We examine the problem of staffing refreshment stations at a long distance road race. A race is modeled as a mixed queueing network in which the required number of servers at each service station has to be estimated. Two models to represent the progress of runners along a long distance road race course are developed. One model is a single-class model that allows a road race manager to staff service stations assuming the runners are identical to those in some historical dataset. Another model is a multi-class simulation model that allows a road race manager to simulate a race of any number of runners, classified based on their running pace into different runner classes.

Both the single-class model and the multi-class model include estimates for the rates at which the runners arrive at specified locations along the course. The arrival rates, combined with assumed service rates, allow us to base staffing decisions on the Erlang loss formula or a lesser known staffing rule that gives a lower bound for the required number of servers. We develop a staffing strategy that we call the PASB, which is based on this staffing bound.

The PASB and the Erlang loss formula are implemented in the single-class model and the multi-class simulation model. By way of numerical experiments, we find that the PASB is numerically stable and can be used to get staffing results regardless of the traffic intensity. This finding is in contrast to the Erlang loss formula, which is known to become numerically unstable and overflows when the traffic intensity exceeds 171. We compare numerical results of the PASB and the Erlang loss formula with a blocking probability level of 5% and find that when the traffic intensity is high, staffing results based on the PASB are more conservative than staffing results based on the Erlang loss formula. As the traffic intensity gets lower, we find that staffing results based on the PASB are similar to staffing results based on the Erlang loss formula. These findings suggest that the PASB can be a valuable tool to aid race directors in making staffing decisions for races of all traffic intensities.

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The public is welcome to attend.