Staffing and scheduling in call centers

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Abstract

We examine the problems of agent's staffing and scheduling in telephone call centers, under two different settings:

1. a center operating in blend mode, with inbound and outbound traffic, and two different types of agents (inbound-only and blend);
2. an inbound-only center with different types of inbound calls and different types of agents, each agent type being able to handle a subset of the call types.

These two cases are commonly called the *blend* and the *multiskill* settings, respectively.

In the *scheduling problem*, we enumerate all the possible (admissible) working shifts that an agent can have on a given day and we decide how many agents of each type we take for each shift. In the *staffing problem*, we just decide how many agents to have for each period of the day (e.g., each half hour), regardless of the feasibility in terms of shift schedules. In both cases, there are constraints on the expected values of some measures of quality of service (e.g., proportion of abandonments, fraction of calls answered within 20 seconds, etc.). These constraints can be per period, per call type, or aggregated. In the blend case, we may also have constraints on the expected volume of successful outbound calls.

The staffing and scheduling problems are formulated as integer programming problems with nonlinear stochastic constraints, which can

be solved via a cut generation method if we assume that the mathematical expectations involved in the constraints are concave functions of the decision parameters. In practice, this assumption holds only in certain areas of the feasible set and we must rely on heuristics to address this issue. We explain how. To estimate the mathematical expectations and their subgradients (in order to define the cuts), we can use *crude approximations* derived from queueing theory or stochastic *simulation* of a detailed model. We do both and provide comparisons with numerical illustrations.

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