Practitioner's Commentary: The Outstanding Coal-Tipple Operations Papers

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Introduction

For the system of two crews, three regular trains, and one special train, all three of the final papers generated the same total cost (in the $87–90 million range, which is good for this stochastic situation). However, one team considered only a five-day week, while the others used a seven-day week.

Similar schedules for the three regular trains were achieved in the case where those trains could be scheduled. Costs ranged from $52 million to $59 million, again similar results given the stochastic nature of the problem.

All agreed that use a of third crew would reduce total annual costs but disagreed significantly on the total amount of savings.

All agreed that the system could handle a fourth regular train, but Thursdays would be problematic and costs may soar.

Detailed Analysis

The teams will be discussed in order of performance, first to last.

The team from Cornell University had the simplest solution and the one most amenable to sensitivity analysis. This team used an existing simulation package to build its model, and the parameters of the model can easily be changed to ask "What if —?" types of questions. This team's presentation of approach and results is probably the clearest, except for the the statistical analysis, which is not clear.

The team from the U.S. Military Academy wrote the clearest summary of the problem, approach, and recommendations. They wrote the most thorough statement of its algorithm, having done their own programming in Pascal; they also used spreadsheets to advantage in summarizing results. I disagree with their assumption of train arrivals on the hour—this is just unrealistic. They state as an assumption that "the distribution of arrival times is

unknown" when they are actually assuming a discrete uniform distribution; they could just as easily have used a continuous uniform distribution.

The team from the University of Alaska Fairbanks is clearly more oriented in the direction of mathematical statistics, and less in the direction of simulation, than the other teams. This team's solution considers only five scenarios or "rule sets" and chooses the one that minimizes cost. Their solution to the scheduled-regular-trains part of the problem is reasonable, but they don't tell us how they arrived at that particular schedule. Their answer to the four-regular-trains question is sketchy at best. The team is to be commended, however, for testing their primary results against those of a Pascal simulation program (which they wrote). Since the simulation was based on the same logic as the theoretical solution, however, one would expect the results to agree.

About the Author

Dr. Ruth Maurer is presently Associate Professor of Mathematics (Operations Research/Applied Statistics) at the Colorado School of Mines. In addition to considerable professional work as a consultant, she is former Mayor of the city of Golden, Colorado. She also was the Consulting Energy Economist for the First Interstate Bank of Denver and was visiting professor of engineering at the U.S. Military Academy at West Point. For her pro bono consulting work for the Department of the Army, she was awarded the Outstanding Civilian Service Medal and the Commander's Medal. She is the co-author (with R.E.D. Woolsey) of the five books in the Useful Management Series.