End of Semester Report
Spring 2005

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May 2, 2005

At the beginning of the semester I proposed to do two things. The first was to alter the model I was using to determine relationships between students at the university. The second was to create a web site where I was going to document my results and progress on this project.

1 A More Realistic Model

The main aim of this project has been to see if we can establish whether or not the University of Utah meets the criteria for a small world, as defined by Duncan Watts. To do this, I have received some data from the university where we can create a graph of students where we place an edge in the graph between students that take at least on class together. We have shown that this graph can be considered a small world. However, if we think about what really happens in the classroom, it is not realistic to think that any given student knows or interacts with, all other students in each course. So we attempted to create a more realistic graph.

In this more realistic graph, we connect students with probability

$$p\left(\frac{k_U}{n_i}\right) \tag{1}$$

Where p is a parameter chosen by us, n_i is the number of students attending the ith course and k_U is the average class size in our data set (this number is approximately 20). What this means is that in an average sized class, a student will know a certain percentage of the people in that class. This percentage is scaled with the size of the class such that in a larger class, the student knows less people, and in a smaller class, the student will know more. Experience tells us that this closely approximates reality.

We ran a few experiments to see what value of p would give us a realistic number of average connections. It turns out that if we pick $p = 0.40$, we get an average degree of 17, this is down from 208 if we connect students to everyone in all their courses. For this graph we have the results

Graph Statistics

Number of Students in Graph	28517
Avg Degree	17
Characteristic Path Length (L)	4.52656
Clustering Coefficient (γ)	0.182163

This shows that, amazingly, the U can be considered a small world even when we make drastic restrictions on how we connect the graph. It is also amazing that the characteristic path length (which measures the typical distance between nodes) only increased slightly from 2.88 to 4.52. This is a very short distance for a disease to travel.

2   Documentation and the Web site

For a large part of the semester I have been working on a web site that will document this project. The web site will eventually feature an explanation of the project, results from the various experiments I have run, the software I have written and an interactive section for students. Some of these things are not ready for release and will be added sometime this summer.

The interactive section will allows students to enter their course schedule so that they can tell a few things about themselves. After entering a course schedule, students will be able to see their Google weight, their mean path length and their clustering coefficient. There are links to definitions for all of these statistics.

The web site can be found at

$$\texttt{http://sundial.math.utah.edu/smallU/}$$

I have had a very good experience with the REU program and thank everyone involved for giving me the opportunity to participate. Thank you.