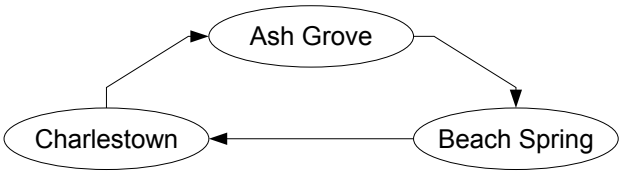
CE 3500: Homework 2
Due Monday, February 28

Problem 1. Three neighborhoods (Ash Grove, Beach Spring, and Charlestown) are connected by a one-way road as shown below, where the travel time on each roadway segment is five minutes if driving, and six minutes by bus. The AM Peak OD matrix is given as follows:

	A	B	C
A	0	100	200
B	500	0	1000
C	600	600	0

You are given utility functions $U_{car} = 2 - T_{car}/10$ and $U_{bus} = -1 - T_{bus}/10$.

1. What is the current total bus ridership?
2. How fast would the bus have to travel between Beach Spring and Charlestown to achieve a 5% share of commuters between these zones?



Problem 2. There are two routes connecting an origin and destination; the first has link performance function $t_1 = 45 + \frac{3x}{1000}$ and the second $t_2 = 20 + \frac{4x^2}{500}$. If 2500 people are traveling between these zones, use the Frank-Wolfe method to find the equilibrium route flows and travel times.

Problem 3. Consider a roadway with capacity 2000 veh/hr and free-flow speed 40 mi/hr. Initially, the flow is 1000 veh/hr and uncongested. A traffic signal is red for 45 seconds, causing several shockwaves.

1. Sketch a time-space diagram, indicating all of the shockwaves which are formed.
2. Calculate the speed and direction of each shockwave from your diagram.
3. What is the minimum green time needed to ensure that no vehicle has to stop more than once before passing the intersection? (Neglect any yellow time, reaction time, etc. Assume that when the signal is green, people move immediately, and that when it is red, people stop immediately.)

Problem 4. Extra credit: In class we used gap acceptance to calculate the "capacity" of a stop sign, assuming that no more than one car would turn in each gap. Extend this procedure to account for the possibility of multiple vehicles turning during one gap, if it is long enough.