**Question 15.1**

Describe a situation or problem from your job, everyday life, current events, etc., for which optimization would be appropriate. What data would you need?

In my prior work at a large aerospace jet engine manufacturing company, one of my tasks was to create an airfoil design that meets structural, aerodynamic, and manufacturing requirements at the lowest weight. Since this problem is formulated best as a multi-objective optimization problem due to the competing engineering objectives, an approach based on genetic algorithms was selected. The search landscape was defined by many airfoil geometry definition parameters including chord, span, twist, lean, etc. The constraints were developed from the physical dimensions available for the airfoils to avoid clashing with the case or other stages of airfoils in the engine including the full deflection of the airfoils. The objective functions were to minimize weight, minimize the stress, maximize aerodynamic efficiency, and maximize a defined “manufacturing fitness” metric. The data required were generated with finite element models that were generated and solved in parallel before the start of the optimization and during each successive iteration of the algorithm. The outputs of these models were used as the data points to inform the optimization solver.