```
from gurobipy import *

#--------------------------------------------------------------------------------------------#
#Sets
d_c=["DO","D1","D2"] # Set for Distribution Centers
s_m=["SO","S1","S2","S3","S4","S5","S6","S7","S8","S9"] #Set for SuperMarket

#--------------------------------------------------------------------------------------------#
#Data

# Cost of transportation of one truckload from each distribution centre to each store
cost=[
      [1938,1424,1407,918,2140,1421,1876,1194,1459,900],
      [1801,1843,1898,1613,919,912,1063,1553,1453,2220],
      [3074,2575,857,2171,2800,1942,,2699,1223,2525,2038]
      ]


# Districution centre capacity  - the maximum capacity of distributon system.
dc_capacity= [28,58,66]

# Weekly demand at the store, including the surges
sm_demand=[
        [8, 12, 12,18, 7, 8, 9, 10, 8, 18],
        [8, 12, 12, 18, 7, 8, 9, 14, 8, 21],
        [8, 12, 12, 18, 7, 8, 9, 10, 8, 18],
        [8, 12, 14, 18, 7, 8, 31, 17, 8, 18],
        [33, 12, 12, 18, 7, 8, 9, 15, 8, 18],
        [8, 12, 12, 18, 7, 8, 31, 11, 8, 18]
]

d_capacity_max = 75

# Specifying the lenghts of the above arrays
S_C = range(len(sm_demand))
S = range(len(s_m))
D = range(len(d_c))

#--------------------------------------------------------------------------------------------#
# Initialising the model
m = Model("logistics")
```

Sets:

- d_c :Set of distribution centers
- s_m :Set of supermarkets
- s_c :Set of scenarios

Data:

- $cost_{dc\ sm}$:Cost to supply to supermarket $sm \in$ s_m from distribution center $dc \in$ d_c
- $dc\_capacity_{dc}$:Capacity of distribution center $dc \in$ d_c
- $sm\_demand_{sc\ sm}$:Demand of each supermarket $sm \in$ s_m in each scenario $sc \in$ s_c
- $d\_capacity\_max$:Maximum available capacity in DC_0 and DC_1

Variables:

- $X_{dc\ sm}$ Proportion of contribution from distribution center $dc \in$ d_c for the supermarket sm

Objective Function:

$$\min \sum_{sm \in s\_m} \sum_{dc \in d\_c} X_{dc\ sm} * cost_{dc\ sm}$$

Constraints:

1. The sum of the contribution proportion from all distribution center for each supermarket should not be greater than 1. For all the scenarios, this constrain will be constant because we are using proportions.

$$\sum_{dc \in d\_c} X_{dc\ sm} == 1 \qquad \forall sm \in s\_m$$

2. The total quantity sent out from each distribution center for all supermarkets in each scenario is less than distribution center capacity.

$$\sum_{sm \in s_m} X_{dc\ sm} * sm_{demand\ sc\ sm} \leq . dc_{capacity\ dc}$$

$$\forall sc \in s\_c \qquad \forall cd \in d\_c$$

3. The total quantity sent out from distribution centres DC0 and DC1 for all supermarkets in each scenario is less than 100 which is the labour capacity.

$$\sum_{dc \in \{DC_0, DC_1\}} \sum_{sm \in s\_m} X_{dc\ sc} * sm_{demand\ sc\ sm} \leq d\_capacity\_max \qquad \forall sc \in s\_c$$

```python
# Declaring variables for the model
X={}
for d in D:
    for s in S:
        X[d,s]=m.addVar()
#------------------------------------------------------------------------------------------#
# Objective Function
# Setting up the objective function of the model- Proportion of contribution of each distribution center for a shopping market
m.setObjective(quicksum(X[d,s]*cost[d][s] for d in D for s in S),GRB.MINIMIZE)

#------------------------------------------------------------------------------------------#
# Adding Constraints

# The sum of proportion for every distribution = 1
sm_demand_constrain={}
for s in S:
  sm_demand_constrain[s]=m.addConstr((quicksum(X[d,s] for d in D))==1)

# Total capacity of the distributiuon centres should be maintained for each senario
cap_c={}
for s_c in S_C:
    for d in D:
        cap_c[d]=m.addConstr(quicksum(X[d,s]*sm_demand[s_c][s] for s in S)<=dc_capacity[d])

# Constrians on D0 + D1 = 75 should be maintained for each senario
for s_c in S_C:
    labour=m.addConstr(quicksum((X[0,s]*sm_demand[s_c][s])+(X[1,s]*sm_demand[s_c][s]) for s in S ) <=d_capacity_max)

m.optimize()
```

Sets:

d_c :Set of distribution centers

s_m :Set of supermarkets

s_c :Set of scenarios

Data:

$cost_{dc\ sm}$:Cost to supply to supermarket $sm \in$ s_m from distribution center $dc \in$ d_c

$dc\_capacity_{dc}$:Capacity of distribution center $dc \in$ d_c

$sm\_demand_{sc\ sm}$:Demand of each supermarket $sm \in$ s_m in each scenario $sc \in$ s_c

$d\_capacity\_max$:Maximum available capacity in DC_0 and DC_1

Variables:

$X_{dc\ sm}$:Proportion of contribution from distribution center $dc \in$ d_c for the supermarket sm

Objective Function:

$$min \sum_{sm\ \in s\_m} \sum_{dc\ \in d\_c} X_{dc\ sm} * cost_{dc\ sm}$$

Constraints:

1. The sum of the contribution proportion from all distribution center for each supermarket should not be greater than 1. For all the scenarios, this constrain will be constant because we are using proportions.

$$\sum\nolimits_{dc\ \in d\_c} X_{dc\ sm} == 1 \qquad \forall sm\ \in s\_m$$

2. The total quantity sent out from each distribution center for all supermarkets in each scenario is less than distribution center capacity.

$$\sum_{sm\ \in s_m} X_{dc\ sm} * sm_{demand_{sc\ sm}} \leq . dc_{capacity_{dc}}$$

$$\forall sc\ \in s\_c \qquad \forall cd\ \in d\_c$$

3. The total quantity sent out from distribution centres DC0 and DC1 for all supermarkets in each scenario is less than 100 which is the labour capacity.

$$\sum_{dc\ \in\{DC_0, DC_1\}} \sum_{sm\ \in\ s\_m} X_{dc\ sc} * sm_{demand_{sc\ sm}} \leq d\_capacity\_\max \qquad \forall sc\ \in s\_c$$