*“Using Gravity to Navigate the Internet and other Graph*

David Dailey, Deborah Whitfield and Jake Weidman

It is known that the shortest path of a graph of n nodes can be expressed with n pieces of information as is done in routing tables for accessing Internet domain names. It can be shown that a single piece of data is insufficient for determining the shortest path. This knowledge inspired the investigators to:

* look for categories of graphs that could be navigated using only one piece of data
* look for a tighter upper bound than n for the amount of information needed to determine the shortest path
* consider the type of information that a human navigating a web site would use as cues

Graph Navigability is the result of research in theoretical graph research and the implementation of a web based graphing tool (grapher). The question which is being investigated is: how much information is needed at a node in a graph for determining the shortest path to a destination node? From a graph perspective, only adjacent nodes from the source node can be examined to determine which node to visit next to find the shortest route to the destination node. From an Internet user’s perspective, what link should be followed on a page to get to the sought after page the fastest?

Graphs of size five and above where too difficult to analyze by hand, so a C program was written to perform calculations of paths. It was quickly determined that a non-textual (i.e., graphical ) program was needed in order to visualize the graphs and investigate possible path information. The C program was translated from C to Javascript and SVG; this code was then integrated into a tool written by former students.

The next portion of the implementation was to generate web sites based on graphs that the user draws. Graph nodes are web pages and edges are hyperlinks. In order to investigate how users navigate a web site, a game was created where web pages are rooms and users attempt to find “the prize” while avoiding the “bad guys”. The time users spend navigating to the prize and the path that is taken is being collected for analysis and will be the basis of a later paper.