Minutes of Monthly Webinar No. 3:
INFORMS RAS · 2020 Problem-Solving Competition
May 22, 2020 · 9:00 AM EDT

RAS Attendance:
Krishna Jha (Host / Problem Owner) · Jay Baillargeon (Problem-Solving Competition Chair)

Agenda:
- Welcome
- Open Forum for Participants' Q&A
- Adjourn (Next Monthly Webinar: **Friday, June 12, 2020**)

Conference Call / Zoom Webinar:
- Jay Baillargeon and Krishna Jha welcomed those who attended the third monthly webinar for the 2020 INFORMS RAS Problem-Solving Competition and re-iterated that the goal of the webinar is to provide an open forum to gather feedback for the problem at hand from the RAS community as well as address questions from participants.
- Mr. Baillargeon then proceeded to re-iterate that questions continue to be submitted via email (railwayapplicationssection@gmail.com) between webinars, which he continued to encourage, and recent questions that might be useful for all participants will be posted on the website in the coming days for all to review.
    - In response to this, one of the participants on the webinar noted that they submitted a lengthy set of questions via email, to which they were addressed exceptionally well and helped their team surmount some initial struggles with the problem, mainly with regard to the output expectations.
- In addition, Mr. Baillargeon also re-iterated the recent INFORMS RAS announcement that, given the unusual and difficult situation we're all facing with the pandemic, registration for the 2020 INFORMS RAS Problem-Solving Competition will be taken until the deadline that all materials are to be submitted for judging (i.e., Friday, July 31, 2020).
- Following his update on recent news, Mr. Baillargeon opened the forum for questions, comments, and any discussion related to the problem statement and Toy Problem dataset as posted on the website. This brought about the following questions:
    - **With regard to the use of sidings and wyes, is there a specific timing participants should follow, or a time penalty for using a siding?**
        - Mr. Jha responded that the trains using the sidings and wyes should be delayed to some extent. As such, the committee will introduce a time delay (e.g., a few minutes, perhaps) for the use of a siding or wye.
        - In addition, Mr. Jha also noted that, when the train continues operations from a siding, participants are expected to assume the train resumes instantaneously.
    - **In the previous response, it was noted "high speed and low priority" when discussing freight trains carrying different commodities, which required clarification.**

        - Mr. Jha noted that the speed of a train depends upon (among other things) geography and the inherent condition of the track on which the train is operating.
        - Although, depending on the type of freight train, it is possible a train can move at higher speeds than other trains. As such, participants should expect trains to travel at the minimum permissible speed given for the track or for that specific train type.
    - **Can participants assume a moving-block system (i.e., a "buffer zone") between two trains traveling in the same direction on the same track?**
        - Mr. Jha noted that, in revenue service operations, a moving-block system, in which trains are spaced accordingly on the network by "buffer zones" of fixed length, can be utilized, but a fixed-block system, in which signals at fixed points in the network, manage train movements between adjacent signals and/or stations, is also used.
        - Although this would be a realistic approach to the problem at hand, this would be entirely too complex for the level of difficulty intended for the Problem-Solving Competition.
    - **There was confusing regarding the occupancy of one train within one segment of track at any given time and, as such, an explanation was requested.**
        - Mr. Baillargeon noted that the definition of a segment is a section of track between two changes in characteristics of the track (e.g., any point which tracks converge or diverges). As such, the section of the main track between the entrance and exit of a siding would be considered an individual segment.
        - In addition, stations can also be the endpoints, so the section of the main track between the entrance of a siding and the next station would be considered an individual segment as well.
        - Mr. Baillargeon also noted that, with regard to yards, which feature multiple tracks on which trains can occupy, the assumption is one train will occupy one of the individual tracks of the yard between switches. The same can be said of industrial spurs as well, such as the one in the Toy Problem dataset just to the east of Station H.
    - **On the network diagram in the Toy Problem dataset, the track speed is listed as 50 MPH at Station A, but it appears that the segment between Stations A and B have different speeds listed. So, what does the 50 MPH represent in this diagram?**
        - Mr. Baillargeon noted that should be considered as an erratum as the 50-MPH speed limit refers to the speed west of Station A, which is not modeled in this network. As such, participants are expected to ignore that and a corrected version of the Toy Problem dataset will be uploaded along with a summary of errata for those still using the previous version.
    - **Can trains occupy multiple segments of track at the same time and, if so, what is the transition time between segments?**
        - Mr. Baillargeon noted that, on the network itself, a train is considered to be a single point, to which Mr. Jha concurred. As such, train lengths are not being considered in this problem. In this case, the transition between segments would be instantaneous.
    - **Can trains operate in the reverse direction?**

        - Given the example of the industrial spurs discussed during the webinar, Mr. Baillargeon noted that operating in the reverse direction to leave a siding or spur is possible, though is not a common occurrence in revenue service operations.
        - In addition, in response to the follow-up question regarding the use of industrial spurs as a temporary siding, this is possible and the same time penalty discussed previously for sidings would apply
    - **Is the representation given in the Toy Problem dataset the numerical representation discussed in the Problem Statement, or will the validation dataset be of some other numerical representation?**
        - Mr. Baillargeon noted that the validation dataset (including the numerical data provided in the visual network) to be acquired from the operating railroad will be in a similar format as the Toy Problem dataset and will include data purposely left out of the Toy Problem dataset, which participants were expected to solve for on their own.
        - Mr. Jha added that the validation dataset will be more structured, so it is expected that some of the information previously represented in the network diagram of the Toy Problem dataset will be numerical in the validation dataset.
    - **Is the expectation a general prediction model or more of simulation?**
        - Mr. Baillargeon noted that the committee is looking for a general solution that can be applied to multiple networks, as opposed to a model that specifically represents only the model given. In other words, it should have the ability to be applied to other networks as well.
        - Mr. Jha also added that the primary objective is to minimize the total delay in the entire system, which means that it may be necessary to hold trains at stations or sidings to allow higher-priority trains pass through unrestricted. Although, you cannot depart a train prior to its intended departure time.
    - **When calculating the total delay, is it more important that the total time to the final destination is reduced, or is it equally important that the arrival times at the intermediate stations are as close as possible to the planned arrival times at these locations?**
        - Mr. Jha noted that it is important that the trains try to minimize the delay to the intermediate stations which, in turn, will minimize the overall delay of the train to its final destination.
    - **Is the delay at one station more critical to the train travel time than another station?**
        - Mr. Jha noted that all the stations are considered equivalent and priorities are only given to the specific train types.

Action Items:

- In response to a request made during the webinar, the Problem-Solving Committee will provide information that elaborates on the time penalty for utilizing a siding or wye during a train's journey so it can be properly modeled.