## PCB 3043 Students

Hope you are safe from this storm. As many of you have discovered, Assignment #1 is now up on blackboard and due in a week! I was hoping to use the lecture today to explain the lab further, but we obviously didn't meet. So, here is some background and an example for this assignment.

The intent of this lab is to get you to think about different ways to think about growth. Each way has different purposes but really is just different ways to arrange the same data.

time	cars		
7:40	164		
7:45	185		
7:50	224		
7:55	266		
8:00	304		
8:05	319		
8:10	345		
8:15	380		
8:20	414		
8:25	469		
8:30	546		
8:35	594		
8:40	658		
8:45	738		
8:50	804		
8:55	884		
9:00	958		
9:05	1029		
9:10	1073		
9:15	1133		
9:20	1171		
9:25	1186		
9:30	1186		
9:35	1186		
9:40	1186		

Here are data I collected one morning for the number of cars in the parking garage next to the King Building. You can see that there were already 164 cars when I arrived that morning, but that eventually the garage filled up.

These types of data are easy to analyze in excel. Let's create some more columns, similar to what I do in the example in Assignment 1.

-- First, let's change "time" into minutes, starting at 0 and having 5 minute intervals.

-- Second, compute how much the population increases each time. This is "pop\_change" in the example and is simply the difference between the population size now and the population size 5 minutes later. In excel, you can write a formula, such as "=b3-b2", then cut and paste this formula in a column next to cars.

-- Third, we want to know how much the population changed **per-individual**. That is, the population increased in the first time interval by 21 cars (185-164). If this was a real population, then that increase would be due to reproduction among the 164 initial cars. So, the per-individual growth rate would be 21/164. Again, this can be done as a formula in excel, something like "=c2/b2".

This produces a table that looks similar to the one provided in the assignment:

minutes	time	cars	pop_change	per_capita
0	7:40	164	21	0.128
5	7:45	185	39	0.211
10	7:50	224	42	0.188
15	7:55	266	38	0.143
20	8:00	304	15	0.049
25	8:05	319	26	0.082
30	8:10	345	35	0.101
35	8:15	380	34	0.089
40	8:20	414	55	0.133
45	8:25	469	77	0.164
50	8:30	546	48	0.088
55	8:35	594	64	0.108
60	8:40	658	80	0.122
65	8:45	738	66	0.089
70	8:50	804	80	0.100
75	8:55	884	74	0.084
80	9:00	958	71	0.074
85	9:05	1029	44	0.043
90	9:10	1073	60	0.056
95	9:15	1133	38	0.034
100	9:20	1171	15	0.013
105	9:25	1186	0	0.000
110	9:30	1186	0	0.000
115	9:35	1186	0	0.000
120	9:40	1186		

The three graphs that you now need are made by plotting "cars" against "minutes", pop\_change against "minutes" and "per-capita" against "cars"

Here are my graphs:



Now, let's fix the names of the axes to use terms used to describe real population variables:



These are the graphs you would turn in with your assignment AND use to answer the questions in the assignment.

Several of you have asked about Question 3, which we have only briefly touched on in the first lecture.

3. Is there any indication that your population is self-limiting (density-dependent growth)? Explain your evidence for or against self-limitation.

What is this "self-limitation"? Self-limitation is when the population growth rate slows down as the population gets larger. The populations may do this by decreasing the per-capita birth rate or increasing the per-capita death rate. Since r = b-d, either one will result in r decreasing as density increases.

So, what you need to do is to make your three graphs, then just look at the last graph. Plotting per-capita growth rate against density is the best test for self-limitation, or what we will later call "density dependence".

So, in looking at the data from the example above, the per-capita growth rate definitely decreases as the population size gets bigger (our last graph on the right). In this case, it is likely a function of the "birth rate". Birth rate, in this case, would be anyone finding an empty parking space. Since empty spaces decline with density, the parking rate declines with density.

A good answer for Question 3 using my data would be:

"Yes, there is some indication that the population is self-limiting. The percapita growth rate (new cars per car in the garage) declines as the number of cars in the garage increases."