**Problem – D (General) 🡪 DATA**

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

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 1

primary\_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [247.4227,268.0412,927.8350,2020.6190,2484.5360,2917.5260];

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

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 2

primary\_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],

[21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],

[69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],

[21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [247.4227,268.0412,927.8350,2020.6190,2484.5360,2917.5260];

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

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 3

primary\_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],

[89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [247.4227,268.0412,927.8350,2020.6190,2484.5360,2917.5260];

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

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 4

primary\_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [247.4227,268.0412,927.8350,2020.6190,2484.5360,2917.5260];

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

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 5

primary\_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],

[80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[559.6875,452.468,450.0555,450.0012,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [247.4227,268.0412,927.8350,2020.6190,2484.5360,2917.5260];

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

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 6

primary\_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],

[125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [247.4227,268.0412,927.8350,2020.6190,2484.5360,2917.5260];

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

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 7

primary\_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],

[61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [247.4227,268.0412,927.8350,2020.6190,2484.5360,2917.5260];

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

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 8

primary\_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],

[24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],

[96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [247.4227,268.0412,927.8350,2020.6190,2484.5360,2917.5260];

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

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 9

primary\_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],

[176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-9: Sum of Product-1,2,3,4,5,6 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-10:Sum of Product-1,2,3,4,5,6 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-15:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-16:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-17:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-18:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-19:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-20:Equal to product-11

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-26:Equal to product-17

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-27:Equal to product-18

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-28:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-29:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-30:Equal to product-20

[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-36:Equal to product-26

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-37:Equal to product-27

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-38:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-39:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [247.4227,268.0412,927.8350,2020.6190,2484.5360,2917.5260];

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

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 1

primary\_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [311.6883,337.6624,1168.8310,2545.4550,3129.87,3675.3250];

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

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 2

primary\_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],

[21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],

[69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],

[21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [311.6883,337.6624,1168.8310,2545.4550,3129.87,3675.3250];

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

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 3

primary\_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],

[89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [311.6883,337.6624,1168.8310,2545.4550,3129.87,3675.3250];

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

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 4

primary\_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [311.6883,337.6624,1168.8310,2545.4550,3129.87,3675.3250];

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

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 5

primary\_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],

[80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[559.6875,452.468,450.0555,450.0012,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [311.6883,337.6624,1168.8310,2545.4550,3129.87,3675.3250];

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

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 6

primary\_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],

[125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [311.6883,337.6624,1168.8310,2545.4550,3129.87,3675.3250];

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

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 7

primary\_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],

[61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [311.6883,337.6624,1168.8310,2545.4550,3129.87,3675.3250];

**Test Instance-17:** TGS1C2D8 (Test General Setup-Profile\_1 Capacity-Profile\_2 Demand-Series\_8)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 8

primary\_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],

[24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],

[96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [311.6883,337.6624,1168.8310,2545.4550,3129.87,3675.3250];

**Test Instance-18:** TGS1C2D9 (Test General Setup-Profile\_1 Capacity-Profile\_2 Demand-Series\_9)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 9

primary\_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],

[176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-9: Sum of Product-1,2,3,4,5,6 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-10:Sum of Product-1,2,3,4,5,6 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-15:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-16:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-17:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-18:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-19:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-20:Equal to product-11

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-26:Equal to product-17

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-27:Equal to product-18

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-28:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-29:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-30:Equal to product-20

[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-36:Equal to product-26

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-37:Equal to product-27

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-38:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-39:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [311.6883,337.6624,1168.8310,2545.4550,3129.87,3675.3250];

**Test Instance-19:** TGS1C3D1 (Test General Setup-Profile\_1 Capacity-Profile\_3 Demand-Series\_1)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 1

primary\_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [421.0526,456.1404,1578.9470,3438.5960,4228.0700,4964.9120];

**Test Instance-20:** TGS1C3D2 (Test General Setup-Profile\_1 Capacity-Profile\_3 Demand-Series\_2)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 2

primary\_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],

[21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],

[69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],

[21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [421.0526,456.1404,1578.9470,3438.5960,4228.0700,4964.9120];

**Test Instance-21:** TGS1C3D3 (Test General Setup-Profile\_1 Capacity-Profile\_3 Demand-Series\_3)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 3

primary\_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],

[89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [421.0526,456.1404,1578.9470,3438.5960,4228.0700,4964.9120];

**Test Instance-22:** TGS1C3D4 (Test General Setup-Profile\_1 Capacity-Profile\_3 Demand-Series\_4)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 4

primary\_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [421.0526,456.1404,1578.9470,3438.5960,4228.0700,4964.9120];

**Test Instance-23:** TGS1C3D5 (Test General Setup-Profile\_1 Capacity-Profile\_3 Demand-Series\_5)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 5

primary\_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],

[80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[559.6875,452.468,450.0555,450.0012,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [421.0526,456.1404,1578.9470,3438.5960,4228.0700,4964.9120];

**Test Instance-24:** TGS1C3D6 (Test General Setup-Profile\_1 Capacity-Profile\_3 Demand-Series\_6)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 6

primary\_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],

[125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [421.0526,456.1404,1578.9470,3438.5960,4228.0700,4964.9120];

**Test Instance-25:** TGS1C3D7 (Test General Setup-Profile\_1 Capacity-Profile\_3 Demand-Series\_7)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 7

primary\_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],

[61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [421.0526,456.1404,1578.9470,3438.5960,4228.0700,4964.9120];

**Test Instance-26:** TGS1C3D8 (Test General Setup-Profile\_1 Capacity-Profile\_3 Demand-Series\_8)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 8

primary\_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],

[24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],

[96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [421.0526,456.1404,1578.9470,3438.5960,4228.0700,4964.9120];

**Test Instance-27:** TGS1C3D9 (Test General Setup-Profile\_1 Capacity-Profile\_3 Demand-Series\_9)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 9

primary\_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],

[176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-9: Sum of Product-1,2,3,4,5,6 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-10:Sum of Product-1,2,3,4,5,6 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-15:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-16:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-17:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-18:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-19:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-20:Equal to product-11

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-26:Equal to product-17

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-27:Equal to product-18

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-28:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-29:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-30:Equal to product-20

[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-36:Equal to product-26

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-37:Equal to product-27

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-38:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-39:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [421.0526,456.1404,1578.9470,3438.5960,4228.0700,4964.9120];

**Test Instance-28:** TGS1C4D1 (Test General Setup-Profile\_1 Capacity-Profile\_4 Demand-Series\_1)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 1

primary\_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [247.4227,268.0412,1168.8310,2545.4550,4228.07,4964.912];

**Test Instance-29:** TGS1C4D2 (Test General Setup-Profile\_1 Capacity-Profile\_4 Demand-Series\_2)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 2

primary\_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],

[21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],

[69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],

[21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [247.4227,268.0412,1168.8310,2545.4550,4228.07,4964.912];

**Test Instance-30:** TGS1C4D3 (Test General Setup-Profile\_1 Capacity-Profile\_4 Demand-Series\_3)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 3

primary\_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],

[89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [247.4227,268.0412,1168.8310,2545.4550,4228.07,4964.912];

**Test Instance-31:** TGS1C4D4 (Test General Setup-Profile\_1 Capacity-Profile\_4 Demand-Series\_4)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 4

primary\_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [247.4227,268.0412,1168.8310,2545.4550,4228.07,4964.912];

**Test Instance-32:** TGS1C4D5 (Test General Setup-Profile\_1 Capacity-Profile\_4 Demand-Series\_5)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 5

primary\_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],

[80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[559.6875,452.468,450.0555,450.0012,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [247.4227,268.0412,1168.8310,2545.4550,4228.07,4964.912];

**Test Instance-33:** TGS1C4D6 (Test General Setup-Profile\_1 Capacity-Profile\_4 Demand-Series\_6)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 6

primary\_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],

[125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [247.4227,268.0412,1168.8310,2545.4550,4228.07,4964.912];

**Test Instance-34:** TGS1C4D7 (Test General Setup-Profile\_1 Capacity-Profile\_4 Demand-Series\_7)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 7

primary\_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],

[61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [247.4227,268.0412,1168.8310,2545.4550,4228.07,4964.912];

**Test Instance-35:** TGS1C4D8 (Test General Setup-Profile\_1 Capacity-Profile\_4 Demand-Series\_8)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 8

primary\_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],

[24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],

[96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [247.4227,268.0412,1168.8310,2545.4550,4228.07,4964.912];

**Test Instance-36:** TGS1C3D9 (Test General Setup-Profile\_1 Capacity-Profile\_3 Demand-Series\_9)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 9

primary\_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],

[176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-9: Sum of Product-1,2,3,4,5,6 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-10:Sum of Product-1,2,3,4,5,6 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-15:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-16:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-17:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-18:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-19:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-20:Equal to product-11

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-26:Equal to product-17

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-27:Equal to product-18

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-28:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-29:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-30:Equal to product-20

[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-36:Equal to product-26

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-37:Equal to product-27

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-38:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-39:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [247.4227,268.0412,1168.8310,2545.4550,4228.07,4964.912];

**Test Instance-37:** TGS1C5D1 (Test General Setup-Profile\_1 Capacity-Profile\_5 Demand-Series\_1)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 1

primary\_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [421.0526,456.1404,1168.8310,2545.4550,2484.5360,2917.5260];

**Test Instance-38:** TGS1C5D2 (Test General Setup-Profile\_1 Capacity-Profile\_5 Demand-Series\_2)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 2

primary\_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],

[21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],

[69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],

[21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [421.0526,456.1404,1168.8310,2545.4550,2484.5360,2917.5260];

**Test Instance-39:** TGS1C5D3 (Test General Setup-Profile\_1 Capacity-Profile\_5 Demand-Series\_3)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 3

primary\_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],

[89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [421.0526,456.1404,1168.8310,2545.4550,2484.5360,2917.5260];

**Test Instance-40:** TGS1C5D4 (Test General Setup-Profile\_1 Capacity-Profile\_5 Demand-Series\_4)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 4

primary\_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [421.0526,456.1404,1168.8310,2545.4550,2484.5360,2917.5260];

**Test Instance-41:** TGS1C5D5 (Test General Setup-Profile\_1 Capacity-Profile\_5 Demand-Series\_5)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 5

primary\_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],

[80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[559.6875,452.468,450.0555,450.0012,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [421.0526,456.1404,1168.8310,2545.4550,2484.5360,2917.5260];

**Test Instance-42:** TGS1C5D6 (Test General Setup-Profile\_1 Capacity-Profile\_5 Demand-Series\_6)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 6

primary\_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],

[125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [421.0526,456.1404,1168.8310,2545.4550,2484.5360,2917.5260];

**Test Instance-43:** TGS1C5D7 (Test General Setup-Profile\_1 Capacity-Profile\_5 Demand-Series\_7)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 7

primary\_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],

[61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [421.0526,456.1404,1168.8310,2545.4550,2484.5360,2917.5260];

**Test Instance-44:** TGS1C5D8 (Test General Setup-Profile\_1 Capacity-Profile\_5 Demand-Series\_8)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 8

primary\_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],

[24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],

[96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [421.0526,456.1404,1168.8310,2545.4550,2484.5360,2917.5260];

**Test Instance-45:** TGS1C5D9 (Test General Setup-Profile\_1 Capacity-Profile\_5 Demand-Series\_9)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 9

primary\_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],

[176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-9: Sum of Product-1,2,3,4,5,6 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-10:Sum of Product-1,2,3,4,5,6 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-15:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-16:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-17:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-18:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-19:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-20:Equal to product-11

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-26:Equal to product-17

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-27:Equal to product-18

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-28:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-29:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-30:Equal to product-20

[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-36:Equal to product-26

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-37:Equal to product-27

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-38:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-39:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300]]; // P-40:Equal to product-29

// Setup Profile - I

setuptime = [25,25,25,25,25,25,25,25,25,25,20,20,20,20,20,20,20,20,20,20,15,15,15,15,15,15,15,15,15,15,10,10,10,10,10,10,10,10,10,10];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [421.0526,456.1404,1168.8310,2545.4550,2484.5360,2917.5260];

**SETUP-II (Profile)**

**Test Instance-1:** TGS2C1D1 (Test General Setup-Profile\_2 Capacity-Profile\_1 Demand-Series\_1)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 1

primary\_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [154.6392,175.2577,804.1237,1927.8350,2567.01,3237.1130];

**Test Instance-2:** TGS2C1D2 (Test General Setup-Profile\_2 Capacity-Profile\_1 Demand-Series\_2)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 2

primary\_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],

[21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],

[69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],

[21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [154.6392,175.2577,804.1237,1927.8350,2567.01,3237.1130];

**Test Instance-3:** TGS2C1D3 (Test General Setup-Profile\_2 Capacity-Profile\_1 Demand-Series\_3)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 3

primary\_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],

[89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [154.6392,175.2577,804.1237,1927.8350,2567.01,3237.1130];

**Test Instance-4:** TGS2C1D4 (Test General Setup-Profile\_2 Capacity-Profile\_1 Demand-Series\_4)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 4

primary\_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [154.6392,175.2577,804.1237,1927.8350,2567.01,3237.1130];

**Test Instance-5:** TGS2C1D5 (Test General Setup-Profile\_2 Capacity-Profile\_1 Demand-Series\_5)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 5

primary\_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],

[80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[559.6875,452.468,450.0555,450.0012,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [154.6392,175.2577,804.1237,1927.8350,2567.01,3237.1130];

**Test Instance-6:** TGS2C1D6 (Test General Setup-Profile\_2 Capacity-Profile\_1 Demand-Series\_6)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 6

primary\_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],

[125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [154.6392,175.2577,804.1237,1927.8350,2567.01,3237.1130];

**Test Instance-7:** TGS2C1D7 (Test General Setup-Profile\_2 Capacity-Profile\_1 Demand-Series\_7)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 7

primary\_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],

[61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [154.6392,175.2577,804.1237,1927.8350,2567.01,3237.1130];

**Test Instance-8:** TGS2C1D8 (Test General Setup-Profile\_2 Capacity-Profile\_1 Demand-Series\_8)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 8

primary\_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],

[24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],

[96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [154.6392,175.2577,804.1237,1927.8350,2567.01,3237.1130];

**Test Instance-9:** TGS2C1D9 (Test General Setup-Profile\_2 Capacity-Profile\_1 Demand-Series\_9)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 9

primary\_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],

[176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-9: Sum of Product-1,2,3,4,5,6 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-10:Sum of Product-1,2,3,4,5,6 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-15:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-16:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-17:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-18:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-19:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-20:Equal to product-11

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-26:Equal to product-17

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-27:Equal to product-18

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-28:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-29:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-30:Equal to product-20

[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-36:Equal to product-26

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-37:Equal to product-27

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-38:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-39:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - I (90%)

productstagecapacity = [154.6392,175.2577,804.1237,1927.8350,2567.01,3237.1130];

**Test Instance-10:** TGS2C2D1 (Test General Setup-Profile\_2 Capacity-Profile\_2 Demand-Series\_1)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 1

primary\_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [194.8052,220.7792,1012.9870,2428.5720,3233.7660,4077.9220];

**Test Instance-11:** TGS2C2D2 (Test General Setup-Profile\_2 Capacity-Profile\_2 Demand-Series\_2)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 2

primary\_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],

[21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],

[69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],

[21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [194.8052,220.7792,1012.9870,2428.5720,3233.7660,4077.9220];

**Test Instance-12:** TGS2C2D3 (Test General Setup-Profile\_2 Capacity-Profile\_2 Demand-Series\_3)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 3

primary\_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],

[89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [194.8052,220.7792,1012.9870,2428.5720,3233.7660,4077.9220];

**Test Instance-13:** TGS2C2D4 (Test General Setup-Profile\_2 Capacity-Profile\_2 Demand-Series\_4)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 4

primary\_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [194.8052,220.7792,1012.9870,2428.5720,3233.7660,4077.9220];

**Test Instance-14:** TGS2C2D5 (Test General Setup-Profile\_2 Capacity-Profile\_2 Demand-Series\_5)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 5

primary\_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],

[80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[559.6875,452.468,450.0555,450.0012,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [194.8052,220.7792,1012.9870,2428.5720,3233.7660,4077.9220];

**Test Instance-15:** TGS2C2D6 (Test General Setup-Profile\_2 Capacity-Profile\_2 Demand-Series\_6)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 6

primary\_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],

[125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [194.8052,220.7792,1012.9870,2428.5720,3233.7660,4077.9220];

**Test Instance-16:** TGS2C2D7 (Test General Setup-Profile\_2 Capacity-Profile\_2 Demand-Series\_7)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 7

primary\_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],

[61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [194.8052,220.7792,1012.9870,2428.5720,3233.7660,4077.9220];

**Test Instance-17:** TGS2C2D8 (Test General Setup-Profile\_2 Capacity-Profile\_2 Demand-Series\_8)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 8

primary\_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],

[24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],

[96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [194.8052,220.7792,1012.9870,2428.5720,3233.7660,4077.9220];

**Test Instance-18:** TGS2C2D9 (Test General Setup-Profile\_2 Capacity-Profile\_2 Demand-Series\_9)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 9

primary\_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],

[176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-9: Sum of Product-1,2,3,4,5,6 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-10:Sum of Product-1,2,3,4,5,6 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-15:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-16:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-17:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-18:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-19:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-20:Equal to product-11

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-26:Equal to product-17

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-27:Equal to product-18

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-28:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-29:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-30:Equal to product-20

[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-36:Equal to product-26

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-37:Equal to product-27

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-38:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-39:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - II (70%)

productstagecapacity = [194.8052,220.7792,1012.9870,2428.5720,3233.7660,4077.9220];

**Test Instance-19:** TGS2C3D1 (Test General Setup-Profile\_2 Capacity-Profile\_3 Demand-Series\_1)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 1

primary\_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [263.1579,298.2456,1368.4210,3280.7020,4368.4210,5508.7720];

**Test Instance-20:** TGS2C3D2 (Test General Setup-Profile\_2 Capacity-Profile\_3 Demand-Series\_2)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 2

primary\_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],

[21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],

[69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],

[21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [263.1579,298.2456,1368.4210,3280.7020,4368.4210,5508.7720];

**Test Instance-21:** TGS2C3D3 (Test General Setup-Profile\_2 Capacity-Profile\_3 Demand-Series\_3)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 3

primary\_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],

[89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [263.1579,298.2456,1368.4210,3280.7020,4368.4210,5508.7720];

**Test Instance-22:** TGS2C3D4 (Test General Setup-Profile\_2 Capacity-Profile\_3 Demand-Series\_4)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 4

primary\_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [263.1579,298.2456,1368.4210,3280.7020,4368.4210,5508.7720];

**Test Instance-23:** TGS2C3D5 (Test General Setup-Profile\_2 Capacity-Profile\_3 Demand-Series\_5)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 5

primary\_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],

[80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[559.6875,452.468,450.0555,450.0012,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [263.1579,298.2456,1368.4210,3280.7020,4368.4210,5508.7720];

**Test Instance-24:** TGS2C3D6 (Test General Setup-Profile\_2 Capacity-Profile\_3 Demand-Series\_6)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 6

primary\_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],

[125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [263.1579,298.2456,1368.4210,3280.7020,4368.4210,5508.7720];

**Test Instance-25:** TGS2C3D7 (Test General Setup-Profile\_2 Capacity-Profile\_3 Demand-Series\_7)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 7

primary\_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],

[61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [263.1579,298.2456,1368.4210,3280.7020,4368.4210,5508.7720];

**Test Instance-26:** TGS2C3D8 (Test General Setup-Profile\_2 Capacity-Profile\_3 Demand-Series\_8)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 8

primary\_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],

[24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],

[96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [263.1579,298.2456,1368.4210,3280.7020,4368.4210,5508.7720];

**Test Instance-27:** TGS2C3D9 (Test General Setup-Profile\_2 Capacity-Profile\_3 Demand-Series\_9)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 9

primary\_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],

[176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-9: Sum of Product-1,2,3,4,5,6 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-10:Sum of Product-1,2,3,4,5,6 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-15:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-16:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-17:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-18:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-19:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-20:Equal to product-11

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-26:Equal to product-17

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-27:Equal to product-18

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-28:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-29:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-30:Equal to product-20

[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-36:Equal to product-26

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-37:Equal to product-27

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-38:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-39:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - III (50%)

productstagecapacity = [263.1579,298.2456,1368.4210,3280.7020,4368.4210,5508.7720];

**Test Instance-28:** TGS2C4D1 (Test General Setup-Profile\_2 Capacity-Profile\_4 Demand-Series\_1)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 1

primary\_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [154.6392,175.2577,1012.9870,2428.5720,4368.4210,5508.7720];

**Test Instance-29:** TGS2C4D2 (Test General Setup-Profile\_2 Capacity-Profile\_4 Demand-Series\_2)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 2

primary\_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],

[21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],

[69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],

[21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [154.6392,175.2577,1012.9870,2428.5720,4368.4210,5508.7720];

**Test Instance-30:** TGS2C4D3 (Test General Setup-Profile\_2 Capacity-Profile\_4 Demand-Series\_3)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 3

primary\_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],

[89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [154.6392,175.2577,1012.9870,2428.5720,4368.4210,5508.7720];

**Test Instance-31:** TGS2C4D4 (Test General Setup-Profile\_2 Capacity-Profile\_4 Demand-Series\_4)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 4

primary\_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [154.6392,175.2577,1012.9870,2428.5720,4368.4210,5508.7720];

**Test Instance-32:** TGS2C4D5 (Test General Setup-Profile\_2 Capacity-Profile\_4 Demand-Series\_5)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 5

primary\_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],

[80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[559.6875,452.468,450.0555,450.0012,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [154.6392,175.2577,1012.9870,2428.5720,4368.4210,5508.7720];

**Test Instance-33:** TGS2C4D6 (Test General Setup-Profile\_2 Capacity-Profile\_4 Demand-Series\_6)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 6

primary\_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],

[125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [154.6392,175.2577,1012.9870,2428.5720,4368.4210,5508.7720];

**Test Instance-34:** TGS2C4D7 (Test General Setup-Profile\_2 Capacity-Profile\_4 Demand-Series\_7)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 7

primary\_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],

[61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [154.6392,175.2577,1012.9870,2428.5720,4368.4210,5508.7720];

**Test Instance-35:** TGS2C4D8 (Test General Setup-Profile\_2 Capacity-Profile\_4 Demand-Series\_8)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 8

primary\_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],

[24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],

[96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [154.6392,175.2577,1012.9870,2428.5720,4368.4210,5508.7720];

**Test Instance-36:** TGS2C3D9 (Test General Setup-Profile\_2 Capacity-Profile\_3 Demand-Series\_9)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 9

primary\_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],

[176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-9: Sum of Product-1,2,3,4,5,6 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-10:Sum of Product-1,2,3,4,5,6 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-15:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-16:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-17:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-18:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-19:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-20:Equal to product-11

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-26:Equal to product-17

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-27:Equal to product-18

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-28:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-29:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-30:Equal to product-20

[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-36:Equal to product-26

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-37:Equal to product-27

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-38:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-39:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - IV (90%, 70%, 50%)

productstagecapacity = [154.6392,175.2577,1012.9870,2428.5720,4368.4210,5508.7720];

**Test Instance-37:** TGS2C5D1 (Test General Setup-Profile\_2 Capacity-Profile\_5 Demand-Series\_1)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 1

primary\_demand = [[40.1600,40.0016,40,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.3600,60.0036,60,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.0400,20.0004,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.0900,30.0009,30,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-7: Sum of Product-1,2,3,4 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-8: Sum of Product-1,2,3,4 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-21:Sum of product-11 & 12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-25:Sum of product-15 & 16

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[451.9500,450.0195,450.0003,450,450,450,450,450,450,450,450,450,450,450,450,450], // P-31:Sum of product-21 & 22

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[301.3000,300.0130,300.0002,300,300,300,300,300,300,300,300,300,300,300,300,300], // P-33:Sum of product-23 & 24

[150.6500,150.0065,150.0001,150,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[401.5600,400.0156,400.0002,400,400,400,400,400,400,400,400,400,400,400,400,400], // P-35:Equal to product-25

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[200.7800,200.0078,200.0001,200,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [263.1579,298.2456,1012.9870,2428.5720,2567.0100,3237.1130];

**Test Instance-38:** TGS2C4D2 (Test General Setup-Profile\_2 Capacity-Profile\_4 Demand-Series\_2)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 2

primary\_demand = [[44.0000,40.0400,40.0004,40,40,40,40,40,40,40,40,40,40,40,40,40],

[21.0000,20.0100,20.001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30],

[69.0000,60.0900,60.0009,60,60,60,60,60,60,60,60,60,60,60,60,60],

[21.0000,20.0100,20.0001,20,20,20,20,20,20,20,20,20,20,20,20,20],

[32.2500,30.0225,30.0002,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[498.75, 450.4875, 450.0049, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[332.5,300.325,300.0033,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[166.2500,150.1625,150.0016,150,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[439,400.39,400.0039,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[219.5000,200.1950,200.0020,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [263.1579,298.2456,1012.9870,2428.5720,2567.0100,3237.1130];

**Test Instance-39:** TGS2C5D3 (Test General Setup-Profile\_2 Capacity-Profile\_5 Demand-Series\_3)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 3

primary\_demand = [[52.96,40.1296,40.0013,40,40,40,40,40,40,40,40,40,40,40,40,40],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30],

[89.16,60.2916,60.0029,60,60,60,60,60,60,60,60,60,60,60,60,60],

[23.24,20.0324,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20]

[37.29,30.0729,30.0007,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[607.95,451.5795,450.0158,450.0002,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[405.3,301.053,300.0105,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[202.65,150.5265,150.0053,150.0001,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[526.36,401.2636,400.0126,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[263.18,200.6318,200.0063,200.0001,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [263.1579,298.2456,1012.9870,2428.5720,2567.0100,3237.1130];

**Test Instance-40:** TGS2C5D4 (Test General Setup-Profile\_2 Capacity-Profile\_5 Demand-Series\_4)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 4

primary\_demand = [[40.36,40.0081,40.0002,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30],

[60.81,60.0182,60.0004,60,60,60,60,60,60,60,60,60,60,60,60,60],

[20.09,20.002,20,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.2025,30.0046,30.0001,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[454.3875,450.0987,450.0022,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[302.925,300.0658,300.0015,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[151.4625,150.0329,150.0007,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[403.51,400.079,400.0018,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[201.7550,200.0395,200.0009,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]];// P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [263.1579,298.2456,1012.9870,2428.5720,2567.0100,3237.1130];

**Test Instance-41:** TGS2C5D5 (Test General Setup-Profile\_2 Capacity-Profile\_5 Demand-Series\_5)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 5

primary\_demand = [[49,40.2025,40.0046,40.0001,40,40,40,40,40,40,40,40,40,40,40,40],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30],

[80.25,60.4556,60.0103,60.0002,60,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[35.0625,30.1139,30.0026,30.0001,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-9: Sum of Product-1,2,3,4,5,6 demands

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200],//P-10:Sum of Product-1,2,3,4,5,6 demands

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[559.6875,452.468,450.0555,450.0012,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[373.125,301.6453,300.037,300.0008,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[186.5625,150.8227,150.0185,150.0004,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[487.75,401.9744,400.0444,400.001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[243.875,200.9872,200.0222,200.0005,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [263.1579,298.2456,1012.9870,2428.5720,2567.0100,3237.1130];

**Test Instance-42:** TGS2C5D6 (Test General Setup-Profile\_2 Capacity-Profile\_5 Demand-Series\_6)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 6

primary\_demand = [[69.16,40.6561,40.0148,40.0003,40,40,40,40,40,40,40,40,40,40,40,40],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30],

[125.61,61.4762,60.0332,60.0007,60,60,60,60,60,60,60,60,60,60,60,60],

[27.29,20.164,20.0037,20.0001,20,20,20,20,20,20,20,20,20,20,20,20],

[46.4025,30.3691,30.0083,30.0002,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-7: Sum of Product-1,2,3,4 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150],// P-8: Sum of Product-1,2,3,4 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-9: Sum of Product-1,2,3,4,5,6 demands

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200],// P-10:Sum of Product-1,2,3,4,5,6 demands

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-11:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-12:Equal to product-7

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-13:Equal to product-8

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-14:Equal to product-8

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-15:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-16:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-17:Equal to product-9

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-18:Equal to product-10

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-19:Equal to product-10

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-20:Equal to product-11

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-22:Equal to product-12

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-23:Equal to product-13

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-24:Equal to product-14

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-26:Equal to product-17

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-27:Equal to product-18

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-28:Equal to product-19

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-29:Equal to product-19

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-30:Equal to product-20

[805.3875,457.9962,450.1799,450.004,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-32:Equal to product-23

[536.925,305.3308,300.1199,300.0027,300.0001,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[268.4625,152.6654,150.06,150.0013,150,150,150,150,150,150,150,150,150,150,150,150], // P-34:Equal to product-24

[684.31,406.397,400.1439,400.0032,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-36:Equal to product-26

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-37:Equal to product-27

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-38:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200], // P-39:Equal to product-28

[342.155,203.1985,200.072,200.0016,200,200,200,200,200,200,200,200,200,200,200,200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [263.1579,298.2456,1012.9870,2428.5720,2567.0100,3237.1130];

**Test Instance-43:** TGS2C5D7 (Test General Setup-Profile\_2 Capacity-Profile\_5 Demand-Series\_7)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 7

primary\_demand = [[40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40,40],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30],

[61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60,60],

[20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20,20],

[30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[406.24,400.2496,400.01,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[203.12,200.1248,200.005,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [263.1579,298.2456,1012.9870,2428.5720,2567.0100,3237.1130];

**Test Instance-44:** TGS2C5D8 (Test General Setup-Profile\_2 Capacity-Profile\_5 Demand-Series\_8)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 8

primary\_demand = [[56,40.64,40.0256,40.001,40,40,40,40,40,40,40,40,40,40,40,40],

[24,20.16,20.0064,20.0003,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30],

[96,61.44,60.0576,60.0023,60.0001,60,60,60,60,60,60,60,60,60,60,60],

[22.25,20.0506,20.0011,20,20,20,20,20,20,20,20,20,20,20,20,20],

[39,30.36,30.0144,30.0006,30,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-9: Sum of Product-1,2,3,4,5,6 demands

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-10:Sum of Product-1,2,3,4,5,6 demands

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-15:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-16:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-17:Equal to product-9

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-18:Equal to product-10

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-19:Equal to product-10

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-20:Equal to product-11

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-26:Equal to product-17

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-27:Equal to product-18

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-28:Equal to product-19

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-29:Equal to product-19

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-30:Equal to product-20

[645,457.8,450.312,450.0125,450.0005,450, 450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[430,305.2,300.208,300.0083,300.0003,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[215,152.6,150.104,150.0042,150.0002,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[552.5,406.0213,400.2391,400.0095,400.0004,400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-36:Equal to product-26

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-37:Equal to product-27

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-38:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200], // P-39:Equal to product-28

[276.25,203.0106,200.1195,200.0048,200.0002,200, 200, 200, 200, 200, 200, 200, 200, 200, 200, 200]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [263.1579,298.2456,1012.9870,2428.5720,2567.0100,3237.1130];

**Test Instance-45:** TGS2C5D9 (Test General Setup-Profile\_2 Capacity-Profile\_5 Demand-Series\_9)

FP = 6;

RP = 40;

J = 40;

L = 6;

T = 16;

S = 48;

allproductsonstage1 = {30,31,32,33,34,35,36,37,38,39,40};

allproductsonstage2 = {20,21,22,23,24,25,26,27,28,29};

allproductsonstage3 = {11,12,13,14,15,16,17,18,19};

allproductsonstage4 = {7,8,9,10};

allproductsonstage5\_1 = {1,2,3};

allproductsonstage5\_2 = {4,5,6};

family1stage1 = {30};

family2stage1 = {31};

family3stage1 = {32,33};

family4stage1 = {33,34};

family5stage1 = {35};

family6stage1 = {36};

family7stage1 = {37};

family8stage1 = {38,39};

family9stage1 = {40};

family1stage2 = {20};

family2stage2 = {21,22};

family3stage2 = {23};

family4stage2 = {24};

family5stage2 = {25};

family6stage2 = {26};

family7stage2 = {27};

family8stage2 = {28};

family9stage2 = {29};

family10stage2 = {20,21};

family11stage2 = {21,22};

family12stage2 = {28,29};

family1stage3 = {11};

family2stage3 = {12};

family3stage3 = {13};

family4stage3 = {14};

family5stage3 = {15,16};

family6stage3 = {17};

family7stage3 = {18};

family8stage3 = {19};

family9stage3 = {11,12};

family10stage3 = {13,14};

family11stage3 = {15,16,17};

family12stage3 = {18,19};

family1stage4 = {7};

family2stage4 = {8};

family3stage4 = {9};

family4stage4 = {10};

family5stage4 = {7,8,9,10};

family6stage4 = {9,10};

family1stage5\_1 = {1,2,3};

family1stage5\_2 = {4};

family2stage5\_2 = {5,6};

microperiods1tomacroperiod = {1,2,3};

microperiods2tomacroperiod = {4,5,6};

microperiods3tomacroperiod = {7,8,9};

microperiods4tomacroperiod = {10,11,12};

microperiods5tomacroperiod = {13,14,15};

microperiods6tomacroperiod = {16,17,18};

microperiods7tomacroperiod = {19,20,21};

microperiods8tomacroperiod = {22,23,24};

microperiods9tomacroperiod = {25,26,27};

microperiods10tomacroperiod = {28,29,30};

microperiods11tomacroperiod = {31,32,33};

microperiods12tomacroperiod = {34,35,36};

microperiods13tomacroperiod = {37,38,39};

microperiods14tomacroperiod = {40,41,42};

microperiods15tomacroperiod = {43,44,45};

microperiods16tomacroperiod = {46,47,48};

min\_lotsize = 1;

production\_cost = 1;

production\_time = 1;

standby\_cost = 1;

BOM = 1;

BigM = 10000;

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

//Product Demand - Series# 9

primary\_demand = [[91.84,42.0736,40.0829,40.0033,40.0001,40,40,40,40,40,40,40,40,40,40,40],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30],

[176.64,64.6656,60.1866,60.0075,60.0003,60,60,60,60,60,60,60,60,60,60,60],

[32.96,20.5184,20.0207,20.0008,20,20,20,20,20,20,20,20,20,20,20,20],

[59.16,31.1664,30.0467,30.0019,30.0001,30,30,30,30,30,30,30,30,30,30,30]];

secondary\_demand = [

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-7: Sum of Product-1,2,3,4 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-8: Sum of Product-1,2,3,4 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-9: Sum of Product-1,2,3,4,5,6 demands

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-10:Sum of Product-1,2,3,4,5,6 demands

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-11:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-12:Equal to product-7

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-13:Equal to product-8

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-14:Equal to product-8

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-15:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-16:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-17:Equal to product-9

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-18:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-19:Equal to product-10

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-20:Equal to product-11

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-21:Sum of product-11 & 12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-22:Equal to product-12

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-23:Equal to product-13

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-24:Equal to product-14

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-25:Sum of product-15 & 16

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-26:Equal to product-17

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-27:Equal to product-18

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-28:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-29:Equal to product-19

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-30:Equal to product-20

[1081.8,475.272,451.0109,450.0404,450.0016,450.0001,450, 450, 450, 450, 450, 450, 450, 450, 450, 450], // P-31:Sum of product-21 & 22

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-32:Equal to product-23

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-33:Sum of product-23 & 24

[360.6,158.424,150.337,150.0135,150.0005,150, 150, 150, 150, 150, 150, 150, 150, 150, 150, 150], // P-34:Equal to product-24

[905.44,420.2176,400.8087,400.0323,400.0013,400.0001,400, 400, 400, 400, 400, 400, 400, 400, 400, 400], // P-35:Equal to product-25

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-36:Equal to product-26

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-37:Equal to product-27

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-38:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300], // P-39:Equal to product-28

[721.2,316.848,300.6739,300.027,300.0011,300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300]]; // P-40:Equal to product-29

// Setup Profile - II

setuptime = [50,50,50,50,50,50,50,50,50,50,40,40,40,40,40,40,40,40,40,40,30,30,30,30,30,30,30,30,30,30,20,20,20,20,20,20,20,20,20,20];

setupcost = [20,10,15,30,10,15,75,75,100,100,75,75,75,75,100,100,100,100,100,75,150,75,75,75,200,100,100,100,100,75,225,75,150,75,200,100,100,100,100,100];

// Capacity Utilization Profile - V (50%, 70%, 90%)

productstagecapacity = [263.1579,298.2456,1012.9870,2428.5720,2567.0100,3237.1130];