RIGA TECHNICAL UNIVERSITY

FACULTY OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

INSTITUTE OF APPLIED COMPUTER SYSTEMS

Introduction to Operations Research
Assignment 7
Writing OPL Program Using CPLEX with External Data

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➢ Task

- Use CPLEX with external data: MS Excel and MS Access. Solve the problem with CPLEX and make report. (Task in Lecture Session - A Cargo Plane Task File)
- Make a report and add conclusion to it.

➢ Answer

- **Code in CPLEX Model File**

```
// define parameters
int n = ...; // number of cargos
int m = ...; // number of compartments

range cargos = 1..n;
range comps = 1..m;

float profit[cargos] = ...; // profit per ton for each cargo
float weight[cargos] = ...; // weight per ton for each cargo
float volume[cargos] = ...; // volume per ton for each cargo

float weight_cap[comps] = ...; // weight capacity for each compartment
float space_cap[comps] = ...; // space capacity for each compartment

// define decision variables
dvar float+ x[cargos][comps]; // amount of each cargo to load into each compartment
dvar float+ y; // proportion of weight capacity to load into each compartment

// define objective function to maximize total profit
maximize sum(i in cargos, j in comps) profit[i] * x[i][j];

// define constraints
subject to {
  // ensure available weight is not exceeded for each cargo
  forall(i in cargos)
    available_weight:
    sum(j in comps) x[i][j] <= weight[i];

  // ensure weight capacity is not exceeded for each compartment
  forall(j in comps)
    weight_capacity:
    sum(i in cargos) x[i][j] <= weight_cap[j];

  // ensure space capacity is not exceeded for each compartment
  forall(j in comps)
    space_capacity:
    sum(i in cargos) volume[i] * x[i][j] <= space_cap[j];

  // ensure plane is balanced by loading proportional weight into each compartment
  forall(j in comps)
    balanced_plane:
    sum(i in cargos) x[i][j] / weight_cap[j] == y;
}
```

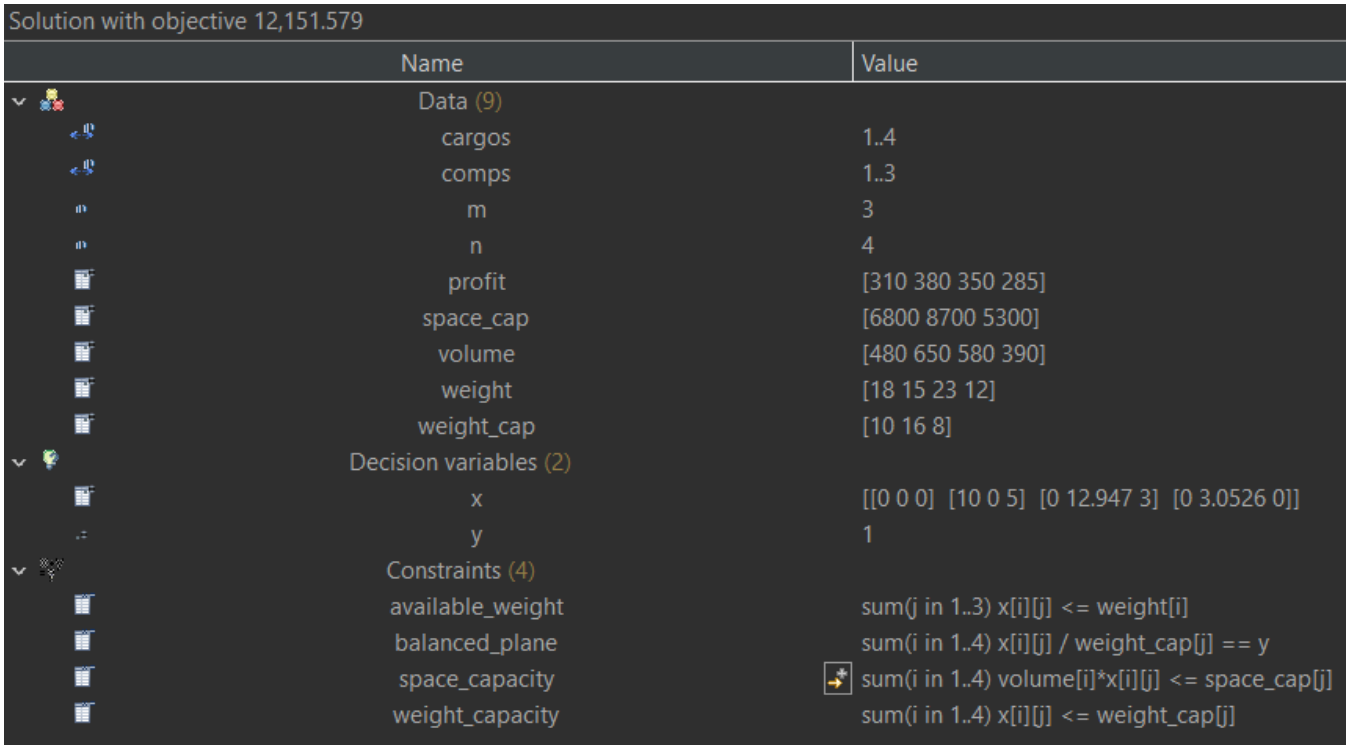
- **Code in CPLEX Data File (for the Excel file)**

```
n = 4; // cargos
m = 3; // comps

SheetConnection my_sheet ("TaskData.xlsx");
profit from SheetRead (my_sheet, "profit");
weight from SheetRead (my_sheet, "weight");
volume from SheetRead (my_sheet, "volume");

weight_cap from SheetRead (my_sheet, "weight_cap");
space_cap from SheetRead (my_sheet, "space_cap");
```

- **Output**



Solution with objective 12,151.579

Name	Value
Data (9)	
cargos	1..4
comps	1..3
m	3
n	4
profit	[310 380 350 285]
space_cap	[6800 8700 5300]
volume	[480 650 580 390]
weight	[18 15 23 12]
weight_cap	[10 16 8]
Decision variables (2)	
x	[[0 0 0] [10 0 5] [0 12.947 3] [0 3.0526 0]]
y	1
Constraints (4)	
available_weight	sum(j in 1..3) x[i][j] <= weight[i]
balanced_plane	sum(i in 1..4) x[i][j] / weight_cap[j] == y
space_capacity	sum(i in 1..4) volume[i]*x[i][j] <= space_cap[j]
weight_capacity	sum(i in 1..4) x[i][j] <= weight_cap[j]

- **Conclusion**

In this assignment, firstly I created a CPLEX data file by writing the necessary codes to use the data in the Excel file. Then I wrote a code where I could use this data and created the CPLEX model file. I added the Excel file to the CPLEX project folder I created and ran the code. I got the data and decision variables that I used in the output and showed them in the assignment as well.

As a result, in this assignment, I found the most optimized way for the Cargo Plane Task. I learned where OPL is used and how to use CPLEX for external data.