Shared Q&A

INFORMS RAS · 2020 Problem-Solving Competition

Dated: June 26, 2020

- **One of the evaluation criteria on [on the Problem-Solving Competition website] is the quality of the solution in terms of its objective function value. You have also stated in Webinar #3 that the primary objective is to minimize the total delay in the entire system. So, do you expect us to develop an optimization model? Or the problem is more about presenting a prediction model?**
  In essence, this is very much an optimization problem. A number of trains have been provided with planned arrival times to their final destinations, as well as intermediate activities that need to be completed (i.e., picking up or dropping off cars). At the same time, each train must compete for passage with other trains in the network. So, it is expected that an optimization model will be developed to minimize the delay in the system.

- **In the validation data set, the actual arrival/departure times are not given while we need them if we want to make a prediction model. Are you going to update the validation data set and include more info? Or is it the final version?**
  Initially, when we were working with the U.S. freight railroad for data, it was expected that they would provide actual arrival/departure times with which to compare with the final results. Unfortunately, since the railroad was unable to provide us the data for legal reasons, we resorted to using the data available from the 2018 Problem-Solving Competition, with some modifications of course. This is all the data we have available to us, so no more information will be provided. As such, the best way to approach this problem is an optimization model for which the delay in the system is effectively minimized.

- **In the validation data set, there is a sheet named "Distances" in which we can find the distance between stations. There is another sheet, "Num Track Chart", where we observe another record of data for distance between stations. Which one should be used in our model? Besides, in the "Distances" sheet we do not have the number of tracks and allowable speed. We also see a distance from one station to itself. What does that mean?**
  In the data that was provided to the committee, the distances were provided in different sheets, so the set in "Distance" will not have all of the stations that you need. As such, you'll have to use "Num Track Chart" as well to get the full picture. We considered combining these but, as this is actual data from an operating railroad, we felt it was appropriate to leave it as is since this is likely the type of situation you would be faced with as an operations researcher for a railroad entity. The number of tracks denotes the number of mainline tracks between the set of stations, and the allowable speeds is the speed limit for that section of track. This is basically a numerical version of the visual diagram provided in "Network Diagram." All of the information you need to put together the network is available between “Network Diagram”, “Distances”, and “Num Track Chart”.

- **Do you have any plan to extend the submission deadline?**
  At this point in time, we are not planning to extend the submission deadline due to the tight schedule between judging and announcing the finalists for the INFORMS Annual Meeting in November. So, the deadline for all submissions will remain July 31, by 11:59 PM CDT.

- **Since there was a delay in providing the validation dataset, would you extend the deadline for asking questions?**
  Of course! I've spoken with the officers of the RAS and we've agreed to extend the Q&A period to

Friday, July 3rd. As such, we'll have additional webinars next week (one for sure on Wednesday, July 1st, at 9:00 AM EDT, and possibly another on Friday, July 3rd, if there is enough demand for it) to address all your questions prior to the Quiet Period. Additionally, since the Quiet Period starts at 11:59 PM CDT on July 3rd, I will honor all questions that come in via email with a timestamp prior to that time.

- **Are there inherent conflicts in the time table? That is, if all the trains run on time as per the time table, is there any conflict going to occur for the resources (e.g., violation of station capacity, or speed restriction)?**
  None that the committee is aware of, and certainly none that would've been intentionally introduced to add further complexity to the problem.

- **Some trains have Train Priority as "S" on one day and "L" on the other day. For example, train number 824. Can this happen? On what basis has it changed?**
  Yes, this can happen in a real-world scenario. The train numbers typical denote a specific service in revenue service operations rather than a specific consist (i.e., what type of cars make up the train). For example, I'm reminded of two trains that I used to work around in Canada when I was doing research there. I forget the exact numbers, but let's say they were 1001 and 1002. Although they were made up of different cars and locomotives each day, they were still designated as 1001 and 1002 each morning per the timetable. Depending on the commodities being carried on any given day, one or the other could've had a different priority from one day to the next but still have the same train designation number because of the scheduled service.

- **Some trains are taking different amount of time to travel from Origin to Destination over the two days. For example, train number 824 is departing from origin at 6:55 AM on 06-Sep and reaching destination at 8:18 AM. However, on the next day these times are 6:55 AM and 8:29 AM, respectively. Therefore, it seems that this data is not the timetable but, rather, actual running status of the train on each day. Is this correct?**
  Some variation was added to the times that would make them more realistic than a timetable would provide. Although, this is why the columns are referred to as "Planned" rather than "Scheduled" as they include some degree of realism such that unforeseen circumstances (e.g., weather) are taken into account. Furthermore, it was advised in Webinar #5 that participants not to assume that the schedule for trains will be the same for both days and, in turn, each train provided can be considered separate and independent.

- **For train number 815, the Work_Ordr flag = Y at station Wt. Although, in "Stn Order & Details" sheet, station Wt does not have a yard. Is the data incorrect?**
  You are correct. Even though a Work Order flag is given, it doesn't necessary mean it will be at a yard. The yards given in "Stn Order & Details" are listed as addition places for temporary storage. So, for the Work Order flags, please assume that an industrial spur will be available at those locations to pick up or drop off cars. These spurs will be separate from any sidings or yards present and, as such, will not hinder other train movement into the sidings/yards.

  For example, if a train is at Wt dropping off cars in the industrial spur, a following train can still use one of the sidings at Wt as well (assuming the sidings are not occupied in the first place). Likewise, if a train is using one of the sidings at Wt, a train scheduled to pick up or drop off cars can still do so at Wt as the industrial spur is separate. This is established in Assumption #7. Although, only one train and pick up or drop off cars at Wt at any time.