**OPERATIONS RESEARCH**

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**INTERPRETATION REPORT**

**Question no 3.1**

* 250 >= 200
* 200 >= 200
* 4800 <= 4800
* 4800 <= 4800
* 500 <= 500
* 400 <= 800

These 2 columns tell about the consumption of resources

**Decision Variables X1 X2 X3 X4**

**Quantity Produced** 150.00 100.00 100.00 100.00

In the 1st row, 250 >= 200 tells that 250-200 = 50 is Slack and the last 400 <= 800 becomes 800-400 = 400 is slack.But in the middle rows, both sides have equal values, meaning they have no Slack.So what we interpret is that:

The binding constraint puts stops on objective function from improving the results. For example, if we increase 200 in the 2nd row from 200+20 then our objective function would be better.

It shows that for each decision Variable how many units are produced to get the max of our profit. The number of product units produced depends on Constraints and availability of resources needed to produce a unit of that particular product.

The sensitivity report,it shows how much we can increase or decrease our coefficients so that our optimal solution doesn’t change

Non-binding constraints have 0 shadow price. The sensitivity report, Table 1, shows to which extent we can increase or decrease our RHS constraints so that the shadow price remains the same. If we increase our value within range then that value \* shadow price will be added to the optimal solution.

**Question no 3.2(a)**

* 4800<=4800
* 1200<=1200
* 2019.23<=2400
* 1200<=1200
* 2946.15<=3000

**Decision Variables X1 X2 X3 X4 X5**

**Quantity Produced** 266.66 488.71 0 0 133.3

It means that we can produce given units like 266.6667 units of X1 and 0 of x3 and x4.So if we produce the above units of decision variables, we get 87051.28 Total profit or cost.The column on the right-hand side represents the availability of resources. But on the left side column represents which are used in our objective function calculation. It tells how much we will utilize to get maximum profit or minimum cost.Here below rows have slack as right – left.

* 2019.231 <= 2400
* 2946.154 <= 3000

It means that we will be left with (2400 – 2019.231) and (3000 – 2946.154) resources.The sensitivity report shows how much we can increase or decrease our coefficients so that our optimal solution doesn’t change. Non-binding constraints have 0 shadow price. The sensitivity report, Table 2, shows to which extent we can increase or decrease our RHS constraints so that the shadow price remains the same. If we increase our value within range then that value \* shadow price will be added to the optimal solution.

**Question no 3.3**

These two columns tell about the consumption of resources:

* 2500 = 2500
* 2339.44 <= 2800
* 22.9357 >= 20
* -45.8751 <= 0

**Decision Variables X1 X2 X3 X4 X5**

**Quantity Produced**  22.93 0 22.93 45.87 91.74

It means that we can produce given units like 22.9 units of X1 and x3.So if we produce the above units of decision variables, we get 54128.44 Total profit.

The column on the right-hand side represents the availability of resources. But on the left side column represents which are used in our objective function calculation. It tells how much we will utilize to get maximum profit or minimum cost.Here below rows have slack as right- left.

* -45.8716<=0
* 2339.45<=2800
* 22.93578>-20

The sensitivity report shows how much we can increase or decrease our coefficients so that our optimal solution doesn’t change.Non-binding constraints have 0 shadow price. The sensitivity report, Table 3.1, shows to which extent we can increase or decrease our RHS constraints so that the shadow price remains the same. If we increase our value within range then that value \* shadow price will be added to the optimal solution.

**Question no 3.4**

These two columns tell about the consumption of resources:

* 50000 = 50000
* 10000 >= 10000
* 20000 >= 0
* 12500 <= 12500

**Decision Variables X1 X2 X3 X4 X5**

**Quantity Produced** 7500 0 2500 30000 0

It means that we can produce given units like 7500 units of EAL stocks.So if we produce the above units of decision variables, we get 5250 Total profit.

The above column on the right-hand side represents the availability of resources. But on the left side column represents which are used in our objective function calculation. It tells how much we will utilize to get maximum profit or minimum cost.Here below rows have slack as right - left.

* 20000>=0

The sensitivity report shows how much we can increase or decrease our coefficients so that our optimal solution doesn’t change.Non-binding constraints have 0 shadow price. The sensitivity report, Table 4.1, shows to which extent we can increase or decrease our RHS constraints so that the shadow price remains the same. If we increase our value within range then that value \* shadow price will be added to the optimal solution.

**Question no 3.5**

* 2688 <= 2700
* 48000 <= 48000
* 3000 <= 3000
* 4032 <= 12000
* 240 >= 120
* 312 >= 120
* 120 >= 120

**Decision Variables X1 X2 X3**

**Quantity Produced** 240 312 120

It means that we can produce given units like 240 units of full comforters.So if we produce the above units of decision variables, we get 5568 Total profit.The column on the right-hand side represents the availability of resources. But on the left side column represents which are used in our objective function calculation. It tells how much we will utilize to get maximum profit or minimum cost.

Here below rows have slack as right- left.

* 2688<=2700
* 4032<=12000
* 240>=120
* 312>-120

The sensitivity report shows how much we can increase or decrease our coefficients so that our optimal solution doesn’t change.Non-binding constraints have 0 shadow price. The sensitivity report, Table 4.1, shows to which extent we can increase or decrease our RHS constraints so that the shadow price remains the same. If we increase our value within range then that value \* shadow price will be added to the optimal solution.

**Question no 3.6**

There are 4 decision variables and some constraints were given about the consumption of resources available.

* 1410 >= 1410
* 1410 <=1610
* 85>=85
* 120.78>=25

**Decision Variables X1 X2 X3 X4**

**Quantity Produced** 1.394 0 5.490 0

It means that we can produce given units like 1.394904459 units of 8-oz steak.So if we produce the above units of decision variables, we get 76.63057325 Total Cost.

The column on the right-hand side represents the availability of resources. But on the left side column represents which are used in our objective function calculation. It tells how much we will utilize to get the minimum cost.Here below rows have slack as right- left.

* 1410<=1610
* 120.7898089>=25

The sensitivity report shows how much we can increase or decrease our coefficients so that our optimal solution doesn’t change.Non-binding constraints have 0 shadow price. The sensitivity report, Table 6.1, shows to which extent we can increase or decrease our RHS constraints so that the shadow price remains the same. If we increase our value within range then that value \* shadow price will be added to the optimal solution.

**Question no 3.7**

There are 4 decision variables and some constraints were given about the consumption of resources available

* 375 >= 100
* 745<=750
* 700<=700
* 525<=550
* 800<=800
* 425<=950
* 1600<=1600
* 850<=1000
* 1125<=1600
* 900<=900
* 425<=850
* 800<=800
* 475<=1250
* 750<=750

**Decision Variables X1 X2 X3 X4**

**Quantity Produced** 325 100 375 425

It means that we can produce given units like 325 units of Student models, 100 units of Plus models and so on each week.So if we produce the above units of decision variables, we get 143250 Total profit.The column on the right-hand side represents the availability of resources. But on the left side column represents which are used in our objective function calculation. It tells how much we will utilize to get maximum profit or minimum cost.

* 375 >= 100
* 745<=750
* 525<=550
* 425<=950
* 850<=1000
* 1125<=1600
* 425<=850
* 800<=800
* 475<=1250

The sensitivity report shows how much we can increase or decrease our coefficients so that our optimal solution doesn’t change.Non-binding constraints have 0 shadow price. The sensitivity report, Table 7.1, shows to which extent we can increase or decrease our RHS constraints so that the shadow price remains the same. If we increase our value within range then that value \* shadow price will be added to the optimal solution.

**Question no 3.8**

We have 3 decision variables and some constraints were given about the consumption of resources available

* 6 <= 7
* 8 <= 8
* 480 <= 480

**Decision Variables X1 X2 X3**

**Quantity Produced** 2 0 4

It means that we can produce given units like 2 units of Delta assemblies, 4 units of Theta assemblies, and 0 Omega assemblies.So if we produce the above units of decision variables, we get 4000 Total profit.

The column on the right-hand side represents the availability of resources. But on the left side column represents which are used in our objective function calculation. It tells how much we will utilize to get maximum profit.Here below rows have slack as right- left.

* 6 <= 7

The sensitivity report shows how much we can increase or decrease our coefficients so that our optimal solution doesn’t change.Non-binding constraints have 0 shadow price. The sensitivity report, Table 8.1, shows to which extent we can increase or decrease our RHS constraints so that the shadow price remains the same. If we increase our value within range then that value \* shadow price will be added to the optimal solution

**Question no 3.9**

There are 6 decision variables with following constraints

* 2000>= 2000
* 1600>=1000
* 500>=500
* 0>=0
* 800<=800
* -200<=0
* 1000>=200
* 600>=200
* 200>=200
* 200>=200
* 1000<=1000
* 600<=1000
* 200<=1000
* 200<=1000

**Decision Variables X1 X2 X3 X4 X5 X6**

**Quantity Produced** 500 600 200 500 0 0

It means that we should contact 500 people of G1 by telephone, 600 people of G2 by telephone, and so on.So if we produce the above units of decision variables, we get 39800 Total costThe column on the right-hand side represents the availability of resources. But on the left side column represents which are used in our objective function calculation. It tells how much we will utilize to get maximum profit or minimum cost.

The sensitivity report shows how much we can increase or decrease our coefficients so that our optimal solution doesn’t change.Non-binding constraints have 0 shadow price. The sensitivity report shows to which extent we can increase or decrease our RHS constraints so that the shadow price remains the same. If we increase our value within range then that value \* shadow price will be added to the optimal solution.

**Question no 3.10**

We have 5 decision variables and some constraints were given about the consumption of resources available.

* 54.24489796 >= 50
* 50 >= 50
* 50 >= 50
* 76.16326531 >= 50
* 106.6530612 >= 50
* 1.024489796 >= 0
* 0.1755102041 >= 0

**Decision Variables X1 X2 X3 X4 X5**

**Quantity Produced** 0.2 1.22 0.37 0.2 2

It means that we should produce given units like 0.2 units of X1, and 1.22 units ofX2. So if we produce the above units of decision variables, we get 19.8 Total Cost.

The column on the right-hand side represents the availability of resources. But on the left side column represents which are used in our objective function calculation. It tells how much we will utilize to get the minimum cost.The sensitivity report shows how much we can decrease our coefficients so that our optimal solution doesn’t change.Non-binding constraints have 0 shadow price. The sensitivity report, Table 10.1, shows to which extent we can increase or decrease our RHS constraints so that the shadow price remains the same. If we increase our value within range then that value \* shadow price will be added to the optimal solution.

**Question no 3.11**

There are 3 decision variables with following constraints 2000000 >= 2000000

* 14550<=5000
* 4000<=4000
* 15000<=2300
* 14550<=15000
* 4000<=15000
* 15000<=15000

**Decision Variables X1 X2 X3**

**Quantity Produced** 14550 4000 1500

It means that we can produce given units like 14550 units of Refrigerators/Ovens. So if we produce the above units of decision variables, we get 2777000 Total cost.

As we made a profit of $2000000 which is exactly what we are required to produce thus we mark this binding constraint in which the required amount exactly equals the output result. As we are making a total of 14550 refrigerators, but the total demand was 5000 thus 9550 is extra and this is called slack. Moreover, as the actual and resulting output is not equal, we can say this is the non-binding constraint.We are making exactly 4000 French fry makers as for initial demand thus there is no extra slack, and this constraint is binding.We are making 15000 French toast makers which is more than the initial demand of 2300, thus we get an extra 12250 French toast makers, and thus the constraint is not binding. We are making 14550 refrigerators which are less than 15000 thus making it slack as it is less than the right-hand side and thus the constraint is not binding. In other words, we can still make 450 more refrigerators. In other words, we can still make 11000 more French fry makers.We are making exactly 15000 French toast makers as of LHS thus there is no slack as the constraint is binding.

The sensitivity report shows how much we can increase or decrease our coefficients so that our optimal solution doesn’t change. Non-binding constraints have 0 shadow price. The sensitivity report shows to which extent we can increase or decrease our RHS constraints so that the shadow price remains the same. If we increase our value within range then that value \* shadow price will be added to the optimal solution.

**Question no 3.12**

* 1178.852459 <= 1920
* 3840 <= 3840
* 150 >= 150
* -416.0655738 >= 0

It means that we can produce given units like 150 Mugs. So if we produce the above units of decision variables, we get 1083.418 Total Profit.

**Decision Variables X1 X2 X3 X4 X5**

**Quantity Produced** 101.80 1.22 0.37 0.2 2

The column on the right-hand side represents the availability of resources. But on the left side column represents which are used in our objective function calculation. It tells how much we will utilize to get the minimum cost.Here below rows have slack as right - left.

* 1178.852<=1920
* -416.066<=0

The sensitivity report shows how much we can increase or decrease our coefficients so that our optimal solution doesn’t change.Non-binding constraints have 0 shadow price. The sensitivity report, Table 12.1, shows to which extent we can increase or decrease our RHS constraints so that the shadow price remains the same. If we increase our value within range then that value \* shadow price will be added to the optimal solution.

**Question no 3.13**

In this question, we have 7 decision variables and some constraints were given about the consumption of resources available.

**Decision Variables X1 X2 X3 X4 X5 X6 X7**

**Quantity Produced**  266666.67 0 23511111.11 222222.222 5000000 8777777.78 63000000

It means that we should invest a given amount like $2351111.1 in third trust deeds. So if we invest the above amount of decision variables, we get 6675444 Total Profit.

* 68000000=68000000
* 5000000>=5000000
* 7.45E-09=0
* 0=0
* 8377778>=0
* 7.45E-09>=0
* 3.4E+08<=340000000

The column on the right-hand side represents the availability of resources. But on the left side column represents which are used in our objective function calculation. It tells how much we will utilize to get maximum profit.Here below rows have slack as right – left.

* 8377778>=0

The sensitivity report shows how much we can increase or decrease our coefficients so that our optimal solution doesn’t change.Non-binding constraints have 0 shadow price. The sensitivity report, Table 13.1, shows to which extent we can increase or decrease our RHS constraints so that the shadow price remains the same. If we increase our value within range then that value \* shadow price will be added to the optimal solution.

**Question no 3.14**

In this question,, we have 18 decision variables and some constraints were given about the consumption of resources available.

**Decision Variables: X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12 X13 X14 X15 X16 X17 X18**

**Quantity Produced:**225 0 250 0 160 0 285 95 150 131 144 0 0 0 10 300 281 25

It means that we can produce given units like 225 Motorhome cabinets in regular time in July. So if we produce the above units of decision variables, we get 367969 Total cost.

* 225=225
* 250=250
* 150=150
* 80=80
* 300=300
* 400=400
* 10>=10
* 25>=25

The column on the right-hand side represents the availability of resources. But on the left side column represents which are used in our objective function calculation. It tells how much we will utilize to get minimum cost.Here below rows have slack as right – left.

* 281<=300
* 35<=300
* 475<=1050
* 655<=750
* 0<=600

The sensitivity report shows how much we can increase or decrease our coefficients so that our optimal solution doesn’t change.Non-binding constraints have 0 shadow price. The sensitivity report, Table 14.1, shows to which extent we can increase or decrease our RHS constraints so that the shadow price remains the same. If we increase our value within range then that value \* shadow price will be added to the optimal solution.

**Question no 3.15**

In this question, we have 4 decision variables and some constraints were given about the consumption of resources available.

**Decision Variables: X1 X2 X3 X4**

**Quantity Produced:**142.85714 142.85714 0 14.28571

It means that we can plant given units like 142.8 acres of wheat. So if we produce the above units of decision variables, we get 197200 Total Profit.

* 1428.571<=1800
* 18714.29<=2500
* 1200<=1200
* 30000>=30000
* 42857.14>=30000
* 0<=25000
* 300<=300

The column on the right-hand side represents the availability of resources. But on the left side column represents which are used in our objective function calculation. It tells how much we will utilize to maximize profit.Here below rows have slack as right – left.

* 1428.571<=1800
* 18714.29<=2500
* 42857.14>=30000
* 0<=25000

The sensitivity report shows how much we can increase or decrease our coefficients so that our optimal solution doesn’t change. Non-binding constraints have 0 shadow price. The sensitivity report, Table 15.1, shows to which extent we can increase or decrease our RHS constraints so that the shadow price remains the same. If we increase our value within range then that value \* shadow price will be added to the optimal solution.

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