Our research examines the problem of determining optimal staffing levels for emergency personnel such as firefighters. There are several factors that make this a particularly interesting problem. Because of their social importance, there is a minimum number of firefighters that are required to be on-duty at any time. However, the actual number of firefighters available for assignment at any particular time is influenced by both temporary absences and permanent attrition due to retirement, injury, etc. Furthermore, due to training requirements, it is often only possible to bring in a new group of firefighters once per year.

We analyze this firefighter staffing problem by relating it to traditional inventory models. We develop a robust model that allows for randomness in both temporary absences and permanent attrition, and we analytically characterize optimal solutions. We also perform numerical work that aids in establishing important managerial opportunities for cost improvement and compares our optimal solutions to heuristic solutions currently used in practice.

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