It is Time to Enjoy the Best of Both Worlds

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Since George Dantzig's famous discovery of the Simplex Algorithm more than 60 years ago, researchers have worked to develop and enhance algorithms to generate solutions for many practical decision problems in Operations Research. Two important classes of algorithms have evolved during this time: these can be broadly classified as mathematical optimization methods and heuristic methods. Optimization based methods have the important properties that they are guaranteed to find a feasible solution if one exists and furthermore, they are able to issue a certificate of optimality for the solution they produce. These two attractive properties come at some cost in that the computation required is often relatively large and in some cases the optimization methods can become prohibitively expensive as the problem size increases. Heuristic methods on the other hand are much less sensitive to problem size but they suffer from two disadvantages in that they are not guaranteed to find a feasible solution even if one exists and they provide no guarantee of optimality or even how far from optimality the heuristic solution is. It is interesting to observe that the research community interested in these methods seems to naturally partition into two almost disjoint groups aligned with these classes of algorithms. In this talk we will argue that the time has come to explore the development of composite methods that exploit the benefits of heuristics to improve the performance of optimization methods or optimization methods to solve sub-problems within a heuristic framework. This theme will be illustrated by four practical problem examples.