MAS report week 3

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1 Activities

In this week we shall be incorporating communication amongst busses. Although we have a plan on the how and why of messaging, we will not be implementing decision making on the basis of communication yet (that's the plan for next week). As opposed to last week the decision of which bus stop to go to is no longer determined by a fixed route, but is dynamic. We go to the next bus stop that maximises (our current definition of) utility. For this week, we only look 'one step ahead', but the functions are generalisable to plans that involve longer routes. A message is sent to all other busses before deciding on a route. Longer routes would reduce the amount of messages sent, but the system would be less robust to the fact that new passengers appear. In following weeks we need to find the right balance between amount of messages and robustness to change by way of tuning the amount of steps we look ahead.

1.1 Utility

The utility of a move to a station is defined by the sum of how many passengers a bus can drop off and how many passengers it can pick up weighted by the desire-parameter α. If the bus is mainly empty, there is more desire to pick up than to drop off, thus α will be high.

$$\alpha = \frac{\#freeseats}{buscapacity}$$

So if for station A we can pick up 2 people, drop off 5 and $\alpha = .25$, utility will be

$$u_A = \alpha 2 + (1 - \alpha)5 = 3.75$$

1.2 Messaging

It may happen that two busses decide to go to the same station. This would not maximise the global utility, because only one of the busses can pick up the

passengers there. Busses need to communicate in order to decide whether it is a better idea to let bus A or bus B go to the station in question.
Before a bus determines its route (for now that means just the next station, but it can be extended to multiple stations) it sends a message to the other busses asking for their routes. If there is no reply it means that the other busses do not intersect the proposed route. If there is a reply it is in the same form as the question. From this conflict it has to be inferred whose stepping down will maximise global utility.

A message is sent according to the following protocol:

("bus_id, current_station, target_station pickup dropoff utility, target_station pickup dropoff utility")

I am bus 22, currently at station 3, from here I can go to station 4, where I can pick up 10 people and drop off 5, which would result in utility 5.8 or I can go to station 5 where I can pick up 3 people and drop off 10, which would result in utility 7.8

("22, 3, 4 10 5 5.8, 5 3 10 7.8")

This can be extended to a route of multiple stations.

I am bus 22, currently at station 3, from here I can go to station 4, where I can pick up 10 people and drop off 5, and then go to station 8, where I can pick up 10 people and drop off 9, which would result in a total utility of 10.1 or I can go to station 5 where I can pick up 3 people and drop off 10 and then go to station 9 where I can pick up 1 person and drop of 1 which would result in a total utility of 8.2

("22, 3, 4 10 5 8 10 9 10.1, 5 3 10 9 1 1 8.2")

With all this info the busses can infer whether it is a good idea to let either bus A go to the station in question or bus B or - in the case of an especially busy station - both. There is no need to communicate the plan because both busses should infer the same thing. Next week we need to come up with what to do in case of a tie.