Bus Simulation Report

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Overview

For a given time of day (and the associated average period of passenger arrival at a non-downtown stop), 54 different combinations of number of buses (1 - 18) and inclusion of large buses (all small, half large or all large) were tested. The combination that yielded the best results was then determined. The times simulated include rush hours (avg arrival period = 40 seconds), lunch (70 seconds), night (120 seconds) and weekend (240 seconds).

Equilibrium

Running multiple simulations for the same time of day yielded the same values in nearly every case (number of buses for rush hour varied +/- 1 bus). As such, these solutions are highly likely to be at equilibrium.

Avoiding Bus Clumping

It is important to avoid bus clumping for obvious reasons. The simulation accounted for this and held buses a bit longer (45 seconds) if they were on course to clump up with a bus in front of them. For best real-world results, it will be important for drivers to wait an extra 45 seconds if there is a bus (headed in the same direction) at the stop next on their route.

Statistics Tracked

Statistics for average travel time of each passenger (avgTT), which is the time they get off the bus subtracted from time they arrived at their initial stop, and passenger miles per gallon (pmpg) were tracked. One may be concerned about working to avoid long passenger lines at each bus stop. This was not tracked directly as it would have been redundant due to the way avgTT was accounted for. In the case lines are not getting excessively long, this is clearly a non-issue. In the cases where line lengths are getting too long, arbitrarily long simulations will lead to arbitrarily long avgTT values for passengers caught in these lines. Due to the exponentially increasing weights of long travel on the determination of the best combination, excessively long lines are naturally avoided.

Conclusion

	Rush Hour	Lunch	Night	Weekend
Number of Buses	6	4	2	1
Large Bus Distribution	1	0	1	2

Based on the simulations, the resulting recommendations are summarized in the preceding figure.

Overall, these results do make sense. For the weekend, a single large bus is the best option because it won't likely get filled up and have to skip passengers (drastically increasing wait times) and it is still more efficient than two small buses in the same situation. For night time, two buses (one large and one small) are employed. With the increase in arrival rate, it makes sense that another bus would be necessary to avoid extreme wait times. Only a small one is necessary as the large bus will likely cary much of the load. As for lunch time, 4 small buses should be used. The further increased arrival rate means this makes sense, and since the four buses will cover a fairly large portion of the map at any time, excessive wait times are avoided. Finally,for rush hour, a 50/50 split of 3 large and 3 small buses should be best. This is likely influenced by inevitably large build up downtown stops during this time.