

Simplified example 20th April 2020

Q1: Consider a Railway line starting at station START and ending at station END and with four **intermediate stops A,B,C,D** at a distance of 25 km each. A is at 25 km from the starting station and the destination of the train lies at 25 km from D. Trains described below all start at START and end at END.

Following 2 scenarios are to be simulated using the section simulator.

Scenario 1 (Homogeneous): 4 trains running at a speed of 100 km per hour are scheduled with a frequency of 3 mins each and stop at alternate stops (i.e. train 1 and 3 stop at A and C and train 2 and 4 stop at B and D) for 5 mins each. The trains can overtake each other only at the stations. Each station has one main line in up/down each, and one loop for allowing overtake: each in up/down.

Scenario 2 (Heterogenous): Now consider a heterogeneous system where 2 trains stop only at A while 2 other trains stop at B,C and D with the same frequency and waiting time as before.

Analyze the above two scenarios and answer the following questions for each of these cases:

- Plot the trains in the space time graph
- What is the minimum headway of the train?
- How many trains can be scheduled in a period of 1 hour if minimum headway should be restricted to 3 min (when trains are running)? (In scenario 2, the ratio of the two types of trains should remain same)
- What is the frequency of scheduling the trains in this case?
- Calculate the average speed of the system

Compare the number of trains and the average speed in the above cases.

Suggest another experiment to see validity of the 2-quadrilateral-4-axes figure.

Q2: Grouping of trains can affect total freight capacity or worsen/improve average freight path quality. Consider the unscheduled.txt file of the previous question. Consider 60 trains totally of Scenario 2: 30 of slow trains and 30 of fast trains.

Choose priority appropriately to maximize average speed. Use grouping so that low priority trains do not have to wait for high-priority trains' overtake.

(Robustness/punctuality is **not** to be studied through experiments since simulator simulates ideal situations or those which are modeled: each uncertainty would need to be modeled and then simulated.)