.0000,107.8400,100.3136]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1

[47.6400,30.7056,30.0282,30.0011], //Products-2

[99.0000,51.9600,50.0784,50.0031], //Prodcut-3

[296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,377.7778,711.1111];

**Test Instance-10:** TGS1C2D1 (Test General Setup-Profile\_1 Capacity-Profile\_2 Demand-Series\_1)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900], //Product-1

[30.0900], //Products-2

[50.2500], //Prodcut-3

[101.0000]]; //Product-4

secondary\_demand = [

[100.5800], //Product-5 (Sum of Product-1 & 2)

[80.3400], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800], //Product-8 (equal to Prodcut-5)

[180.9200], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049], //Product-1

[30.0900,30.0009], //Products-2

[50.2500,50.0025], //Prodcut-3

[101.0000,100.0100]]; //Product-4

secondary\_demand = [

[100.5800,100.0058], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049,70.0000], //Product-1

[30.0900,30.0009,30.0000], //Products-2

[50.2500,50.0025,50.0000], //Prodcut-3

[101.0000,100.0100,100.0001]]; //Product-4

secondary\_demand = [

[100.5800,100.0058,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125,150.0001], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058,100.0000], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1

[30.0900,30.0009,30.0000,30.0000], //Products-2

[50.2500,50.0025,50.0000,50.0000], //Prodcut-3

[101.0000,100.0100,100.0001,100.0000]]; //Product-4

secondary\_demand = [

[100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034,80.0000,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Test Instance-11:** TGS1C2D2 (Test General Setup-Profile\_1 Capacity-Profile\_2 Demand-Series\_2)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400], //Product-1

[31.4400], //Products-2

[54.0000], //Prodcut-3

[116.0000]]; //Product-4

secondary\_demand = [

[109.2800], //Product-5 (Sum of Product-1 & 2)

[85.4400], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800], //Product-8 (equal to Prodcut-5)

[194.7200], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784], //Product-1

[31.4400,30.0144], //Products-2

[54.0000,50.0040], //Prodcut-3

[116.0000,100.1600]]; //Product-4

secondary\_demand = [

[109.2800,100.0928], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008], //Product-1

[31.4400,30.0144,30.0001], //Products-2

[54.0000,50.0040,50.0004], //Prodcut-3

[116.0000,100.1600,100.0016]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544,230.0025]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1

[31.4400,30.0144,30.0001,30.0000], //Products-2

[54.0000,50.0040,50.0004,50.0000], //Prodcut-3

[116.0000,100.1600,100.0016,100.0000]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000,150.0020,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928,100.0009,100.0000], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472,180.0015,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544,230.0025,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Test Instance-12:** TGS1C2D3 (Test General Setup-Profile\_1 Capacity-Profile\_2 Demand-Series\_3)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100], //Product-1

[34.4100], //Products-2

[62.2500], //Prodcut-3

[149.0000]]; //Product-4

secondary\_demand = [

[128.4200], //Product-5 (Sum of Product-1 & 2)

[96.6600], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200], //Product-8 (equal to Prodcut-5)

[225.0800], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401], //Product-1

[34.4100,30.0441], //Products-2

[62.2500,50.1225], //Prodcut-3

[149.0000,100.4900]]; //Product-4

secondary\_demand = [

[128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024], //Product-1

[34.4100,30.0441,30.0004], //Products-2

[62.2500,50.1225,50.0012], //Prodcut-3

[149.0000,100.4900,100.0049]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1

[34.4100,30.0441,30.0004,30.0000], //Products-2

[62.2500,50.1225,50.0012,50.0000], //Prodcut-3

[149.0000,100.4900,100.0049,100.0000]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Test Instance-13:** TGS1C2D4 (Test General Setup-Profile\_1 Capacity-Profile\_2 Demand-Series\_4)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025], //Product-1

[30.2025], //Products-2

[50.5625], //Prodcut-3

[102.2500]]; //Product-4

secondary\_demand = [

[101.3050], //Product-5 (Sum of Product-1 & 2)

[80.7650], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050], //Product-8 (equal to Prodcut-5)

[182.0700], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048], //Product-1

[30.2025,30.0046], //Products-2

[50.5625,50.0127], //Prodcut-3

[102.2500,100.0506]]; //Product-4

secondary\_demand = [

[101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006], //Product-1

[30.2025,30.0046,30.0001], //Products-2

[50.5625,50.0127,50.0003], //Prodcut-3

[102.2500,100.0506,100.0011]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006,70.0000], //Product-1

[30.2025,30.0046,30.0001,30.0000], //Products-2

[50.5625,50.0127,50.0003,50.0000], //Prodcut-3

[102.2500,100.0506,100.0011,100.0000]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007,100.0000], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Test Instance-14:** TGS1C2D5 (Test General Setup-Profile\_1 Capacity-Profile\_2 Demand-Series\_5)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400], //Product-1

[33.2400], //Products-2

[59.0000], //Prodcut-3

[136.0000]]; //Product-4

secondary\_demand = [

[120.8800], //Product-5 (Sum of Product-1 & 2)

[92.2400], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800], //Product-8 (equal to Prodcut-5)

[213.1200], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969], //Product-1

[33.2400,30.0729], //Products-2

[59.0000,50.2025], //Prodcut-3

[136.0000,100.8100]]; //Product-4

secondary\_demand = [

[120.8800,100.4698], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089], //Product-1

[33.2400,30.0729,30.0016], //Products-2

[59.0000,50.2025,50.0046], //Prodcut-3

[136.0000,100.8100,100.0182]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089,70.0002], //Product-1

[33.2400,30.0729,30.0016,30.0000], //Products-2

[59.0000,50.2025,50.0046,50.0001], //Prodcut-3

[136.0000,100.8100,100.0182,100.0004]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106,100.0002], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228,150.0005], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106,100.0002], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168,180.0004], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290,230.0007]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Test Instance-15:** TGS1C2D6 (Test General Setup-Profile\_1 Capacity-Profile\_2 Demand-Series\_6)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225], //Product-1

[39.9225], //Products-2

[77.5625], //Prodcut-3

[210.2500]]; //Product-4

secondary\_demand = [

[163.9450], //Product-5 (Sum of Product-1 & 2)

[117.4850], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450], //Product-8 (equal to Prodcut-5)

[281.4300], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155], //Product-1

[39.9225,30.2233], //Products-2

[77.5625,50.6202], //Prodcut-3

[210.2500,102.4806]]; //Product-4

secondary\_demand = [

[163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273], //Product-1

[39.9225,30.2233,30.0050], //Products-2

[77.5625,50.6202,50.0140], //Prodcut-3

[210.2500,102.4806,100.0558]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273,70.0006], //Product-1

[39.9225,30.2233,30.0050,30.0001], //Products-2

[77.5625,50.6202,50.0140,50.0003], //Prodcut-3

[210.2500,102.4806,100.0558,100.0013]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324,100.0007], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698,150.0016], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324,100.0007], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513,180.0012], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887,230.0020]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Test Instance-16:** TGS1C2D7 (Test General Setup-Profile\_1 Capacity-Profile\_2 Demand-Series\_7)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600], //Product-1

[30.3600], //Products-2

[51.0000], //Prodcut-3

[104.0000]]; //Product-4

secondary\_demand = [

[102.3200], //Product-5 (Sum of Product-1 & 2)

[81.3600], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200], //Product-8 (equal to Prodcut-5)

[183.6800], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784], //Product-1

[30.3600,30.0144], //Products-2

[51.0000,50.0400], //Prodcut-3

[104.0000,100.1600]]; //Product-4

secondary\_demand = [

[102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031], //Product-1

[30.3600,30.0144,30.0006], //Products-2

[51.0000,50.0400,50.0016], //Prodcut-3

[104.0000,100.1600,100.0064]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031,70.0001], //Product-1

[30.3600,30.0144,30.0006,30.0000], //Products-2

[51.0000,50.0400,50.0016,50.0001], //Prodcut-3

[104.0000,100.1600,100.0064,100.0003]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037,100.0001], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080,150.0003], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037,100.0001], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059,180.0002], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102,230.0004]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Test Instance-17:** TGS1C2D8 (Test General Setup-Profile\_1 Capacity-Profile\_2 Demand-Series\_8)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600], //Product-1

[35.7600], //Products-2

[66.0000], //Prodcut-3

[164.0000]]; //Product-4

secondary\_demand = [

[137.1200], //Product-5 (Sum of Product-1 & 2)

[101.7600], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200], //Product-8 (equal to Prodcut-5)

[238.8800], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544], //Product-1

[35.7600,30.2304], //Products-2

[66.0000,50.6400], //Prodcut-3

[164.0000,102.5600]]; //Product-4

secondary\_demand = [

[137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.050], //Product-1

[35.7600,30.2304,30.0092], //Products-2

[66.0000,50.6400,50.0256], //Prodcut-3

[164.0000,102.5600,100.1024]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1

[35.7600,30.2304,30.0092,30.0004], //Products-2

[66.0000,50.6400,50.0256,50.0010], //Prodcut-3

[164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Test Instance-18:** TGS1C2D9 (Test General Setup-Profile\_1 Capacity-Profile\_2 Demand-Series\_9)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400], //Product-1

[47.6400], //Products-2

[99.0000], //Prodcut-3

[296.0000]]; //Product-4

secondary\_demand = [

[213.6800], //Product-5 (Sum of Product-1 & 2)

[146.6400], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800], //Product-8 (equal to Prodcut-5)

[360.3200], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416], //Product-1

[47.6400,30.7056], //Products-2

[99.0000,51.9600], //Prodcut-3

[296.0000,107.8400]]; //Product-4

secondary\_demand = [

[213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537], //Product-1

[47.6400,30.7056,30.0282], //Products-2

[99.0000,51.9600,50.0784], //Prodcut-3

[296.0000,107.8400,100.3136]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1

[47.6400,30.7056,30.0282,30.0011], //Products-2

[99.0000,51.9600,50.0784,50.0031], //Prodcut-3

[296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,485.7143,914.2857];

**Test Instance-19:** TGS1C3D1 (Test General Setup-Profile\_1 Capacity-Profile\_3 Demand-Series\_1)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900], //Product-1

[30.0900], //Products-2

[50.2500], //Prodcut-3

[101.0000]]; //Product-4

secondary\_demand = [

[100.5800], //Product-5 (Sum of Product-1 & 2)

[80.3400], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800], //Product-8 (equal to Prodcut-5)

[180.9200], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049], //Product-1

[30.0900,30.0009], //Products-2

[50.2500,50.0025], //Prodcut-3

[101.0000,100.0100]]; //Product-4

secondary\_demand = [

[100.5800,100.0058], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049,70.0000], //Product-1

[30.0900,30.0009,30.0000], //Products-2

[50.2500,50.0025,50.0000], //Prodcut-3

[101.0000,100.0100,100.0001]]; //Product-4

secondary\_demand = [

[100.5800,100.0058,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125,150.0001], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058,100.0000], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1

[30.0900,30.0009,30.0000,30.0000], //Products-2

[50.2500,50.0025,50.0000,50.0000], //Prodcut-3

[101.0000,100.0100,100.0001,100.0000]]; //Product-4

secondary\_demand = [

[100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034,80.0000,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Test Instance-20:** TGS1C3D2 (Test General Setup-Profile\_1 Capacity-Profile\_3 Demand-Series\_2)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400], //Product-1

[31.4400], //Products-2

[54.0000], //Prodcut-3

[116.0000]]; //Product-4

secondary\_demand = [

[109.2800], //Product-5 (Sum of Product-1 & 2)

[85.4400], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800], //Product-8 (equal to Prodcut-5)

[194.7200], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784], //Product-1

[31.4400,30.0144], //Products-2

[54.0000,50.0040], //Prodcut-3

[116.0000,100.1600]]; //Product-4

secondary\_demand = [

[109.2800,100.0928], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008], //Product-1

[31.4400,30.0144,30.0001], //Products-2

[54.0000,50.0040,50.0004], //Prodcut-3

[116.0000,100.1600,100.0016]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544,230.0025]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1

[31.4400,30.0144,30.0001,30.0000], //Products-2

[54.0000,50.0040,50.0004,50.0000], //Prodcut-3

[116.0000,100.1600,100.0016,100.0000]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000,150.0020,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928,100.0009,100.0000], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472,180.0015,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544,230.0025,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Test Instance-21:** TGS1C3D3 (Test General Setup-Profile\_1 Capacity-Profile\_3 Demand-Series\_3)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100], //Product-1

[34.4100], //Products-2

[62.2500], //Prodcut-3

[149.0000]]; //Product-4

secondary\_demand = [

[128.4200], //Product-5 (Sum of Product-1 & 2)

[96.6600], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200], //Product-8 (equal to Prodcut-5)

[225.0800], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401], //Product-1

[34.4100,30.0441], //Products-2

[62.2500,50.1225], //Prodcut-3

[149.0000,100.4900]]; //Product-4

secondary\_demand = [

[128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024], //Product-1

[34.4100,30.0441,30.0004], //Products-2

[62.2500,50.1225,50.0012], //Prodcut-3

[149.0000,100.4900,100.0049]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1

[34.4100,30.0441,30.0004,30.0000], //Products-2

[62.2500,50.1225,50.0012,50.0000], //Prodcut-3

[149.0000,100.4900,100.0049,100.0000]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Test Instance-22:** TGS1C3D4 (Test General Setup-Profile\_1 Capacity-Profile\_3 Demand-Series\_4)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025], //Product-1

[30.2025], //Products-2

[50.5625], //Prodcut-3

[102.2500]]; //Product-4

secondary\_demand = [

[101.3050], //Product-5 (Sum of Product-1 & 2)

[80.7650], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050], //Product-8 (equal to Prodcut-5)

[182.0700], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048], //Product-1

[30.2025,30.0046], //Products-2

[50.5625,50.0127], //Prodcut-3

[102.2500,100.0506]]; //Product-4

secondary\_demand = [

[101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006], //Product-1

[30.2025,30.0046,30.0001], //Products-2

[50.5625,50.0127,50.0003], //Prodcut-3

[102.2500,100.0506,100.0011]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006,70.0000], //Product-1

[30.2025,30.0046,30.0001,30.0000], //Products-2

[50.5625,50.0127,50.0003,50.0000], //Prodcut-3

[102.2500,100.0506,100.0011,100.0000]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007,100.0000], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Test Instance-23:** TGS1C3D5 (Test General Setup-Profile\_1 Capacity-Profile\_3 Demand-Series\_5)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400], //Product-1

[33.2400], //Products-2

[59.0000], //Prodcut-3

[136.0000]]; //Product-4

secondary\_demand = [

[120.8800], //Product-5 (Sum of Product-1 & 2)

[92.2400], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800], //Product-8 (equal to Prodcut-5)

[213.1200], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969], //Product-1

[33.2400,30.0729], //Products-2

[59.0000,50.2025], //Prodcut-3

[136.0000,100.8100]]; //Product-4

secondary\_demand = [

[120.8800,100.4698], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089], //Product-1

[33.2400,30.0729,30.0016], //Products-2

[59.0000,50.2025,50.0046], //Prodcut-3

[136.0000,100.8100,100.0182]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089,70.0002], //Product-1

[33.2400,30.0729,30.0016,30.0000], //Products-2

[59.0000,50.2025,50.0046,50.0001], //Prodcut-3

[136.0000,100.8100,100.0182,100.0004]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106,100.0002], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228,150.0005], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106,100.0002], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168,180.0004], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290,230.0007]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Test Instance-24:** TGS1C3D6 (Test General Setup-Profile\_1 Capacity-Profile\_3 Demand-Series\_6)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225], //Product-1

[39.9225], //Products-2

[77.5625], //Prodcut-3

[210.2500]]; //Product-4

secondary\_demand = [

[163.9450], //Product-5 (Sum of Product-1 & 2)

[117.4850], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450], //Product-8 (equal to Prodcut-5)

[281.4300], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155], //Product-1

[39.9225,30.2233], //Products-2

[77.5625,50.6202], //Prodcut-3

[210.2500,102.4806]]; //Product-4

secondary\_demand = [

[163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273], //Product-1

[39.9225,30.2233,30.0050], //Products-2

[77.5625,50.6202,50.0140], //Prodcut-3

[210.2500,102.4806,100.0558]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273,70.0006], //Product-1

[39.9225,30.2233,30.0050,30.0001], //Products-2

[77.5625,50.6202,50.0140,50.0003], //Prodcut-3

[210.2500,102.4806,100.0558,100.0013]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324,100.0007], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698,150.0016], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324,100.0007], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513,180.0012], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887,230.0020]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Test Instance-25:** TGS1C3D7 (Test General Setup-Profile\_1 Capacity-Profile\_3 Demand-Series\_7)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600], //Product-1

[30.3600], //Products-2

[51.0000], //Prodcut-3

[104.0000]]; //Product-4

secondary\_demand = [

[102.3200], //Product-5 (Sum of Product-1 & 2)

[81.3600], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200], //Product-8 (equal to Prodcut-5)

[183.6800], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784], //Product-1

[30.3600,30.0144], //Products-2

[51.0000,50.0400], //Prodcut-3

[104.0000,100.1600]]; //Product-4

secondary\_demand = [

[102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031], //Product-1

[30.3600,30.0144,30.0006], //Products-2

[51.0000,50.0400,50.0016], //Prodcut-3

[104.0000,100.1600,100.0064]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031,70.0001], //Product-1

[30.3600,30.0144,30.0006,30.0000], //Products-2

[51.0000,50.0400,50.0016,50.0001], //Prodcut-3

[104.0000,100.1600,100.0064,100.0003]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037,100.0001], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080,150.0003], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037,100.0001], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059,180.0002], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102,230.0004]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Test Instance-26:** TGS1C3D8 (Test General Setup-Profile\_1 Capacity-Profile\_3 Demand-Series\_8)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600], //Product-1

[35.7600], //Products-2

[66.0000], //Prodcut-3

[164.0000]]; //Product-4

secondary\_demand = [

[137.1200], //Product-5 (Sum of Product-1 & 2)

[101.7600], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200], //Product-8 (equal to Prodcut-5)

[238.8800], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544], //Product-1

[35.7600,30.2304], //Products-2

[66.0000,50.6400], //Prodcut-3

[164.0000,102.5600]]; //Product-4

secondary\_demand = [

[137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.0502], //Product-1

[35.7600,30.2304,30.0092], //Products-2

[66.0000,50.6400,50.0256], //Prodcut-3

[164.0000,102.5600,100.1024]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1

[35.7600,30.2304,30.0092,30.0004], //Products-2

[66.0000,50.6400,50.0256,50.0010], //Prodcut-3

[164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Test Instance-27:** TGS1C3D9 (Test General Setup-Profile\_1 Capacity-Profile\_3 Demand-Series\_9)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400], //Product-1

[47.6400], //Products-2

[99.0000], //Prodcut-3

[296.0000]]; //Product-4

secondary\_demand = [

[213.6800], //Product-5 (Sum of Product-1 & 2)

[146.6400], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800], //Product-8 (equal to Prodcut-5)

[360.3200], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416], //Product-1

[47.6400,30.7056], //Products-2

[99.0000,51.9600], //Prodcut-3

[296.0000,107.8400]]; //Product-4

secondary\_demand = [

[213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537], //Product-1

[47.6400,30.7056,30.0282], //Products-2

[99.0000,51.9600,50.0784], //Prodcut-3

[296.0000,107.8400,100.3136]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1

[47.6400,30.7056,30.0282,30.0011], //Products-2

[99.0000,51.9600,50.0784,50.0031], //Prodcut-3

[296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,680.0000,1280.0000];

**Test Instance-28:** TGS1C4D1 (Test General Setup-Profile\_1 Capacity-Profile\_4 Demand-Series\_1)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900], //Product-1

[30.0900], //Products-2

[50.2500], //Prodcut-3

[101.0000]]; //Product-4

secondary\_demand = [

[100.5800], //Product-5 (Sum of Product-1 & 2)

[80.3400], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800], //Product-8 (equal to Prodcut-5)

[180.9200], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049], //Product-1

[30.0900,30.0009], //Products-2

[50.2500,50.0025], //Prodcut-3

[101.0000,100.0100]]; //Product-4

secondary\_demand = [

[100.5800,100.0058], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049,70.0000], //Product-1

[30.0900,30.0009,30.0000], //Products-2

[50.2500,50.0025,50.0000], //Prodcut-3

[101.0000,100.0100,100.0001]]; //Product-4

secondary\_demand = [

[100.5800,100.0058,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125,150.0001], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058,100.0000], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1

[30.0900,30.0009,30.0000,30.0000], //Products-2

[50.2500,50.0025,50.0000,50.0000], //Prodcut-3

[101.0000,100.0100,100.0001,100.0000]]; //Product-4

secondary\_demand = [

[100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034,80.0000,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Test Instance-29:** TGS1C4D2 (Test General Setup-Profile\_1 Capacity-Profile\_4 Demand-Series\_2)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400], //Product-1

[31.4400], //Products-2

[54.0000], //Prodcut-3

[116.0000]]; //Product-4

secondary\_demand = [

[109.2800], //Product-5 (Sum of Product-1 & 2)

[85.4400], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800], //Product-8 (equal to Prodcut-5)

[194.7200], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784], //Product-1

[31.4400,30.0144], //Products-2

[54.0000,50.0040], //Prodcut-3

[116.0000,100.1600]]; //Product-4

secondary\_demand = [

[109.2800,100.0928], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008], //Product-1

[31.4400,30.0144,30.0001], //Products-2

[54.0000,50.0040,50.0004], //Prodcut-3

[116.0000,100.1600,100.0016]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544,230.0025]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1

[31.4400,30.0144,30.0001,30.0000], //Products-2

[54.0000,50.0040,50.0004,50.0000], //Prodcut-3

[116.0000,100.1600,100.0016,100.0000]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000,150.0020,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928,100.0009,100.0000], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472,180.0015,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544,230.0025,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Test Instance-30:** TGS1C4D3 (Test General Setup-Profile\_1 Capacity-Profile\_4 Demand-Series\_3)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100], //Product-1

[34.4100], //Products-2

[62.2500], //Prodcut-3

[149.0000]]; //Product-4

secondary\_demand = [

[128.4200], //Product-5 (Sum of Product-1 & 2)

[96.6600], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200], //Product-8 (equal to Prodcut-5)

[225.0800], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401], //Product-1

[34.4100,30.0441], //Products-2

[62.2500,50.1225], //Prodcut-3

[149.0000,100.4900]]; //Product-4

secondary\_demand = [

[128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024], //Product-1

[34.4100,30.0441,30.0004], //Products-2

[62.2500,50.1225,50.0012], //Prodcut-3

[149.0000,100.4900,100.0049]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1

[34.4100,30.0441,30.0004,30.0000], //Products-2

[62.2500,50.1225,50.0012,50.0000], //Prodcut-3

[149.0000,100.4900,100.0049,100.0000]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Test Instance-31:** TGS1C4D4 (Test General Setup-Profile\_1 Capacity-Profile\_4 Demand-Series\_4)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025], //Product-1

[30.2025], //Products-2

[50.5625], //Prodcut-3

[102.2500]]; //Product-4

secondary\_demand = [

[101.3050], //Product-5 (Sum of Product-1 & 2)

[80.7650], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050], //Product-8 (equal to Prodcut-5)

[182.0700], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048], //Product-1

[30.2025,30.0046], //Products-2

[50.5625,50.0127], //Prodcut-3

[102.2500,100.0506]]; //Product-4

secondary\_demand = [

[101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006], //Product-1

[30.2025,30.0046,30.0001], //Products-2

[50.5625,50.0127,50.0003], //Prodcut-3

[102.2500,100.0506,100.0011]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006,70.0000], //Product-1

[30.2025,30.0046,30.0001,30.0000], //Products-2

[50.5625,50.0127,50.0003,50.0000], //Prodcut-3

[102.2500,100.0506,100.0011,100.0000]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007,100.0000], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Test Instance-32:** TGS1C4D5 (Test General Setup-Profile\_1 Capacity-Profile\_4 Demand-Series\_5)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400], //Product-1

[33.2400], //Products-2

[59.0000], //Prodcut-3

[136.0000]]; //Product-4

secondary\_demand = [

[120.8800], //Product-5 (Sum of Product-1 & 2)

[92.2400], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800], //Product-8 (equal to Prodcut-5)

[213.1200], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969], //Product-1

[33.2400,30.0729], //Products-2

[59.0000,50.2025], //Prodcut-3

[136.0000,100.8100]]; //Product-4

secondary\_demand = [

[120.8800,100.4698], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089], //Product-1

[33.2400,30.0729,30.0016], //Products-2

[59.0000,50.2025,50.0046], //Prodcut-3

[136.0000,100.8100,100.0182]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089,70.0002], //Product-1

[33.2400,30.0729,30.0016,30.0000], //Products-2

[59.0000,50.2025,50.0046,50.0001], //Prodcut-3

[136.0000,100.8100,100.0182,100.0004]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106,100.0002], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228,150.0005], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106,100.0002], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168,180.0004], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290,230.0007]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Test Instance-33:** TGS1C4D6 (Test General Setup-Profile\_1 Capacity-Profile\_4 Demand-Series\_6)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225], //Product-1

[39.9225], //Products-2

[77.5625], //Prodcut-3

[210.2500]]; //Product-4

secondary\_demand = [

[163.9450], //Product-5 (Sum of Product-1 & 2)

[117.4850], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450], //Product-8 (equal to Prodcut-5)

[281.4300], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155], //Product-1

[39.9225,30.2233], //Products-2

[77.5625,50.6202], //Prodcut-3

[210.2500,102.4806]]; //Product-4

secondary\_demand = [

[163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273], //Product-1

[39.9225,30.2233,30.0050], //Products-2

[77.5625,50.6202,50.0140], //Prodcut-3

[210.2500,102.4806,100.0558]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273,70.0006], //Product-1

[39.9225,30.2233,30.0050,30.0001], //Products-2

[77.5625,50.6202,50.0140,50.0003], //Prodcut-3

[210.2500,102.4806,100.0558,100.0013]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324,100.0007], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698,150.0016], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324,100.0007], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513,180.0012], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887,230.0020]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Test Instance-34:** TGS1C4D7 (Test General Setup-Profile\_1 Capacity-Profile\_4 Demand-Series\_7)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600], //Product-1

[30.3600], //Products-2

[51.0000], //Prodcut-3

[104.0000]]; //Product-4

secondary\_demand = [

[102.3200], //Product-5 (Sum of Product-1 & 2)

[81.3600], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200], //Product-8 (equal to Prodcut-5)

[183.6800], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784], //Product-1

[30.3600,30.0144], //Products-2

[51.0000,50.0400], //Prodcut-3

[104.0000,100.1600]]; //Product-4

secondary\_demand = [

[102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031], //Product-1

[30.3600,30.0144,30.0006], //Products-2

[51.0000,50.0400,50.0016], //Prodcut-3

[104.0000,100.1600,100.0064]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031,70.0001], //Product-1

[30.3600,30.0144,30.0006,30.0000], //Products-2

[51.0000,50.0400,50.0016,50.0001], //Prodcut-3

[104.0000,100.1600,100.0064,100.0003]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037,100.0001], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080,150.0003], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037,100.0001], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059,180.0002], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102,230.0004]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Test Instance-35:** TGS1C4D8 (Test General Setup-Profile\_1 Capacity-Profile\_4 Demand-Series\_8)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600], //Product-1

[35.7600], //Products-2

[66.0000], //Prodcut-3

[164.0000]]; //Product-4

secondary\_demand = [

[137.1200], //Product-5 (Sum of Product-1 & 2)

[101.7600], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200], //Product-8 (equal to Prodcut-5)

[238.8800], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544], //Product-1

[35.7600,30.2304], //Products-2

[66.0000,50.6400], //Prodcut-3

[164.0000,102.5600]]; //Product-4

secondary\_demand = [

[137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.0502], //Product-1

[35.7600,30.2304,30.0092], //Products-2

[66.0000,50.6400,50.0256], //Prodcut-3

[164.0000,102.5600,100.1024]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1

[35.7600,30.2304,30.0092,30.0004], //Products-2

[66.0000,50.6400,50.0256,50.0010], //Prodcut-3

[164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Test Instance-36:** TGS1C4D9 (Test General Setup-Profile\_1 Capacity-Profile\_4 Demand-Series\_9)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400], //Product-1

[47.6400], //Products-2

[99.0000], //Prodcut-3

[296.0000]]; //Product-4

secondary\_demand = [

[213.6800], //Product-5 (Sum of Product-1 & 2)

[146.6400], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800], //Product-8 (equal to Prodcut-5)

[360.3200], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416], //Product-1

[47.6400,30.7056], //Products-2

[99.0000,51.9600], //Prodcut-3

[296.0000,107.8400]]; //Product-4

secondary\_demand = [

[213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537], //Product-1

[47.6400,30.7056,30.0282], //Products-2

[99.0000,51.9600,50.0784], //Prodcut-3

[296.0000,107.8400,100.3136]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1

[47.6400,30.7056,30.0282,30.0011], //Products-2

[99.0000,51.9600,50.0784,50.0031], //Prodcut-3

[296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,485.7143,1280.0000];

**Test Instance-37:** TGS1C5D1 (Test General Setup-Profile\_1 Capacity-Profile\_5 Demand-Series\_1)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900], //Product-1

[30.0900], //Products-2

[50.2500], //Prodcut-3

[101.0000]]; //Product-4

secondary\_demand = [

[100.5800], //Product-5 (Sum of Product-1 & 2)

[80.3400], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800], //Product-8 (equal to Prodcut-5)

[180.9200], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049], //Product-1

[30.0900,30.0009], //Products-2

[50.2500,50.0025], //Prodcut-3

[101.0000,100.0100]]; //Product-4

secondary\_demand = [

[100.5800,100.0058], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049,70.0000], //Product-1

[30.0900,30.0009,30.0000], //Products-2

[50.2500,50.0025,50.0000], //Prodcut-3

[101.0000,100.0100,100.0001]]; //Product-4

secondary\_demand = [

[100.5800,100.0058,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125,150.0001], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058,100.0000], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1

[30.0900,30.0009,30.0000,30.0000], //Products-2

[50.2500,50.0025,50.0000,50.0000], //Prodcut-3

[101.0000,100.0100,100.0001,100.0000]]; //Product-4

secondary\_demand = [

[100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034,80.0000,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Test Instance-38:** TGS1C5D2 (Test General Setup-Profile\_1 Capacity-Profile\_5 Demand-Series\_2)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400], //Product-1

[31.4400], //Products-2

[54.0000], //Prodcut-3

[116.0000]]; //Product-4

secondary\_demand = [

[109.2800], //Product-5 (Sum of Product-1 & 2)

[85.4400], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800], //Product-8 (equal to Prodcut-5)

[194.7200], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784], //Product-1

[31.4400,30.0144], //Products-2

[54.0000,50.0040], //Prodcut-3

[116.0000,100.1600]]; //Product-4

secondary\_demand = [

[109.2800,100.0928], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008], //Product-1

[31.4400,30.0144,30.0001], //Products-2

[54.0000,50.0040,50.0004], //Prodcut-3

[116.0000,100.1600,100.0016]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544,230.0025]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1

[31.4400,30.0144,30.0001,30.0000], //Products-2

[54.0000,50.0040,50.0004,50.0000], //Prodcut-3

[116.0000,100.1600,100.0016,100.0000]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000,150.0020,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928,100.0009,100.0000], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472,180.0015,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544,230.0025,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Test Instance-39:** TGS1C5D3 (Test General Setup-Profile\_1 Capacity-Profile\_5 Demand-Series\_3)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100], //Product-1

[34.4100], //Products-2

[62.2500], //Prodcut-3

[149.0000]]; //Product-4

secondary\_demand = [

[128.4200], //Product-5 (Sum of Product-1 & 2)

[96.6600], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200], //Product-8 (equal to Prodcut-5)

[225.0800], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401], //Product-1

[34.4100,30.0441], //Products-2

[62.2500,50.1225], //Prodcut-3

[149.0000,100.4900]]; //Product-4

secondary\_demand = [

[128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024], //Product-1

[34.4100,30.0441,30.0004], //Products-2

[62.2500,50.1225,50.0012], //Prodcut-3

[149.0000,100.4900,100.0049]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1

[34.4100,30.0441,30.0004,30.0000], //Products-2

[62.2500,50.1225,50.0012,50.0000], //Prodcut-3

[149.0000,100.4900,100.0049,100.0000]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Test Instance-40:** TGS1C5D4 (Test General Setup-Profile\_1 Capacity-Profile\_5 Demand-Series\_4)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025], //Product-1

[30.2025], //Products-2

[50.5625], //Prodcut-3

[102.2500]]; //Product-4

secondary\_demand = [

[101.3050], //Product-5 (Sum of Product-1 & 2)

[80.7650], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050], //Product-8 (equal to Prodcut-5)

[182.0700], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048], //Product-1

[30.2025,30.0046], //Products-2

[50.5625,50.0127], //Prodcut-3

[102.2500,100.0506]]; //Product-4

secondary\_demand = [

[101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006], //Product-1

[30.2025,30.0046,30.0001], //Products-2

[50.5625,50.0127,50.0003], //Prodcut-3

[102.2500,100.0506,100.0011]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006,70.0000], //Product-1

[30.2025,30.0046,30.0001,30.0000], //Products-2

[50.5625,50.0127,50.0003,50.0000], //Prodcut-3

[102.2500,100.0506,100.0011,100.0000]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007,100.0000], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Test Instance-41:** TGS1C5D5 (Test General Setup-Profile\_1 Capacity-Profile\_5 Demand-Series\_5)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400], //Product-1

[33.2400], //Products-2

[59.0000], //Prodcut-3

[136.0000]]; //Product-4

secondary\_demand = [

[120.8800], //Product-5 (Sum of Product-1 & 2)

[92.2400], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800], //Product-8 (equal to Prodcut-5)

[213.1200], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969], //Product-1

[33.2400,30.0729], //Products-2

[59.0000,50.2025], //Prodcut-3

[136.0000,100.8100]]; //Product-4

secondary\_demand = [

[120.8800,100.4698], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089], //Product-1

[33.2400,30.0729,30.0016], //Products-2

[59.0000,50.2025,50.0046], //Prodcut-3

[136.0000,100.8100,100.0182]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089,70.0002], //Product-1

[33.2400,30.0729,30.0016,30.0000], //Products-2

[59.0000,50.2025,50.0046,50.0001], //Prodcut-3

[136.0000,100.8100,100.0182,100.0004]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106,100.0002], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228,150.0005], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106,100.0002], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168,180.0004], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290,230.0007]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Test Instance-42:** TGS1C5D6 (Test General Setup-Profile\_1 Capacity-Profile\_5 Demand-Series\_6)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225], //Product-1

[39.9225], //Products-2

[77.5625], //Prodcut-3

[210.2500]]; //Product-4

secondary\_demand = [

[163.9450], //Product-5 (Sum of Product-1 & 2)

[117.4850], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450], //Product-8 (equal to Prodcut-5)

[281.4300], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155], //Product-1

[39.9225,30.2233], //Products-2

[77.5625,50.6202], //Prodcut-3

[210.2500,102.4806]]; //Product-4

secondary\_demand = [

[163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273], //Product-1

[39.9225,30.2233,30.0050], //Products-2

[77.5625,50.6202,50.0140], //Prodcut-3

[210.2500,102.4806,100.0558]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273,70.0006], //Product-1

[39.9225,30.2233,30.0050,30.0001], //Products-2

[77.5625,50.6202,50.0140,50.0003], //Prodcut-3

[210.2500,102.4806,100.0558,100.0013]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324,100.0007], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698,150.0016], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324,100.0007], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513,180.0012], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887,230.0020]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Test Instance-43:** TGS1C5D7 (Test General Setup-Profile\_1 Capacity-Profile\_5 Demand-Series\_7)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600], //Product-1

[30.3600], //Products-2

[51.0000], //Prodcut-3

[104.0000]]; //Product-4

secondary\_demand = [

[102.3200], //Product-5 (Sum of Product-1 & 2)

[81.3600], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200], //Product-8 (equal to Prodcut-5)

[183.6800], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784], //Product-1

[30.3600,30.0144], //Products-2

[51.0000,50.0400], //Prodcut-3

[104.0000,100.1600]]; //Product-4

secondary\_demand = [

[102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031], //Product-1

[30.3600,30.0144,30.0006], //Products-2

[51.0000,50.0400,50.0016], //Prodcut-3

[104.0000,100.1600,100.0064]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031,70.0001], //Product-1

[30.3600,30.0144,30.0006,30.0000], //Products-2

[51.0000,50.0400,50.0016,50.0001], //Prodcut-3

[104.0000,100.1600,100.0064,100.0003]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037,100.0001], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080,150.0003], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037,100.0001], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059,180.0002], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102,230.0004]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Test Instance-44:** TGS1C5D8 (Test General Setup-Profile\_1 Capacity-Profile\_5 Demand-Series\_8)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600], //Product-1

[35.7600], //Products-2

[66.0000], //Prodcut-3

[164.0000]]; //Product-4

secondary\_demand = [

[137.1200], //Product-5 (Sum of Product-1 & 2)

[101.7600], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200], //Product-8 (equal to Prodcut-5)

[238.8800], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544], //Product-1

[35.7600,30.2304], //Products-2

[66.0000,50.6400], //Prodcut-3

[164.0000,102.5600]]; //Product-4

secondary\_demand = [

[137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.0502], //Product-1

[35.7600,30.2304,30.0092], //Products-2

[66.0000,50.6400,50.0256], //Prodcut-3

[164.0000,102.5600,100.1024]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1

[35.7600,30.2304,30.0092,30.0004], //Products-2

[66.0000,50.6400,50.0256,50.0010], //Prodcut-3

[164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Test Instance-45:** TGS1C5D9 (Test General Setup-Profile\_1 Capacity-Profile\_5 Demand-Series\_9)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400], //Product-1

[47.6400], //Products-2

[99.0000], //Prodcut-3

[296.0000]]; //Product-4

secondary\_demand = [

[213.6800], //Product-5 (Sum of Product-1 & 2)

[146.6400], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800], //Product-8 (equal to Prodcut-5)

[360.3200], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416], //Product-1

[47.6400,30.7056], //Products-2

[99.0000,51.9600], //Prodcut-3

[296.0000,107.8400]]; //Product-4

secondary\_demand = [

[213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537], //Product-1

[47.6400,30.7056,30.0282], //Products-2

[99.0000,51.9600,50.0784], //Prodcut-3

[296.0000,107.8400,100.3136]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1

[47.6400,30.7056,30.0282,30.0011], //Products-2

[99.0000,51.9600,50.0784,50.0031], //Prodcut-3

[296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - I

setuptime = [10,10,15,15,10,10,5,5,5,5];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,485.7143,711.1111];

**SETUP-II (Profile)**

**Test Instance-1:** TGS2C1D1 (Test General Setup-Profile\_2 Capacity-Profile\_1 Demand-Series\_1)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900], //Product-1

[30.0900], //Products-2

[50.2500], //Prodcut-3

[101.0000]]; //Product-4

secondary\_demand = [

[100.5800], //Product-5 (Sum of Product-1 & 2)

[80.3400], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800], //Product-8 (equal to Prodcut-5)

[180.9200], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049], //Product-1

[30.0900,30.0009], //Products-2

[50.2500,50.0025], //Prodcut-3

[101.0000,100.0100]]; //Product-4

secondary\_demand = [

[100.5800,100.0058], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - 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], //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 - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1

[30.0900,30.0009,30.0000,30.0000], //Products-2

[50.2500,50.0025,50.0000,50.0000], //Prodcut-3

[101.0000,100.0100,100.0001,100.0000]]; //Product-4

secondary\_demand = [

[100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034,80.0000,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Test Instance-2:** TGS2C1D2 (Test General Setup-Profile\_2 Capacity-Profile\_1 Demand-Series\_2)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400], //Product-1

[31.4400], //Products-2

[54.0000], //Prodcut-3

[116.0000]]; //Product-4

secondary\_demand = [

[109.2800], //Product-5 (Sum of Product-1 & 2)

[85.4400], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800], //Product-8 (equal to Prodcut-5)

[194.7200], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784], //Product-1

[31.4400,30.0144], //Products-2

[54.0000,50.0040], //Prodcut-3

[116.0000,100.1600]]; //Product-4

secondary\_demand = [

[109.2800,100.0928], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008], //Product-1

[31.4400,30.0144,30.0001], //Products-2

[54.0000,50.0040,50.0004], //Prodcut-3

[116.0000,100.1600,100.0016]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544,230.0025]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1

[31.4400,30.0144,30.0001,30.0000], //Products-2

[54.0000,50.0040,50.0004,50.0000], //Prodcut-3

[116.0000,100.1600,100.0016,100.0000]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000,150.0020,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928,100.0009,100.0000], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472,180.0015,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544,230.0025,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Test Instance-3:** TGS2C1D3 (Test General Setup-Profile\_2 Capacity-Profile\_1 Demand-Series\_3)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100], //Product-1

[34.4100], //Products-2

[62.2500], //Prodcut-3

[149.0000]]; //Product-4

secondary\_demand = [

[128.4200], //Product-5 (Sum of Product-1 & 2)

[96.6600], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200], //Product-8 (equal to Prodcut-5)

[225.0800], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401], //Product-1

[34.4100,30.0441], //Products-2

[62.2500,50.1225], //Prodcut-3

[149.0000,100.4900]]; //Product-4

secondary\_demand = [

[128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024], //Product-1

[34.4100,30.0441,30.0004], //Products-2

[62.2500,50.1225,50.0012], //Prodcut-3

[149.0000,100.4900,100.0049]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1

[34.4100,30.0441,30.0004,30.0000], //Products-2

[62.2500,50.1225,50.0012,50.0000], //Prodcut-3

[149.0000,100.4900,100.0049,100.0000]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Test Instance-4:** TGS2C1D4 (Test General Setup-Profile\_2 Capacity-Profile\_1 Demand-Series\_4)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025], //Product-1

[30.2025], //Products-2

[50.5625], //Prodcut-3

[102.2500]]; //Product-4

secondary\_demand = [

[101.3050], //Product-5 (Sum of Product-1 & 2)

[80.7650], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050], //Product-8 (equal to Prodcut-5)

[182.0700], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048], //Product-1

[30.2025,30.0046], //Products-2

[50.5625,50.0127], //Prodcut-3

[102.2500,100.0506]]; //Product-4

secondary\_demand = [

[101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006], //Product-1

[30.2025,30.0046,30.0001], //Products-2

[50.5625,50.0127,50.0003], //Prodcut-3

[102.2500,100.0506,100.0011]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006,70.0000], //Product-1

[30.2025,30.0046,30.0001,30.0000], //Products-2

[50.5625,50.0127,50.0003,50.0000], //Prodcut-3

[102.2500,100.0506,100.0011,100.0000]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007,100.0000], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Test Instance-5:** TGS2C1D5 (Test General Setup-Profile\_2 Capacity-Profile\_1 Demand-Series\_5)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400], //Product-1

[33.2400], //Products-2

[59.0000], //Prodcut-3

[136.0000]]; //Product-4

secondary\_demand = [

[120.8800], //Product-5 (Sum of Product-1 & 2)

[92.2400], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800], //Product-8 (equal to Prodcut-5)

[213.1200], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969], //Product-1

[33.2400,30.0729], //Products-2

[59.0000,50.2025], //Prodcut-3

[136.0000,100.8100]]; //Product-4

secondary\_demand = [

[120.8800,100.4698], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089], //Product-1

[33.2400,30.0729,30.0016], //Products-2

[59.0000,50.2025,50.0046], //Prodcut-3

[136.0000,100.8100,100.0182]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089,70.0002], //Product-1

[33.2400,30.0729,30.0016,30.0000], //Products-2

[59.0000,50.2025,50.0046,50.0001], //Prodcut-3

[136.0000,100.8100,100.0182,100.0004]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106,100.0002], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228,150.0005], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106,100.0002], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168,180.0004], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290,230.0007]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Test Instance-6:** TGS2C1D6 (Test General Setup-Profile\_2 Capacity-Profile\_1 Demand-Series\_6)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225], //Product-1

[39.9225], //Products-2

[77.5625], //Prodcut-3

[210.2500]]; //Product-4

secondary\_demand = [

[163.9450], //Product-5 (Sum of Product-1 & 2)

[117.4850], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450], //Product-8 (equal to Prodcut-5)

[281.4300], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155], //Product-1

[39.9225,30.2233], //Products-2

[77.5625,50.6202], //Prodcut-3

[210.2500,102.4806]]; //Product-4

secondary\_demand = [

[163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273], //Product-1

[39.9225,30.2233,30.0050], //Products-2

[77.5625,50.6202,50.0140], //Prodcut-3

[210.2500,102.4806,100.0558]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273,70.0006], //Product-1

[39.9225,30.2233,30.0050,30.0001], //Products-2

[77.5625,50.6202,50.0140,50.0003], //Prodcut-3

[210.2500,102.4806,100.0558,100.0013]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324,100.0007], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698,150.0016], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324,100.0007], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513,180.0012], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887,230.0020]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Test Instance-7:** TGS2C1D7 (Test General Setup-Profile\_2 Capacity-Profile\_1 Demand-Series\_7)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600], //Product-1

[30.3600], //Products-2

[51.0000], //Prodcut-3

[104.0000]]; //Product-4

secondary\_demand = [

[102.3200], //Product-5 (Sum of Product-1 & 2)

[81.3600], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200], //Product-8 (equal to Prodcut-5)

[183.6800], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784], //Product-1

[30.3600,30.0144], //Products-2

[51.0000,50.0400], //Prodcut-3

[104.0000,100.1600]]; //Product-4

secondary\_demand = [

[102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031], //Product-1

[30.3600,30.0144,30.0006], //Products-2

[51.0000,50.0400,50.0016], //Prodcut-3

[104.0000,100.1600,100.0064]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031,70.0001], //Product-1

[30.3600,30.0144,30.0006,30.0000], //Products-2

[51.0000,50.0400,50.0016,50.0001], //Prodcut-3

[104.0000,100.1600,100.0064,100.0003]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037,100.0001], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080,150.0003], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037,100.0001], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059,180.0002], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102,230.0004]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Test Instance-8:** TGS2C1D8 (Test General Setup-Profile\_2 Capacity-Profile\_1 Demand-Series\_8)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600], //Product-1

[35.7600], //Products-2

[66.0000], //Prodcut-3

[164.0000]]; //Product-4

secondary\_demand = [

[137.1200], //Product-5 (Sum of Product-1 & 2)

[101.7600], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200], //Product-8 (equal to Prodcut-5)

[238.8800], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544], //Product-1

[35.7600,30.2304], //Products-2

[66.0000,50.6400], //Prodcut-3

[164.0000,102.5600]]; //Product-4

secondary\_demand = [

[137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.0502], //Product-1

[35.7600,30.2304,30.0092], //Products-2

[66.0000,50.6400,50.0256], //Prodcut-3

[164.0000,102.5600,100.1024]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1

[35.7600,30.2304,30.0092,30.0004], //Products-2

[66.0000,50.6400,50.0256,50.0010], //Prodcut-3

[164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Test Instance-9:** TGS2C1D9 (Test General Setup-Profile\_2 Capacity-Profile\_1 Demand-Series\_9)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400], //Product-1

[47.6400], //Products-2

[99.0000], //Prodcut-3

[296.0000]]; //Product-4

secondary\_demand = [

[213.6800], //Product-5 (Sum of Product-1 & 2)

[146.6400], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800], //Product-8 (equal to Prodcut-5)

[360.3200], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416], //Product-1

[47.6400,30.7056], //Products-2

[99.0000,51.9600], //Prodcut-3

[296.0000,107.8400]]; //Product-4

secondary\_demand = [

[213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537], //Product-1

[47.6400,30.7056,30.0282], //Products-2

[99.0000,51.9600,50.0784], //Prodcut-3

[296.0000,107.8400,100.3136]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1

[47.6400,30.7056,30.0282,30.0011], //Products-2

[99.0000,51.9600,50.0784,50.0031], //Prodcut-3

[296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [122.2222,355.5556,755.5556];

**Test Instance-10:** TGS2C2D1 (Test General Setup-Profile\_2 Capacity-Profile\_2 Demand-Series\_1)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900], //Product-1

[30.0900], //Products-2

[50.2500], //Prodcut-3

[101.0000]]; //Product-4

secondary\_demand = [

[100.5800], //Product-5 (Sum of Product-1 & 2)

[80.3400], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800], //Product-8 (equal to Prodcut-5)

[180.9200], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049], //Product-1

[30.0900,30.0009], //Products-2

[50.2500,50.0025], //Prodcut-3

[101.0000,100.0100]]; //Product-4

secondary\_demand = [

[100.5800,100.0058], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049,70.0000], //Product-1

[30.0900,30.0009,30.0000], //Products-2

[50.2500,50.0025,50.0000], //Prodcut-3

[101.0000,100.0100,100.0001]]; //Product-4

secondary\_demand = [

[100.5800,100.0058,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125,150.0001], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058,100.0000], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1

[30.0900,30.0009,30.0000,30.0000], //Products-2

[50.2500,50.0025,50.0000,50.0000], //Prodcut-3

[101.0000,100.0100,100.0001,100.0000]]; //Product-4

secondary\_demand = [

[100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034,80.0000,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Test Instance-11:** TGS2C2D2 (Test General Setup-Profile\_2 Capacity-Profile\_2 Demand-Series\_2)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400], //Product-1

[31.4400], //Products-2

[54.0000], //Prodcut-3

[116.0000]]; //Product-4

secondary\_demand = [

[109.2800], //Product-5 (Sum of Product-1 & 2)

[85.4400], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800], //Product-8 (equal to Prodcut-5)

[194.7200], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784], //Product-1

[31.4400,30.0144], //Products-2

[54.0000,50.0040], //Prodcut-3

[116.0000,100.1600]]; //Product-4

secondary\_demand = [

[109.2800,100.0928], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008], //Product-1

[31.4400,30.0144,30.0001], //Products-2

[54.0000,50.0040,50.0004], //Prodcut-3

[116.0000,100.1600,100.0016]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544,230.0025]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1

[31.4400,30.0144,30.0001,30.0000], //Products-2

[54.0000,50.0040,50.0004,50.0000], //Prodcut-3

[116.0000,100.1600,100.0016,100.0000]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000,150.0020,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928,100.0009,100.0000], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472,180.0015,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544,230.0025,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Test Instance-12:** TGS2C2D3 (Test General Setup-Profile\_2 Capacity-Profile\_2 Demand-Series\_3)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100], //Product-1

[34.4100], //Products-2

[62.2500], //Prodcut-3

[149.0000]]; //Product-4

secondary\_demand = [

[128.4200], //Product-5 (Sum of Product-1 & 2)

[96.6600], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200], //Product-8 (equal to Prodcut-5)

[225.0800], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401], //Product-1

[34.4100,30.0441], //Products-2

[62.2500,50.1225], //Prodcut-3

[149.0000,100.4900]]; //Product-4

secondary\_demand = [

[128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024], //Product-1

[34.4100,30.0441,30.0004], //Products-2

[62.2500,50.1225,50.0012], //Prodcut-3

[149.0000,100.4900,100.0049]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1

[34.4100,30.0441,30.0004,30.0000], //Products-2

[62.2500,50.1225,50.0012,50.0000], //Prodcut-3

[149.0000,100.4900,100.0049,100.0000]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Test Instance-13:** TGS2C2D4 (Test General Setup-Profile\_2 Capacity-Profile\_2 Demand-Series\_4)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025], //Product-1

[30.2025], //Products-2

[50.5625], //Prodcut-3

[102.2500]]; //Product-4

secondary\_demand = [

[101.3050], //Product-5 (Sum of Product-1 & 2)

[80.7650], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050], //Product-8 (equal to Prodcut-5)

[182.0700], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048], //Product-1

[30.2025,30.0046], //Products-2

[50.5625,50.0127], //Prodcut-3

[102.2500,100.0506]]; //Product-4

secondary\_demand = [

[101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006], //Product-1

[30.2025,30.0046,30.0001], //Products-2

[50.5625,50.0127,50.0003], //Prodcut-3

[102.2500,100.0506,100.0011]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006,70.0000], //Product-1

[30.2025,30.0046,30.0001,30.0000], //Products-2

[50.5625,50.0127,50.0003,50.0000], //Prodcut-3

[102.2500,100.0506,100.0011,100.0000]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007,100.0000], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Test Instance-14:** TGS2C2D5 (Test General Setup-Profile\_2 Capacity-Profile\_2 Demand-Series\_5)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400], //Product-1

[33.2400], //Products-2

[59.0000], //Prodcut-3

[136.0000]]; //Product-4

secondary\_demand = [

[120.8800], //Product-5 (Sum of Product-1 & 2)

[92.2400], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800], //Product-8 (equal to Prodcut-5)

[213.1200], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969], //Product-1

[33.2400,30.0729], //Products-2

[59.0000,50.2025], //Prodcut-3

[136.0000,100.8100]]; //Product-4

secondary\_demand = [

[120.8800,100.4698], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089], //Product-1

[33.2400,30.0729,30.0016], //Products-2

[59.0000,50.2025,50.0046], //Prodcut-3

[136.0000,100.8100,100.0182]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089,70.0002], //Product-1

[33.2400,30.0729,30.0016,30.0000], //Products-2

[59.0000,50.2025,50.0046,50.0001], //Prodcut-3

[136.0000,100.8100,100.0182,100.0004]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106,100.0002], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228,150.0005], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106,100.0002], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168,180.0004], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290,230.0007]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Test Instance-15:** TGS2C2D6 (Test General Setup-Profile\_2 Capacity-Profile\_2 Demand-Series\_6)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225], //Product-1

[39.9225], //Products-2

[77.5625], //Prodcut-3

[210.2500]]; //Product-4

secondary\_demand = [

[163.9450], //Product-5 (Sum of Product-1 & 2)

[117.4850], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450], //Product-8 (equal to Prodcut-5)

[281.4300], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155], //Product-1

[39.9225,30.2233], //Products-2

[77.5625,50.6202], //Prodcut-3

[210.2500,102.4806]]; //Product-4

secondary\_demand = [

[163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273], //Product-1

[39.9225,30.2233,30.0050], //Products-2

[77.5625,50.6202,50.0140], //Prodcut-3

[210.2500,102.4806,100.0558]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273,70.0006], //Product-1

[39.9225,30.2233,30.0050,30.0001], //Products-2

[77.5625,50.6202,50.0140,50.0003], //Prodcut-3

[210.2500,102.4806,100.0558,100.0013]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324,100.0007], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698,150.0016], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324,100.0007], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513,180.0012], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887,230.0020]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Test Instance-16:** TGS2C2D7 (Test General Setup-Profile\_2 Capacity-Profile\_2 Demand-Series\_7)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

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 - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784], //Product-1

[30.3600,30.0144], //Products-2

[51.0000,50.0400], //Prodcut-3

[104.0000,100.1600]]; //Product-4

secondary\_demand = [

[102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031], //Product-1

[30.3600,30.0144,30.0006], //Products-2

[51.0000,50.0400,50.0016], //Prodcut-3

[104.0000,100.1600,100.0064]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031,70.0001], //Product-1

[30.3600,30.0144,30.0006,30.0000], //Products-2

[51.0000,50.0400,50.0016,50.0001], //Prodcut-3

[104.0000,100.1600,100.0064,100.0003]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037,100.0001], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080,150.0003], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037,100.0001], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059,180.0002], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102,230.0004]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Test Instance-17:** TGS2C2D8 (Test General Setup-Profile\_2 Capacity-Profile\_2 Demand-Series\_8)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600], //Product-1

[35.7600], //Products-2

[66.0000], //Prodcut-3

[164.0000]]; //Product-4

secondary\_demand = [

[137.1200], //Product-5 (Sum of Product-1 & 2)

[101.7600], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200], //Product-8 (equal to Prodcut-5)

[238.8800], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544], //Product-1

[35.7600,30.2304], //Products-2

[66.0000,50.6400], //Prodcut-3

[164.0000,102.5600]]; //Product-4

secondary\_demand = [

[137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.0502], //Product-1

[35.7600,30.2304,30.0092], //Products-2

[66.0000,50.6400,50.0256], //Prodcut-3

[164.0000,102.5600,100.1024]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1

[35.7600,30.2304,30.0092,30.0004], //Products-2

[66.0000,50.6400,50.0256,50.0010], //Prodcut-3

[164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Test Instance-18:** TGS2C2D9 (Test General Setup-Profile\_2 Capacity-Profile\_2 Demand-Series\_9)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400], //Product-1

[47.6400], //Products-2

[99.0000], //Prodcut-3

[296.0000]]; //Product-4

secondary\_demand = [

[213.6800], //Product-5 (Sum of Product-1 & 2)

[146.6400], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800], //Product-8 (equal to Prodcut-5)

[360.3200], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416], //Product-1

[47.6400,30.7056], //Products-2

[99.0000,51.9600], //Prodcut-3

[296.0000,107.8400]]; //Product-4

secondary\_demand = [

[213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537], //Product-1

[47.6400,30.7056,30.0282], //Products-2

[99.0000,51.9600,50.0784], //Prodcut-3

[296.0000,107.8400,100.3136]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1

[47.6400,30.7056,30.0282,30.0011], //Products-2

[99.0000,51.9600,50.0784,50.0031], //Prodcut-3

[296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [157.1429,457.1429,971.4286];

**Test Instance-19:** TGS2C3D1 (Test General Setup-Profile\_2 Capacity-Profile\_3 Demand-Series\_1)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900], //Product-1

[30.0900], //Products-2

[50.2500], //Prodcut-3

[101.0000]]; //Product-4

secondary\_demand = [

[100.5800], //Product-5 (Sum of Product-1 & 2)

[80.3400], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800], //Product-8 (equal to Prodcut-5)

[180.9200], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049], //Product-1

[30.0900,30.0009], //Products-2

[50.2500,50.0025], //Prodcut-3

[101.0000,100.0100]]; //Product-4

secondary\_demand = [

[100.5800,100.0058], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049,70.0000], //Product-1

[30.0900,30.0009,30.0000], //Products-2

[50.2500,50.0025,50.0000], //Prodcut-3

[101.0000,100.0100,100.0001]]; //Product-4

secondary\_demand = [

[100.5800,100.0058,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125,150.0001], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058,100.0000], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1

[30.0900,30.0009,30.0000,30.0000], //Products-2

[50.2500,50.0025,50.0000,50.0000], //Prodcut-3

[101.0000,100.0100,100.0001,100.0000]]; //Product-4

secondary\_demand = [

[100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034,80.0000,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Test Instance-20:** TGS2C3D2 (Test General Setup-Profile\_2 Capacity-Profile\_3 Demand-Series\_2)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400], //Product-1

[31.4400], //Products-2

[54.0000], //Prodcut-3

[116.0000]]; //Product-4

secondary\_demand = [

[109.2800], //Product-5 (Sum of Product-1 & 2)

[85.4400], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800], //Product-8 (equal to Prodcut-5)

[194.7200], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784], //Product-1

[31.4400,30.0144], //Products-2

[54.0000,50.0040], //Prodcut-3

[116.0000,100.1600]]; //Product-4

secondary\_demand = [

[109.2800,100.0928], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008], //Product-1

[31.4400,30.0144,30.0001], //Products-2

[54.0000,50.0040,50.0004], //Prodcut-3

[116.0000,100.1600,100.0016]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544,230.0025]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1

[31.4400,30.0144,30.0001,30.0000], //Products-2

[54.0000,50.0040,50.0004,50.0000], //Prodcut-3

[116.0000,100.1600,100.0016,100.0000]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000,150.0020,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928,100.0009,100.0000], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472,180.0015,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544,230.0025,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Test Instance-21:** TGS2C3D3 (Test General Setup-Profile\_2 Capacity-Profile\_3 Demand-Series\_3)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100], //Product-1

[34.4100], //Products-2

[62.2500], //Prodcut-3

[149.0000]]; //Product-4

secondary\_demand = [

[128.4200], //Product-5 (Sum of Product-1 & 2)

[96.6600], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200], //Product-8 (equal to Prodcut-5)

[225.0800], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401], //Product-1

[34.4100,30.0441], //Products-2

[62.2500,50.1225], //Prodcut-3

[149.0000,100.4900]]; //Product-4

secondary\_demand = [

[128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024], //Product-1

[34.4100,30.0441,30.0004], //Products-2

[62.2500,50.1225,50.0012], //Prodcut-3

[149.0000,100.4900,100.0049]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1

[34.4100,30.0441,30.0004,30.0000], //Products-2

[62.2500,50.1225,50.0012,50.0000], //Prodcut-3

[149.0000,100.4900,100.0049,100.0000]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Test Instance-22:** TGS2C3D4 (Test General Setup-Profile\_2 Capacity-Profile\_3 Demand-Series\_4)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025], //Product-1

[30.2025], //Products-2

[50.5625], //Prodcut-3

[102.2500]]; //Product-4

secondary\_demand = [

[101.3050], //Product-5 (Sum of Product-1 & 2)

[80.7650], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050], //Product-8 (equal to Prodcut-5)

[182.0700], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048], //Product-1

[30.2025,30.0046], //Products-2

[50.5625,50.0127], //Prodcut-3

[102.2500,100.0506]]; //Product-4

secondary\_demand = [

[101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006], //Product-1

[30.2025,30.0046,30.0001], //Products-2

[50.5625,50.0127,50.0003], //Prodcut-3

[102.2500,100.0506,100.0011]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006,70.0000], //Product-1

[30.2025,30.0046,30.0001,30.0000], //Products-2

[50.5625,50.0127,50.0003,50.0000], //Prodcut-3

[102.2500,100.0506,100.0011,100.0000]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007,100.0000], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Test Instance-23:** TGS2C3D5 (Test General Setup-Profile\_2 Capacity-Profile\_3 Demand-Series\_5)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400], //Product-1

[33.2400], //Products-2

[59.0000], //Prodcut-3

[136.0000]]; //Product-4

secondary\_demand = [

[120.8800], //Product-5 (Sum of Product-1 & 2)

[92.2400], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800], //Product-8 (equal to Prodcut-5)

[213.1200], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969], //Product-1

[33.2400,30.0729], //Products-2

[59.0000,50.2025], //Prodcut-3

[136.0000,100.8100]]; //Product-4

secondary\_demand = [

[120.8800,100.4698], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089], //Product-1

[33.2400,30.0729,30.0016], //Products-2

[59.0000,50.2025,50.0046], //Prodcut-3

[136.0000,100.8100,100.0182]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089,70.0002], //Product-1

[33.2400,30.0729,30.0016,30.0000], //Products-2

[59.0000,50.2025,50.0046,50.0001], //Prodcut-3

[136.0000,100.8100,100.0182,100.0004]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106,100.0002], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228,150.0005], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106,100.0002], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168,180.0004], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290,230.0007]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Test Instance-24:** TGS2C3D6 (Test General Setup-Profile\_2 Capacity-Profile\_3 Demand-Series\_6)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225], //Product-1

[39.9225], //Products-2

[77.5625], //Prodcut-3

[210.2500]]; //Product-4

secondary\_demand = [

[163.9450], //Product-5 (Sum of Product-1 & 2)

[117.4850], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450], //Product-8 (equal to Prodcut-5)

[281.4300], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155], //Product-1

[39.9225,30.2233], //Products-2

[77.5625,50.6202], //Prodcut-3

[210.2500,102.4806]]; //Product-4

secondary\_demand = [

[163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273], //Product-1

[39.9225,30.2233,30.0050], //Products-2

[77.5625,50.6202,50.0140], //Prodcut-3

[210.2500,102.4806,100.0558]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273,70.0006], //Product-1

[39.9225,30.2233,30.0050,30.0001], //Products-2

[77.5625,50.6202,50.0140,50.0003], //Prodcut-3

[210.2500,102.4806,100.0558,100.0013]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324,100.0007], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698,150.0016], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324,100.0007], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513,180.0012], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887,230.0020]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Test Instance-25:** TGS2C3D7 (Test General Setup-Profile\_2 Capacity-Profile\_3 Demand-Series\_7)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600], //Product-1

[30.3600], //Products-2

[51.0000], //Prodcut-3

[104.0000]]; //Product-4

secondary\_demand = [

[102.3200], //Product-5 (Sum of Product-1 & 2)

[81.3600], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200], //Product-8 (equal to Prodcut-5)

[183.6800], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784], //Product-1

[30.3600,30.0144], //Products-2

[51.0000,50.0400], //Prodcut-3

[104.0000,100.1600]]; //Product-4

secondary\_demand = [

[102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031], //Product-1

[30.3600,30.0144,30.0006], //Products-2

[51.0000,50.0400,50.0016], //Prodcut-3

[104.0000,100.1600,100.0064]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031,70.0001], //Product-1

[30.3600,30.0144,30.0006,30.0000], //Products-2

[51.0000,50.0400,50.0016,50.0001], //Prodcut-3

[104.0000,100.1600,100.0064,100.0003]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037,100.0001], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080,150.0003], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037,100.0001], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059,180.0002], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102,230.0004]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Test Instance-26:** TGS2C3D8 (Test General Setup-Profile\_2 Capacity-Profile\_3 Demand-Series\_8)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600], //Product-1

[35.7600], //Products-2

[66.0000], //Prodcut-3

[164.0000]]; //Product-4

secondary\_demand = [

[137.1200], //Product-5 (Sum of Product-1 & 2)

[101.7600], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200], //Product-8 (equal to Prodcut-5)

[238.8800], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544], //Product-1

[35.7600,30.2304], //Products-2

[66.0000,50.6400], //Prodcut-3

[164.0000,102.5600]]; //Product-4

secondary\_demand = [

[137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.0502], //Product-1

[35.7600,30.2304,30.0092], //Products-2

[66.0000,50.6400,50.0256], //Prodcut-3

[164.0000,102.5600,100.1024]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1

[35.7600,30.2304,30.0092,30.0004], //Products-2

[66.0000,50.6400,50.0256,50.0010], //Prodcut-3

[164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Test Instance-27:** TGS2C3D9 (Test General Setup-Profile\_2 Capacity-Profile\_3 Demand-Series\_9)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400], //Product-1

[47.6400], //Products-2

[99.0000], //Prodcut-3

[296.0000]]; //Product-4

secondary\_demand = [

[213.6800], //Product-5 (Sum of Product-1 & 2)

[146.6400], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800], //Product-8 (equal to Prodcut-5)

[360.3200], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416], //Product-1

[47.6400,30.7056], //Products-2

[99.0000,51.9600], //Prodcut-3

[296.0000,107.8400]]; //Product-4

secondary\_demand = [

[213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537], //Product-1

[47.6400,30.7056,30.0282], //Products-2

[99.0000,51.9600,50.0784], //Prodcut-3

[296.0000,107.8400,100.3136]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1

[47.6400,30.7056,30.0282,30.0011], //Products-2

[99.0000,51.9600,50.0784,50.0031], //Prodcut-3

[296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [220.0000,640.0000,1360.0000];

**Test Instance-28:** TGS2C4D1 (Test General Setup-Profile\_2 Capacity-Profile\_4 Demand-Series\_1)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900], //Product-1

[30.0900], //Products-2

[50.2500], //Prodcut-3

[101.0000]]; //Product-4

secondary\_demand = [

[100.5800], //Product-5 (Sum of Product-1 & 2)

[80.3400], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800], //Product-8 (equal to Prodcut-5)

[180.9200], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049], //Product-1

[30.0900,30.0009], //Products-2

[50.2500,50.0025], //Prodcut-3

[101.0000,100.0100]]; //Product-4

secondary\_demand = [

[100.5800,100.0058], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049,70.0000], //Product-1

[30.0900,30.0009,30.0000], //Products-2

[50.2500,50.0025,50.0000], //Prodcut-3

[101.0000,100.0100,100.0001]]; //Product-4

secondary\_demand = [

[100.5800,100.0058,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125,150.0001], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058,100.0000], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1

[30.0900,30.0009,30.0000,30.0000], //Products-2

[50.2500,50.0025,50.0000,50.0000], //Prodcut-3

[101.0000,100.0100,100.0001,100.0000]]; //Product-4

secondary\_demand = [

[100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034,80.0000,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Test Instance-29:** TGS2C4D2 (Test General Setup-Profile\_2 Capacity-Profile\_4 Demand-Series\_2)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400], //Product-1

[31.4400], //Products-2

[54.0000], //Prodcut-3

[116.0000]]; //Product-4

secondary\_demand = [

[109.2800], //Product-5 (Sum of Product-1 & 2)

[85.4400], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800], //Product-8 (equal to Prodcut-5)

[194.7200], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784], //Product-1

[31.4400,30.0144], //Products-2

[54.0000,50.0040], //Prodcut-3

[116.0000,100.1600]]; //Product-4

secondary\_demand = [

[109.2800,100.0928], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008], //Product-1

[31.4400,30.0144,30.0001], //Products-2

[54.0000,50.0040,50.0004], //Prodcut-3

[116.0000,100.1600,100.0016]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544,230.0025]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1

[31.4400,30.0144,30.0001,30.0000], //Products-2

[54.0000,50.0040,50.0004,50.0000], //Prodcut-3

[116.0000,100.1600,100.0016,100.0000]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of 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 - 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], //Product-5 (Sum of Product-1 & 2)

[96.6600], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200], //Product-8 (equal to Prodcut-5)

[225.0800], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401], //Product-1

[34.4100,30.0441], //Products-2

[62.2500,50.1225], //Prodcut-3

[149.0000,100.4900]]; //Product-4

secondary\_demand = [

[128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024], //Product-1

[34.4100,30.0441,30.0004], //Products-2

[62.2500,50.1225,50.0012], //Prodcut-3

[149.0000,100.4900,100.0049]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1

[34.4100,30.0441,30.0004,30.0000], //Products-2

[62.2500,50.1225,50.0012,50.0000], //Prodcut-3

[149.0000,100.4900,100.0049,100.0000]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Test Instance-31:** TGS2C4D4 (Test General Setup-Profile\_2 Capacity-Profile\_4 Demand-Series\_4)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025], //Product-1

[30.2025], //Products-2

[50.5625], //Prodcut-3

[102.2500]]; //Product-4

secondary\_demand = [

[101.3050], //Product-5 (Sum of Product-1 & 2)

[80.7650], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050], //Product-8 (equal to Prodcut-5)

[182.0700], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048], //Product-1

[30.2025,30.0046], //Products-2

[50.5625,50.0127], //Prodcut-3

[102.2500,100.0506]]; //Product-4

secondary\_demand = [

[101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006], //Product-1

[30.2025,30.0046,30.0001], //Products-2

[50.5625,50.0127,50.0003], //Prodcut-3

[102.2500,100.0506,100.0011]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006,70.0000], //Product-1

[30.2025,30.0046,30.0001,30.0000], //Products-2

[50.5625,50.0127,50.0003,50.0000], //Prodcut-3

[102.2500,100.0506,100.0011,100.0000]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007,100.0000], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Test Instance-32:** TGS2C4D5 (Test General Setup-Profile\_2 Capacity-Profile\_4 Demand-Series\_5)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400], //Product-1

[33.2400], //Products-2

[59.0000], //Prodcut-3

[136.0000]]; //Product-4

secondary\_demand = [

[120.8800], //Product-5 (Sum of Product-1 & 2)

[92.2400], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800], //Product-8 (equal to Prodcut-5)

[213.1200], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969], //Product-1

[33.2400,30.0729], //Products-2

[59.0000,50.2025], //Prodcut-3

[136.0000,100.8100]]; //Product-4

secondary\_demand = [

[120.8800,100.4698], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089], //Product-1

[33.2400,30.0729,30.0016], //Products-2

[59.0000,50.2025,50.0046], //Prodcut-3

[136.0000,100.8100,100.0182]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089,70.0002], //Product-1

[33.2400,30.0729,30.0016,30.0000], //Products-2

[59.0000,50.2025,50.0046,50.0001], //Prodcut-3

[136.0000,100.8100,100.0182,100.0004]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106,100.0002], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228,150.0005], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106,100.0002], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168,180.0004], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290,230.0007]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Test Instance-33:** TGS2C4D6 (Test General Setup-Profile\_2 Capacity-Profile\_4 Demand-Series\_6)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225], //Product-1

[39.9225], //Products-2

[77.5625], //Prodcut-3

[210.2500]]; //Product-4

secondary\_demand = [

[163.9450], //Product-5 (Sum of Product-1 & 2)

[117.4850], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450], //Product-8 (equal to Prodcut-5)

[281.4300], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155], //Product-1

[39.9225,30.2233], //Products-2

[77.5625,50.6202], //Prodcut-3

[210.2500,102.4806]]; //Product-4

secondary\_demand = [

[163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273], //Product-1

[39.9225,30.2233,30.0050], //Products-2

[77.5625,50.6202,50.0140], //Prodcut-3

[210.2500,102.4806,100.0558]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273,70.0006], //Product-1

[39.9225,30.2233,30.0050,30.0001], //Products-2

[77.5625,50.6202,50.0140,50.0003], //Prodcut-3

[210.2500,102.4806,100.0558,100.0013]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324,100.0007], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698,150.0016], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324,100.0007], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513,180.0012], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887,230.0020]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Test Instance-34:** TGS2C4D7 (Test General Setup-Profile\_2 Capacity-Profile\_4 Demand-Series\_7)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600], //Product-1

[30.3600], //Products-2

[51.0000], //Prodcut-3

[104.0000]]; //Product-4

secondary\_demand = [

[102.3200], //Product-5 (Sum of Product-1 & 2)

[81.3600], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200], //Product-8 (equal to Prodcut-5)

[183.6800], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784], //Product-1

[30.3600,30.0144], //Products-2

[51.0000,50.0400], //Prodcut-3

[104.0000,100.1600]]; //Product-4

secondary\_demand = [

[102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031], //Product-1

[30.3600,30.0144,30.0006], //Products-2

[51.0000,50.0400,50.0016], //Prodcut-3

[104.0000,100.1600,100.0064]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031,70.0001], //Product-1

[30.3600,30.0144,30.0006,30.0000], //Products-2

[51.0000,50.0400,50.0016,50.0001], //Prodcut-3

[104.0000,100.1600,100.0064,100.0003]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037,100.0001], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080,150.0003], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037,100.0001], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059,180.0002], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102,230.0004]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Test Instance-35:** TGS2C4D8 (Test General Setup-Profile\_2 Capacity-Profile\_4 Demand-Series\_8)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600], //Product-1

[35.7600], //Products-2

[66.0000], //Prodcut-3

[164.0000]]; //Product-4

secondary\_demand = [

[137.1200], //Product-5 (Sum of Product-1 & 2)

[101.7600], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200], //Product-8 (equal to Prodcut-5)

[238.8800], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544], //Product-1

[35.7600,30.2304], //Products-2

[66.0000,50.6400], //Prodcut-3

[164.0000,102.5600]]; //Product-4

secondary\_demand = [

[137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.0502], //Product-1

[35.7600,30.2304,30.0092], //Products-2

[66.0000,50.6400,50.0256], //Prodcut-3

[164.0000,102.5600,100.1024]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1

[35.7600,30.2304,30.0092,30.0004], //Products-2

[66.0000,50.6400,50.0256,50.0010], //Prodcut-3

[164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Test Instance-36:** TGS2C4D9 (Test General Setup-Profile\_2 Capacity-Profile\_4 Demand-Series\_9)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400], //Product-1

[47.6400], //Products-2

[99.0000], //Prodcut-3

[296.0000]]; //Product-4

secondary\_demand = [

[213.6800], //Product-5 (Sum of Product-1 & 2)

[146.6400], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800], //Product-8 (equal to Prodcut-5)

[360.3200], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416], //Product-1

[47.6400,30.7056], //Products-2

[99.0000,51.9600], //Prodcut-3

[296.0000,107.8400]]; //Product-4

secondary\_demand = [

[213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537], //Product-1

[47.6400,30.7056,30.0282], //Products-2

[99.0000,51.9600,50.0784], //Prodcut-3

[296.0000,107.8400,100.3136]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1

[47.6400,30.7056,30.0282,30.0011], //Products-2

[99.0000,51.9600,50.0784,50.0031], //Prodcut-3

[296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [122.2222,457.1429,1360.0000];

**Test Instance-37:** TGS2C5D1 (Test General Setup-Profile\_2 Capacity-Profile\_5 Demand-Series\_1)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900], //Product-1

[30.0900], //Products-2

[50.2500], //Prodcut-3

[101.0000]]; //Product-4

secondary\_demand = [

[100.5800], //Product-5 (Sum of Product-1 & 2)

[80.3400], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800], //Product-8 (equal to Prodcut-5)

[180.9200], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049], //Product-1

[30.0900,30.0009], //Products-2

[50.2500,50.0025], //Prodcut-3

[101.0000,100.0100]]; //Product-4

secondary\_demand = [

[100.5800,100.0058], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049,70.0000], //Product-1

[30.0900,30.0009,30.0000], //Products-2

[50.2500,50.0025,50.0000], //Prodcut-3

[101.0000,100.0100,100.0001]]; //Product-4

secondary\_demand = [

[100.5800,100.0058,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125,150.0001], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058,100.0000], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 1

primary\_demand = [[70.4900,70.0049,70.0000,70.0000], //Product-1

[30.0900,30.0009,30.0000,30.0000], //Products-2

[50.2500,50.0025,50.0000,50.0000], //Prodcut-3

[101.0000,100.0100,100.0001,100.0000]]; //Product-4

secondary\_demand = [

[100.5800,100.0058,100.0000,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.3400,80.0034,80.0000,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[151.2500,150.0125,150.0001,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[100.5800,100.0058,100.0000,100.0000], //Product-8 (equal to Prodcut-5)

[180.9200,180.0092,180.0000,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[231.5900,230.0159,230.0000,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Test Instance-38:** TGS2C5D2 (Test General Setup-Profile\_2 Capacity-Profile\_5 Demand-Series\_2)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400], //Product-1

[31.4400], //Products-2

[54.0000], //Prodcut-3

[116.0000]]; //Product-4

secondary\_demand = [

[109.2800], //Product-5 (Sum of Product-1 & 2)

[85.4400], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800], //Product-8 (equal to Prodcut-5)

[194.7200], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784], //Product-1

[31.4400,30.0144], //Products-2

[54.0000,50.0040], //Prodcut-3

[116.0000,100.1600]]; //Product-4

secondary\_demand = [

[109.2800,100.0928], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008], //Product-1

[31.4400,30.0144,30.0001], //Products-2

[54.0000,50.0040,50.0004], //Prodcut-3

[116.0000,100.1600,100.0016]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000,150.0020], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928,100.0009], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472,180.0015], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544,230.0025]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 2

primary\_demand = [[77.8400,70.0784,70.0008,70.0000], //Product-1

[31.4400,30.0144,30.0001,30.0000], //Products-2

[54.0000,50.0040,50.0004,50.0000], //Prodcut-3

[116.0000,100.1600,100.0016,100.0000]]; //Product-4

secondary\_demand = [

[109.2800,100.0928,100.0009,100.0000], //Product-5 (Sum of Product-1 & 2)

[85.4400,80.0544,80.0005,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[170.0000,150.2000,150.0020,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[109.2800,100.0928,100.0009,100.0000], //Product-8 (equal to Prodcut-5)

[194.7200,180.1472,180.0015,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[255.4400,230.2544,230.0025,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Test Instance-39:** TGS2C5D3 (Test General Setup-Profile\_2 Capacity-Profile\_5 Demand-Series\_3)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100], //Product-1

[34.4100], //Products-2

[62.2500], //Prodcut-3

[149.0000]]; //Product-4

secondary\_demand = [

[128.4200], //Product-5 (Sum of Product-1 & 2)

[96.6600], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200], //Product-8 (equal to Prodcut-5)

[225.0800], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401], //Product-1

[34.4100,30.0441], //Products-2

[62.2500,50.1225], //Prodcut-3

[149.0000,100.4900]]; //Product-4

secondary\_demand = [

[128.4200,100.2842], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024], //Product-1

[34.4100,30.0441,30.0004], //Products-2

[62.2500,50.1225,50.0012], //Prodcut-3

[149.0000,100.4900,100.0049]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 3

primary\_demand = [[94.0100,70.2401,70.0024,70.0000], //Product-1

[34.4100,30.0441,30.0004,30.0000], //Products-2

[62.2500,50.1225,50.0012,50.0000], //Prodcut-3

[149.0000,100.4900,100.0049,100.0000]]; //Product-4

secondary\_demand = [

[128.4200,100.2842,100.0028,100.0000], //Product-5 (Sum of Product-1 & 2)

[96.6600,80.1666,80.0017,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[211.2500,150.6125,150.0061,150.0001], //Product-7 (Sum of Prodcut-3 & 4)

[128.4200,100.2842,100.0028,100.0000], //Product-8 (equal to Prodcut-5)

[225.0800,180.4508,180.0045,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[307.9100,230.7791,230.0078,230.0001]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Test Instance-40:** TGS2C5D4 (Test General Setup-Profile\_2 Capacity-Profile\_5 Demand-Series\_4)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025], //Product-1

[30.2025], //Products-2

[50.5625], //Prodcut-3

[102.2500]]; //Product-4

secondary\_demand = [

[101.3050], //Product-5 (Sum of Product-1 & 2)

[80.7650], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050], //Product-8 (equal to Prodcut-5)

[182.0700], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048], //Product-1

[30.2025,30.0046], //Products-2

[50.5625,50.0127], //Prodcut-3

[102.2500,100.0506]]; //Product-4

secondary\_demand = [

[101.3050,100.0294], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006], //Product-1

[30.2025,30.0046,30.0001], //Products-2

[50.5625,50.0127,50.0003], //Prodcut-3

[102.2500,100.0506,100.0011]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 4

primary\_demand = [[71.1025,70.048,70.0006,70.0000], //Product-1

[30.2025,30.0046,30.0001,30.0000], //Products-2

[50.5625,50.0127,50.0003,50.0000], //Prodcut-3

[102.2500,100.0506,100.0011,100.0000]]; //Product-4

secondary\_demand = [

[101.3050,100.0294,100.0007,100.0000], //Product-5 (Sum of Product-1 & 2)

[80.7650,80.0172,80.0004,80.0000], //Product-6 (Sum of Prodcut-2 & 3)

[152.8125,150.0633,150.0014,150.0000], //Product-7 (Sum of Prodcut-3 & 4)

[101.3050,100.0294,100.0007,100.0000], //Product-8 (equal to Prodcut-5)

[182.0700,180.0466,180.0010,180.0000], //Product-9 (Sum of Prodcut-5 & 6)

[233.5775,230.0805,230.0018,230.0000]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Test Instance-41:** TGS2C5D5 (Test General Setup-Profile\_2 Capacity-Profile\_5 Demand-Series\_5)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400], //Product-1

[33.2400], //Products-2

[59.0000], //Prodcut-3

[136.0000]]; //Product-4

secondary\_demand = [

[120.8800], //Product-5 (Sum of Product-1 & 2)

[92.2400], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800], //Product-8 (equal to Prodcut-5)

[213.1200], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969], //Product-1

[33.2400,30.0729], //Products-2

[59.0000,50.2025], //Prodcut-3

[136.0000,100.8100]]; //Product-4

secondary\_demand = [

[120.8800,100.4698], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089], //Product-1

[33.2400,30.0729,30.0016], //Products-2

[59.0000,50.2025,50.0046], //Prodcut-3

[136.0000,100.8100,100.0182]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 5

primary\_demand = [[87.6400,70.3969,70.0089,70.0002], //Product-1

[33.2400,30.0729,30.0016,30.0000], //Products-2

[59.0000,50.2025,50.0046,50.0001], //Prodcut-3

[136.0000,100.8100,100.0182,100.0004]]; //Product-4

secondary\_demand = [

[120.8800,100.4698,100.0106,100.0002], //Product-5 (Sum of Product-1 & 2)

[92.2400,80.2754,80.0062,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[195.0000,151.0125,150.0228,150.0005], //Product-7 (Sum of Prodcut-3 & 4)

[120.8800,100.4698,100.0106,100.0002], //Product-8 (equal to Prodcut-5)

[213.1200,180.7452,180.0168,180.0004], //Product-9 (Sum of Prodcut-5 & 6)

[287.2400,231.2879,230.0290,230.0007]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Test Instance-42:** TGS2C5D6 (Test General Setup-Profile\_2 Capacity-Profile\_5 Demand-Series\_6)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225], //Product-1

[39.9225], //Products-2

[77.5625], //Prodcut-3

[210.2500]]; //Product-4

secondary\_demand = [

[163.9450], //Product-5 (Sum of Product-1 & 2)

[117.4850], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450], //Product-8 (equal to Prodcut-5)

[281.4300], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155], //Product-1

[39.9225,30.2233], //Products-2

[77.5625,50.6202], //Prodcut-3

[210.2500,102.4806]]; //Product-4

secondary\_demand = [

[163.9450,101.4388], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273], //Product-1

[39.9225,30.2233,30.0050], //Products-2

[77.5625,50.6202,50.0140], //Prodcut-3

[210.2500,102.4806,100.0558]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 6

primary\_demand = [[124.0225,71.2155,70.0273,70.0006], //Product-1

[39.9225,30.2233,30.0050,30.0001], //Products-2

[77.5625,50.6202,50.0140,50.0003], //Prodcut-3

[210.2500,102.4806,100.0558,100.0013]]; //Product-4

secondary\_demand = [

[163.9450,101.4388,100.0324,100.0007], //Product-5 (Sum of Product-1 & 2)

[117.4850,80.8434,80.0190,80.0004], //Product-6 (Sum of Prodcut-2 & 3)

[287.8125,153.1008,150.0698,150.0016], //Product-7 (Sum of Prodcut-3 & 4)

[163.9450,101.4388,100.0324,100.0007], //Product-8 (equal to Prodcut-5)

[281.4300,182.2822,180.0513,180.0012], //Product-9 (Sum of Prodcut-5 & 6)

[405.2975,233.9442,230.0887,230.0020]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Test Instance-43:** TGS2C5D7 (Test General Setup-Profile\_2 Capacity-Profile\_5 Demand-Series\_7)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600], //Product-1

[30.3600], //Products-2

[51.0000], //Prodcut-3

[104.0000]]; //Product-4

secondary\_demand = [

[102.3200], //Product-5 (Sum of Product-1 & 2)

[81.3600], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200], //Product-8 (equal to Prodcut-5)

[183.6800], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784], //Product-1

[30.3600,30.0144], //Products-2

[51.0000,50.0400], //Prodcut-3

[104.0000,100.1600]]; //Product-4

secondary\_demand = [

[102.3200,100.0928], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031], //Product-1

[30.3600,30.0144,30.0006], //Products-2

[51.0000,50.0400,50.0016], //Prodcut-3

[104.0000,100.1600,100.0064]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 7

primary\_demand = [[71.9600,70.0784,70.0031,70.0001], //Product-1

[30.3600,30.0144,30.0006,30.0000], //Products-2

[51.0000,50.0400,50.0016,50.0001], //Prodcut-3

[104.0000,100.1600,100.0064,100.0003]]; //Product-4

secondary\_demand = [

[102.3200,100.0928,100.0037,100.0001], //Product-5 (Sum of Product-1 & 2)

[81.3600,80.0544,80.0022,80.0001], //Product-6 (Sum of Prodcut-2 & 3)

[155.0000,150.2000,150.0080,150.0003], //Product-7 (Sum of Prodcut-3 & 4)

[102.3200,100.0928,100.0037,100.0001], //Product-8 (equal to Prodcut-5)

[183.6800,180.1472,180.0059,180.0002], //Product-9 (Sum of Prodcut-5 & 6)

[236.3600,230.2544,230.0102,230.0004]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Test Instance-44:** TGS2C5D8 (Test General Setup-Profile\_2 Capacity-Profile\_5 Demand-Series\_8)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600], //Product-1

[35.7600], //Products-2

[66.0000], //Prodcut-3

[164.0000]]; //Product-4

secondary\_demand = [

[137.1200], //Product-5 (Sum of Product-1 & 2)

[101.7600], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200], //Product-8 (equal to Prodcut-5)

[238.8800], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544], //Product-1

[35.7600,30.2304], //Products-2

[66.0000,50.6400], //Prodcut-3

[164.0000,102.5600]]; //Product-4

secondary\_demand = [

[137.1200,101.4848], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.0502], //Product-1

[35.7600,30.2304,30.0092], //Products-2

[66.0000,50.6400,50.0256], //Prodcut-3

[164.0000,102.5600,100.1024]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 8

primary\_demand = [[101.3600,71.2544,70.0502,70.0020], //Product-1

[35.7600,30.2304,30.0092,30.0004], //Products-2

[66.0000,50.6400,50.0256,50.0010], //Prodcut-3

[164.0000,102.5600,100.1024,100.0041]]; //Product-4

secondary\_demand = [

[137.1200,101.4848,100.0594,100.0024], //Product-5 (Sum of Product-1 & 2)

[101.7600,80.8704,80.0348,80.0014], //Product-6 (Sum of Prodcut-2 & 3)

[230.0000,153.2000,150.1280,150.0051], //Product-7 (Sum of Prodcut-3 & 4)

[137.1200,101.4848,100.0594,100.0024], //Product-8 (equal to Prodcut-5)

[238.8800,182.3552,180.0942,180.0038], //Product-9 (Sum of Prodcut-5 & 6)

[331.7600,234.0704,230.1628,230.0065]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Test Instance-45:** TGS2C5D9 (Test General Setup-Profile\_2 Capacity-Profile\_5 Demand-Series\_9)

**Model–1 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 1;

S = 3;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400], //Product-1

[47.6400], //Products-2

[99.0000], //Prodcut-3

[296.0000]]; //Product-4

secondary\_demand = [

[213.6800], //Product-5 (Sum of Product-1 & 2)

[146.6400], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800], //Product-8 (equal to Prodcut-5)

[360.3200], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–2 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 2;

S = 6;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416], //Product-1

[47.6400,30.7056], //Products-2

[99.0000,51.9600], //Prodcut-3

[296.0000,107.8400]]; //Product-4

secondary\_demand = [

[213.6800,104.5472], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–3 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 3;

S = 9;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537], //Product-1

[47.6400,30.7056,30.0282], //Products-2

[99.0000,51.9600,50.0784], //Prodcut-3

[296.0000,107.8400,100.3136]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];

**Model–4 Data:**

FP = 4;

RP = 10;

J = 10;

L = 3;

T = 4;

S = 12;

allproductsonstage1 = {8,9,10};

allproductsonstage2 = {5,6,7};

allproductsonstage3 = {1,2,3,4};

family1stage1 = {8,9};

family2stage1 = {9,10};

family3stage1 = {10};

family1stage2 = {5};

family2stage2 = {6};

family3stage2 = {7};

family1stage3 = {1,2};

family2stage3 = {2,3};

family3stage3 = {3,4};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

holdingcost = [4,7,6,3,3,3,2,1,1,1];

// Product Demand - Series# 9

primary\_demand = [[166.0400,73.8416,70.1537,70.0061], //Product-1

[47.6400,30.7056,30.0282,30.0011], //Products-2

[99.0000,51.9600,50.0784,50.0031], //Prodcut-3

[296.0000,107.8400,100.3136,100.0125]]; //Product-4

secondary\_demand = [

[213.6800,104.5472,100.1819,100.0073], //Product-5 (Sum of Product-1 & 2)

[146.6400,82.6656,80.1066,80.0043], //Product-6 (Sum of Prodcut-2 & 3)

[395.0000,159.8000,150.3920,150.0157], //Product-7 (Sum of Prodcut-3 & 4)

[213.6800,104.5472,100.1819,100.0073], //Product-8 (equal to Prodcut-5)

[360.3200,187.2128,180.2885,180.0115], //Product-9 (Sum of Prodcut-5 & 6)

[541.6400,242.4656,230.4986,230.0199]]; //Product-10 (Sum of Prodcut-6 & 7)

// Setup Profile - II

setuptime = [10,10,5,5,10,10,15,15,15,15];

setupcost = [35,15,25,50,50,40,75,50,90,115];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [220.0000,457.1429,755.5556];