Linear Model Assignment

Please attach the outputs (LINDO or EXCEL or PYTHON) in the file.

Ex1:

Below are the data collected in the university departments, divided into inputs and outputs that represent the research and pedagogical activities:



1. Explain the choice of indices presented in the table for analyzing the effectiveness of departments in the academic institution. Is there justification for using all the metrics and observations (DMUs) collected? Should the current database be expanded or reduced? Explain your answer.
2. Select the appropriate model for analyzing the relative efficiency of university departments (CCR or output-oriented or input-oriented, BCC). Explain your choice.
3. Explain the assumptions of the chosen model, the limitations and the strengths.
4. Present the problems of linear model (primal and dual) for the model chosen in section 2 for department number 4.
5. Find the optimal solution with the help of computer software. Check if department number 4 is effective. If not, present the list of departments that can serve as an example for it and the quantitative target on the efficiency envelope.

EX2:

The operations manager at the manufacturing plant is preparing a shift system for his employees for the coming month. Suppose the planning horizon is for 4 weeks or 28 working days ahead (i = 1, .., 28) and the next month begins on the first day (j = 1).

The plant works non-stop 7 days a week (j = 1,…, 7).

Each working day is divided into three shifts of 8 hours each: "night", "day" and "evening" (k = 1,…, 3).

The monthly wage per production worker is calculated on the basis of working days per week and shifts Wjk.The factory employs N workers (l = 1, .., N)

The plant must be manned at all times, When every day of the week j in each shift k must work at least Mjk workers.

An agreement with the Workers' Committee requires that the following conditions be met:

• Each employee will work at least 10 days a month.

• Each employee will be assigned to only one type of shift (night / day / evening) and will remain in it until the end of the month (will not change the type of shift during the month).

• Each employee will work up to 4 consecutive days. Note that during the monthly planning the data regarding the placement in the previous month are available and they serve as input in the planning problem.

1. Formulate the Integer linear model in the general form (Integer LP). It should be noted: decision variables, constraints and goal function. Add the verbal explanation to the mathematical wording of the problem; refer to all its components.
2. You relied in the wording on a number of assumptions, such as linearity (proportionality and connectivity), certainty. What are the less likely assumptions in analyzing the specific problem in your eyes? Suggest solutions: what information should be collected and how to use it in formulating the mathematical model and applying its solution.