Question 1:
Could you please clarify below mentioned point on "exclusive constraint"

The exclusive constraint which states that shipments with the same destination if classified at a particular yard must be grouped into the same block. As per our interpretation, this rule will be applicable only while deciding blocking plan of the shipments and not while determining physical paths of the trains. For example (ref fig 8 rail network), the paths of train services Y01-Y06: (Y01->Y02->Y03->Y04->Y05->Y06) and Y02-Y06 (Y02->Y07->Y04->Y05->Y06) is valid, even if they have different routes from yard Y02. Is this correct?

Answer: It is true that the exclusive constraint is applicable when deciding blocking plan (train service) of the shipments. The paths of train services Y01-Y06: (Y01->Y02->Y03->Y04->Y05->Y06) and Y02-Y06 (Y02->Y07->Y04->Y05->Y06) is valid, even if the physical routes of them is different. Notice that only the shipments with the same destination can be grouped into the same block.

Question 2:
We have a question about the model formulation in Lin 2017 (3.2 on page 10) that we were hoping you could answer. This is to ensure we are understanding the problem and the previous models that have been proposed.

Specifically, at the bottom on page 10 in Lin 2017, the author wrote that “Constraint (2) guarantees that (i) every shipment can reach its destination; …” While we find that this could not always be true. Please see a detailed example below.
Our question is why “Constraint (2) guarantees that (i) every shipment can reach its destination” as stated on the second line from the bottom on page 10 in Lin (2017). Please consider the following example:

Given $N_{i,j} \neq 0$, $\forall i \neq j$, $\forall i = 1, \ldots, 4$, $\forall j = 1, \ldots, 4$.

Given the rail network on the left of Figure 1.

Define $P(i,j)$ the set of yards through which a flow from $i$ to $j$ pass on its itinerary excluding yard $i$ and $j$, same as the definition in (Lin 2017). So,

- $P(1, 2) = \{3, 4\};$
- $P(1, 3) = \{2, 4\};$
- $P(1, 4) = \{2, 3\};$
- $P(2, 3) = \{1, 4\};$
- $P(2, 4) = \{1, 3\};$ and
- $P(3, 4) = \{1, 2\}.$

Then, the following values of decision variables (see Table 1) satisfy Constraints (2) and (3) in the formulation in (Lin 2017), as shown as the red arcs on the right of Figure 1. Same as the definitions in (Lin 2017), $x_{i,j}^k$ is car flow variable; it takes value one if cars whose destination is yard $j$ are consolidated into train service $i \rightarrow k$ at yard $i$. $y_{i,j}$ is train variable; the value is one if the train service $i \rightarrow j$ is provided.

<table>
<thead>
<tr>
<th>$i$</th>
<th>$j$</th>
<th>$y_{i,j}$</th>
<th>$x_{1,2}^1$</th>
<th>$x_{1,2}^2$</th>
<th>$x_{1,2}^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>$y_{1,2} + \sum_{k \in P(1,2)} x_{1,2}^k = 1$</td>
<td>$y_{1,2} = 1$</td>
<td>$x_{1,2}^1 = 0$</td>
<td>$x_{1,2}^2 = 0$</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>$y_{1,3} + \sum_{k \in P(1,3)} x_{1,3}^k = 1$</td>
<td>$y_{1,3} = 0$</td>
<td>$x_{1,3}^1 = 1$</td>
<td>$x_{1,3}^2 = 0$</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>$y_{1,4} + \sum_{k \in P(1,4)} x_{1,4}^k = 1$</td>
<td>$y_{1,4} = 0$</td>
<td>$x_{1,4}^1 = 1$</td>
<td>$x_{1,4}^2 = 0$</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>$y_{2,1} + \sum_{k \in P(2,1)} x_{2,1}^k = 1$</td>
<td>$y_{2,1} = 1$</td>
<td>$x_{2,1}^1 = 0$</td>
<td>$x_{2,1}^2 = 0$</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>$y_{2,3} + \sum_{k \in P(2,3)} x_{2,3}^k = 1$</td>
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<td>1</td>
<td>$y_{3,1} + \sum_{k \in P(3,1)} x_{3,1}^k = 1$</td>
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<td>4</td>
<td>$y_{3,4} + \sum_{k \in P(3,4)} x_{3,4}^k = 1$</td>
<td>$y_{3,4} = 1$</td>
<td>$x_{3,4}^1 = 0$</td>
<td>$x_{3,4}^2 = 0$</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>$y_{4,1} + \sum_{k \in P(4,1)} x_{4,1}^k = 1$</td>
<td>$y_{4,1} = 0$</td>
<td>$x_{4,1}^1 = 0$</td>
<td>$x_{4,1}^2 = 1$</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>$y_{4,2} + \sum_{k \in P(4,2)} x_{4,2}^k = 1$</td>
<td>$y_{4,2} = 0$</td>
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</tbody>
</table>

However, in the resulting network, as shown on the right of Figure 1, only the red arcs are selected. Shipments at yard 1 cannot reach yard 3 or 4. So, we were wondering how “Constraint (2) guarantees that (i) everything shipment can reach its destination”. 
This could happen if only constraint (2) is taken into consideration when calculating. Actually, the situation mentioned above can be avoided if the objective function is also considered when optimizing. The reclassification strategy, such as $x_{1,3}^2 = 1$ and $x_{2,3}^1 = 1$ ($x_{ij}^k = 1$ and $x_{kj}^i = 1$) at the same time (which means $N_{1,3}$ being reclassified at node 2 first and then node 1), is apparently irrational and unpractical, which will be eliminated when optimizing the objective function instead of only considering constraint (2).

**Question 3:**

a) Should the proposed algorithms be presented in a software package, so that those of each participant are executed in the same computing environment (in the interest of fairness and replicability)?

**Answer:** All the instances are calculated by the simulated annealing algorithm, but it does not mean that this algorithm is recommended (The software is developed by the problem owner). Participants should propose their own solving approach. Of course, the simulated annealing algorithm can be employed to solve the problem, however, the specific design and parameters of the algorithm should be determined by participants themselves.

b) If so, will other instances be executed using the submitted software?

**Answer:** In general, all the instances should be solved by the same solving approach. If it is necessary, participants can employ different approaches to compare the computational efficiency.

c) Finally, could you share with us the specifics of the computing environment on which these would be tested (type of processor, number of threads/cores, amount of RAM, Operating System)?

**Answer:** Of course we can disclose our computing environment, which is Intel(R) Core(TM) i7-4702MQ CPU @2.20 GHz.

**Question 4:**

Are you sure that the data set of the problems 2 and 3 is feasible?!
We designed an exact method to solve the problem that gives an optimal solution for problem 1 (existing example in "2019_RAS_Problem_Solving_Competition_March18"). But our proposed exact method implies that the problem 2 (with 16 yard and 48 link) is infeasible!

It seems that reason of infeasibility is link capacity constraint. If we replace the train size \((m_{ij})\) from 50 to 52, the problem is optimally solved!

**Answer:** The data set of problems 2 and 3 is sure feasible and we have confirmed that.

**Question 5:**

a) As per the problem statement, because of arc capacity it may not be possible to use only the shortest paths between yards to send the railcars. This also means that for some combinations of the detour ratio and arc capacities the problem may become infeasible. Can we be sure that all test instances are feasible with the provided parameters?

**Answer:** It is sure that all test instances are feasible with provided parameters.

b) Based on your answer to the second question of the second QA round, what will be the main criteria for evaluation? Satisfying the detour ratio or the objective function? Adding the detour ratio constraint may lead to a worse solution (with respect to cost) than not adding it.

**Answer:** We only provide data sets of instances online and the solutions of them to RAS. The main criteria for evaluation are that the solution can meet all the constraints and minimize the objective function as the same time. if you can provide a solution which is optimal in terms of cost but some path(s) are longer than the detour ratio, it can be acceptable. Other criteria should be comprehensively evaluated by RAS.

**Question 6:**

a) We wanted to clarify how we should decide the set \(S_f\) which includes any train services we are not allowed to provide (defined by \(S_f\) in Lin 2017). We went through the paper of Lin (2012) and noticed that they considered a criteria [equation (16) on page 664] to decide the train service \(i-j\) that should not be provided. We cannot find any further elaboration in Lin 2012 and Lin 2017 and do not see any other information in the [competitions’] problem description. Should we also use the same criteria to determine set \(S_f\) for our problems?

**Answer:** As we mentioned in the document of TBSP, the Set of train services that are not allowed to provide \((S_f)\) and the set of specific paths \((\rho^f)\) are empty sets, that is, the constraints (8) and (9) in the mathematical model (Boliang Lin, 2017) are not considered.

b) We wanted to confirm the sufficient conditions for adding train services prior to optimization (defined by the set \(S_b\) in Lin 2017). These conditions are adjacent paths with positive train flow and those that meet criteria (13) in Lin 2012 - is that correct? Are there any additional sufficiency conditions?

**Answer:** Only the criteria (13) in Lin 2012 is the sufficient condition, while the adjacent paths with positive train flow are not. The sufficient condition is employed to reduce the computational range in Lin et al. (2012), which has no necessary to be taken into consideration.
c) I also have another general query regarding one comment of Q&A document (from the first round of questions). In the question 3, there was a mentioning about exclusive constraints named in an earlier version (March18). Can you please clarify me what was the earlier version (March 18), he/she was mentioning to? Is this the same constraint (c) on page 8 of the problem description now? I just wanted to make sure that I am not missing any information.

**Answer:** The exclusive constraint in the earlier version (March18) and the constraint (c) on page 8 of the current problem description are the same constraint.

d) What are the evaluation criterion for the solution feasibility? On Page 8, we notice that the problem owner lists four kinds of constraints, passing capacity in each arc, classification capacity in each station, sort tracks in each station, and exclusive constraints named in an earlier version (March18).

**Answer:** The solution is feasible as long as it can satisfy all the constraints mentioned in Lin 2017, including passing capacity in each arc, classification capacity in each station, sort tracks in each station, and exclusive constraints.