REPORT TO BOSS

(Xinqian Wang s4565489)

Formulation

SETS

S sets of Scenarios

D sets of target islands DDP

F sets of teansfer islands FSD

DATA

Demand_d	d∈D	the demend goods(t) for island
DF_{fd}	f∈F d∈D	the price of transportation from DDP to FSD
FC_f	f∈F	the price of transportation from CDRD to FSD
Cost		the price of goods
$\mathrm{ScenarioRate}_s$	s∈S	the probability of scenarios happenning
$\mathrm{FSDaffected}_{sf}$	s∈S f∈F	the conditions of the FSD if it can be used

VARUABLE

$$\mathrm{X}_{fd} \quad \text{f∈F d∈D}$$

OBJECTIVE FUNCTIONS

$$\text{Minimize } (\sum_{\text{f∈F,d∈D}} \mathrm{X}_{fd} * (Cost + \mathrm{FC}_f) +$$

$$\sum_{\text{s∈S,f∈F,d∈D}} \mathrm{ScenarioRate}_s * \mathrm{X}_{fd} * \mathrm{FSDaffected}_{sf} * \mathrm{DF}_{fd})$$

CONSTRAINS

$$\sum_{\text{s∈S,f∈F,d∈D}} \mathrm{X}_{fd} * \mathrm{FSDaffected}_{sf} \geq \mathrm{Demand}_d$$

$$\sum_{\text{s∈S,f∈F,d∈D}} \mathrm{X}_{fd} * \mathrm{FSDaffected}_{sf} \leq 820$$

$$\sum_{\text{s∈S,f∈F,d∈D}} 2 * \mathrm{X}_{fd} * \mathrm{FSDaffected}_{sf} \leq \mathrm{Demand}_d$$

$$\mathrm{X}_{fd} \geq 0$$

Code

Can be found in the python file.

The answer of 1-4 communications are [425868, 425949, 436338, 611988]

REPORT TO CLIENT

Communication-1

Goods(t) the client should move from **CDRD** to **FSD**:

FSD0	FSD1	FSD2	FSD3	FSD4
0	0	676	235	901

Goods(t) the client should move from **FSD** to DDP:

	FSD0	FSD1	FSD2	FSD3	FSD4
DDP0	0	0	0	235	0
DDP1	0	0	184	0	0
DDP2	0	0	275	0	0
DDP3	0	0	217	0	0
DDP4	0	0	0	0	169
DDP5	0	0	0	0	202
DDP6	0	0	0	0	128
DDP7	0	0	0	0	128
DDP8	0	0	0	0	110
DDP9	0	0	0	0	164

We should buy 1812 t goods and spend $425868 as the total cost. For the constrains we find that dual values of the constrains are great than 0 which means they are all binding, so the slack value must be all 0. The plan perfactly meet all the demands and uses the cheapest way.

Communication-2

Goods(t) the client should move from **CDRD** to **FSD**:

FSD0	FSD1	FSD2	FSD3	FSD4
0	0	757	235	820

Goods(t) the client should move from **FSD** to DDP:

	FSD0	FSD1	FSD2	FSD3	FSD4
DDP0	0	0	0	235	0
DDP1	0	0	184	0	0
DDP2	0	0	275	0	0
DDP3	0	0	217	0	0
DDP4	0	0	0	0	169
DDP5	0	0	81	0	121
DDP6	0	0	0	0	128
DDP7	0	0	0	0	128
DDP8	0	0	0	0	110
DDP9	0	0	0	0	164

We should buy 1812 t goods and spend $425949 as the total cost. Because of the new constrain, the plan needs to be revised, especially for FSD4 which is great than the new constrain, the limit capacity of 820 t goods. The plan is to assign DDP5's 81 t goods to FSD2.

Communication-3

Goods(t) the client should move from **CDRD** to **FSD**:

FSD0	FSD1	FSD2	FSD3	FSD4
0.0	86.0	706.5	199.5	820.0

Goods(t) the client should move from **FSD** to DDP:

	FSD0	FSD1	FSD2	FSD3	FSD4
DDP0	0.0	0.0	0.0	117.5	117.5
DDP1	0.0	0.0	92.0	0.0	92.0
DDP2	0.0	0.0	137.5	0.0	137.5
DDP3	0.0	0.0	108.5	0.0	108.5
DDP4	0.0	0.0	84.5	0.0	84.5
DDP5	0.0	86.0	101.0	0.0	15.0
DDP6	0.0	0.0	64.0	0.0	64.0
DDP7	0.0	0.0	64.0	0.0	64.0
DDP8	0.0	0.0	55.0	0.0	55.0
DDP9	0.0	0.0	0.0	82.0	82.0

We should buy 1812t goods and spend $436337.5 as the total cost. The new constrain is that no more than half of the demand at each DDP is coming from a single FSD. Communication 3 and 4 controls the value from both dual and primal perspective. Then, based on the former optimal solution, the computer mostly do the change is that assign half of the original goods to another FSD with a second cheapest price. The most different is the DDP5. Because the assignmnet have to meet the limit of FSD4 capacity, so the program assigns part of the goods to FSD1.

Communication-4

Goods(t) the client should move from **CDRD** to **FSD**:

FSD0	FSD1	FSD2	FSD3	FSD4
604.00	604.00	604.00	0.00	604.00

Goods(t) the client should move from **FSD** to DDP:

	FSD0	FSD1	FSD2	FSD3	FSD4
DDP0	78.33	78.33	78.33	0.00	78.33
DDP1	61.33	61.33	61.33	0.00	61.33
DDP2	91.67	91.67	91.67	0.00	91.67
DDP3	72.33	72.33	72.33	0.00	72.33
DDP4	56.33	56.33	56.33	0.00	56.33
DDP5	67.33	67.33	67.33	0.00	67.33
DDP6	42.67	42.67	42.67	0.00	42.67
DDP7	42.67	42.67	42.67	0.00	42.67
DDP8	36.67	36.67	36.67	0.00	36.67
DDP9	54.67	54.67	54.67	0.00	54.67

We should buy 2416t goods and spend $611987.75 as the total cost. At communication-4 where 6 scenarioes added, the possibility of the FSD3 be destroyed is 51%, so none of the goods will be added to FSD3.

Range of optimality

The range of optimality we can see by checking SAObjLow and SAObjLow. The most interesting part of it is in FSD3, except from FSD3 to DDP8(X[3,8]), all the values of SAObjUP is infinite which means, with other conditions stay unchanged, no matter what price it becomes higher, we do not change our decision.

RHS Research

Through the research of DDP9 in each constrains, we can know for every increase of the demand[8](DDP9's first demand for goods in communication-1), the total cost could decrease by -54.67. In communication-2,3 it could add the total cost by 216.00 and 54.67 respectively. Obviously, DDP9 in the first constrain are not bingding.