Indian Institute of Technology, Kharagpur
Department of Industrial & Systems Engineering

Spring 2022-23
IM29204: Operations Research Laboratory
L-T-P : 0-0-3, Credits - 2

Lab Assignment – 4

Maximum Marks: 10

Instructions:

1. Attempt **all Questions**.
2. All questions carry **equal** marks.
3. Assume any missing data suitably and state all your assumptions clearly.
4. You need to make this submission via **MS teams**.
5. The usage of **mobile phones** and **internet** during the lab hours is **strictly prohibited** unless specially instructed.
6. Write your name and roll number inside the file. Name your file as: Your Roll No_Name. For example, if your Roll No. is 10IM9999 and your name is Ravi, then you should name your file as: **10IM9999_Ravi**
7. Submission Deadline – The file must be submitted during the lab hours. **Assignments submitted after due date and time will NOT be evaluated.**
8. Do not submit multiple files for same assignment. In case of multiple files compress them in one ".zip" file and then submit.

Problem 1. You have a knapsack with a fixed capacity (an integer) and a number of items. Each item has an associated weight (an integer) and an associated utility value (another integer). Formulate this integer programming problem consists of filling the knapsack without exceeding its capacity, while maximizing the overall utility value of its contents. Find the optimal number of each type of items that should be taken to fill the knapsacks in order to maximize the overall utility value of its contents using CPLEX-OPL.

a) Create model (.mod) and data (.dat) files to solve the above problem on CPLEX-OPL.

b) Find the optimal solution and the corresponding best objective function value.

c) Display the solution into 'Scripting log' in the following format:

Optimal solution found with objective: X
{<X X> <X X>……..<X X>}

Use the following data for above Problem 1.

Number of knapsacks = 10
Number of Items = 16
capacity of knapsacks = [1837, 1828, 9383, 83838, 27738, 68118, 12260, 74653, 15626, 73736]
Utility value of items = [41, 21, 96, 10, 66, 13, 55, 96, 73, 17, 8, 91, 67, 54, 34, 98]
Weight of items = [8, 4, 15, 5, 7, 12, 12, 19, 8, 4, 1, 1, 2, 4, 5, 9]

Problem 2. Suppose a company is considering a number of locations for building warehouses to supply its existing set of stores. Each possible warehouse has a fixed operating cost and a maximum capacity specifying how many stores it can support. In addition, each store can be supplied by exactly one warehouse and the supply cost to the store differs according to the warehouse selected. The model consists of choosing which warehouses to build and which of them to assign to various stores in order to minimize the total cost, i.e., the sum of the fixed operating cost and supply costs. Consider six warehouses and twelve stores. The fixed costs for the warehouses are all identical and equal to 40. The data for the transportation costs and the capacity constraints is as given below. Formulate this discrete optimization integer programming problem and solve using CPLEX-OPL.

Warehouses	Location1	Location2	Location3	Location4	Location5	Location6
Capacity	2	3	3	1	2	4
Store1	24	34	10	56	32	21
Store2	56	28	78	43	71	32
Store3	43	95	74	78	60	26
Store4	67	59	79	54	50	11
Store5	23	94	62	23	46	43
Store6	46	29	26	33	60	76
Store7	54	8	79	46	55	54
Store8	68	69	15	58	33	23
Store9	34	41	46	90	37	22
Store10	52	62	44	32	95	55
Store11	45	69	32	55	27	65
Store12	21	45	67	44	35	45

a) Create model (.mod) and data (.dat) files to solve the above problem on CPLEX-OPL.

b) Find the optimal solution and the corresponding best objective function value.

c) Display the solution into ‘Scripting log’ in the following format:

Optimal solution found with objective: XXX
Warehouse Location to open = [X X X X X X]
Store number to open in a given warehourse = [{X} {X} {X} {X} {X} {X}]