This praxis overviews the development and application of a linear integer program to support engineering managers as they assign people to projects which span multi-time periods that each have budget constraints. This model includes the capability for assigning multiple engineers to tasks and for using new hire or outsourced labor in addition to or as an alternative to internal resources. The model also includes the capability for different resources to take different amounts of time to complete a task of a known duration based on a standardized estimate and works within the available personnel hours available for each time period. Additionally, the model includes the capability for allowing an engineer to be assigned to attrition to develop the staffing scenario with least impact in benefit to the organization. Finally, the model allows an engineer to be assigned to a desired career goal which removes him from the resource pool if that assignment generates the most economic value to the organization.

Supporting the development of the optimization model, a case study is presented wherein data from an actual engineering department including engineers and projects to be completed are analyzed to determine the best assignment of engineers to projects to be worked to maximize the value to the company. Comparison of the benefit generated using manual methods shows them to be inferior to the optimization results. The case study data is further analyzed to determine the potential loss in benefit to the organization if an employee suddenly decides to leave the company both with and without replacement. The case study data was further analyzed and an overall methodology for estimating the expected cost of attrition for an employee group developed. The value to
the organization of allowing an employee to pursue career goals while remaining employed is developed using the optimization model as a basis.

Finally, multi-year planning of personnel staffing levels are investigated. This includes the development of a model to forecast future personnel needs based on assumed values for growth, attrition, etc. and a method shown for determining the personnel needs based on retirements and general unavailability for work as employees age. The optimization model and data files used in the analysis are presented in the appendices.
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