

1 Group decisions

1.1 Voting system

The voting system we implement this week is twofold. First, we implement a system which concerns a passenger transport scheme, which is complementary to the coordination scheme implemented last week, in which we use fixed routes to transport passengers over their respective shortest route. The second scheme concerns the spawning and retirement of buses on a fixed route, and considers information specific to buses, who vote to make the decision as to whether a new bus is necessary to handle the passengers within a specific route.

For the flexible bus voting scheme, we spawn a new bus which does not have a designated route, such that its route is determined by the votes of both passengers on board, and passengers waiting at the current bus stop.

For the fixed route voting scheme all buses on a route give a vote depending on their capacity utilization, as to decide whether an additional bus on that route is required.

1.2 Logic

The flexible bus voting system works as follows. When a bus arrives at a bus stop which is at a junction, all passengers are dropped, such that waiting passengers at passengers previously on board form a single group. Then, each waiting passengers votes for what ought to be the next stop for the bus, based on the passenger's shortest path to his destination. Finally, the bus continues to what stop received the most votes, taking with it only those passengers which voted for that stop. In this case of a draw, the bus goes to the closest bus stop. In the case there are no passengers, the bus goes to the nearest bus stop as well.

Note that this voting scheme constitutes a plurality voting scheme. We have deliberately chosen to implement a plurality voting scheme, as opposed to one with ordered (ranked) preferences, because we made the (what we consider reasonable) assumption that passengers prefer to take the shortest route to their destination, and are willing to wait slightly longer to attain this goal.

The fixed route bus spawning voting system depends on capacity utilization of buses on a specific route. That is, every bus on a route votes on whether to add a bus to that route based on the utilization of its own capacity. This procedure is only started if a bus has to reject passenger at a bus station, because the bus is full. This bus then communicates with other buses to get to know their respective votes. If a bus is fuller than 80% of its capacity, it votes in favor of an additional bus, and against otherwise. Whether a bus is added is determined by majority vote. Since buses can only vote in favor or against, a majority is always reached, unless there is a tie, in which case we do not spawn a new bus.

For the fixed route voting scheme and the flexible bus voting scheme alike, the size of the bus added depends on the absolute difference of the number of waiting passengers with respect to the capacity of the route (fixed buses) or the size capacity of the entire fleet (flexible buses), respectively. The threshold for each bus size is determined empirically. The benefit of taking the absolute difference, compared to relative measures, is that the appropriate bus for the number of waiting passengers is chosen.

Retiring of buses is done according to the following rules. For the flexible buses, the ratio of the total number of waiting passengers to the total capacity of the fleet is measured. If that ratio falls below a certain (to be determined) level, the a bus is retired. This process is executed every tick.

For fixed route buses, voting is used to determine whether a bus is to be retired. If a bus is empty, this bus initiates a voting procedure. Every bus on a route then votes based on its capacity utilization. If a bus has a utilization lower than 50%, that bus votes in favor of retiring a bus. A bus votes against retiring if the utilization is above that level. A tie implies no bus is retired.