Combinatorial Problems and Heuristics

Dr. Aaron Koehl

In this assignment, we will get some practice with optimization using Excel and Solver. However, these problems are solved using objective functions which are nonlinear. You will be using the GRG (Generalized Reduced Gradient) Nonlinear or Evolutionary optimization engines in Solver.

1 Setup and Deliverables

You should complete this assignment using Excel. (If you use a Mac, you must make sure that your file opens fine on a Windows machine *before* submitting.) Your deliverable will be `lastname-m7.xlsx`. **Each problem should appear on its own worksheet tab**, labeled *7.25*, *7.53*, *7.70*, *8.40*, *8.26*, and *Case 8.1*.

Exercises from Practical Management Science

1. Chapter 7, Exercise 25 on page 378 (Begin with the model from Example 7.7 on page 374)
2. Chapter 7, Exercise 53 on page 400
3. Chapter 7, Exercise 70 on page 402
4. Chapter 8, Exercise 26 on page 451
5. Chapter 8, Exercise 40 on page 453 (The data is provided in `m7-P08_40.xlsx`)
6. Chapter 8, Case 8.1 on page 454[1]

[1] This problem can be challenging, but here is the trick. Divide your decision variables into 14 groups as evenly as possible. Your decision variables will be a permutation using the AllDifferent constraint, where the first few variables are the integer IDs of students assigned to group 1, the next few are group 2, etc. For each attribute, compute the global mean of the 1's and 0's for that attribute. Then, compute a score for each group based on the students assigned to that group. The key is to penalize groups that are far from the global mean using, say, squared difference. Your objective function will be to minimize this penalty. Since this is an $O(n!)$ problem, you will want your evolutionary solver to run for a while. How balanced are your teams?