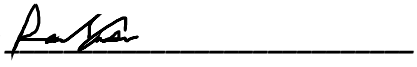
ISE 4623/5023: Deterministic Systems Models / Systems Optimization
University of Oklahoma
College of Engineering
School of Industrial and Systems Engineering
Fall 2021

Individual Assignment 5 (100 points)
NOTE: For all problems, you need to upload a PDF file of the solution, along with support files of any software used (Excel, Gurobi/Python, etc).

PLEDGE:
"On my honor, I affirm that I have neither given nor received inappropriate aid in the completion of this exercise."

Name: Daniel Carpenter ***Signature:*** 

Student ID: 113009743 ***Date:*** 11/1/2021

Problem 1 (100 points)

You are currently making a study on how to improve training efficiency for optimal lean muscle mass gains. For this, you start by following 10 people on different training routines, and record (i) how much lean muscle mass they gain after 3 months and (ii) the average weight they lifted during their exercise routines.

a. (30 points) Use an DEA output-oriented model to find the relative efficiency of each person. Also, provide for each person their reference set, along with their respective λ's (which indicate the fractions or weights associated with each benchmark weightlifter to reach the efficiency frontier). The measured data is shown in the sheet "initial_data_a" of the file "DEA_IA5.xlsx".

b. (30 points) After talking to some experience trainers, you conclude that the number of hours trained by each person should also be considered as another input in your analysis. Use an DEA output-oriented model to find the relative efficiency of each person. Also, provide for each person their reference set, along with their respective λ's (which indicate the fractions or weights associated with each benchmark weightlifter to reach the efficiency frontier). The measured data including hours trained per week is shown in the sheet "initial_data_b" of the file "DEA_IA5.xlsx".

c. (40 points) Knowing that you are doing this study, weightlifter #3 comes to you and tells your that is considering to either increase the average weight they lift or the number of hours they train each week. For this person, how much would be their marginal muscle gains (i.e., how much they could they improve their muscle gains) per extra kg in their average training? Similarly, how much would be their marginal muscle gains per extra hour of training per week? Explain your answer in detail.