**Math 107**

**Project 2: Traveling ESPN GameDay Problem**

**Due: Wednesday, February 22, 2011**

Suppose the ESPN GameDay college basketball show has decided to visit 8 colleges, at their basketball arenas. They would like to determine the shortest route possible that connects all eight in a circuit. Since you are now experts on Hamilton circuits, they have turned to you for help.

The 8 campuses are Wake Forest University along with the top 7 ranked schools in this week’s ESPN/USA Today poll:

|  |  |  |
| --- | --- | --- |
| **Rank** | **School** | **Stadium** |
| 1 | University of Kentucky | Rupp Arena |
| 2 | Syracuse University | Carrier Dome |
| 3 | University of Missouri | Mizzou Arena |
| 4 | Duke University | Cameron Indoor Stadium |
| 5 | Kansas University | Allen Fieldhouse |
| 6 | Ohio State University | Schottenstein Center |
| 7 | University of North Carolina | Dean Smith Center |
| -- | Wake Forest University | Lawrence Joel Veterans Memorial Coliseum |

Here is your task: working in groups of 2 (there might be one group of 3), solve this “traveling salesman” problem using three of the four algorithms presented in the book, plus one more. We won’t use the brute-force algorithm, which would require you to compute the lengths of 7!/2=2520 different circuits. Instead, you will use these 4 algorithms:

* Visit in Order
* Nearest Neighbor
* Repetitive Nearest Neighbor
* Cheapest Link

We all want to use the same data, so the following instructions are **very important**. Enter the stadium name, exactly as written in the third column, into Google Maps ([maps.google.com](http://maps.google.com)) to find the distance between each pair of schools. You must enter each name exactly as above and hit return; do not choose a location from Google’s scrolldown menus. (Google Maps sometimes suggests locations that are incorrect!)

Next, begin with a copy of a US map (available on Sakai). Plot and label each school on your map and using a ruler draw a straight line (i.e., an edge of our graph) between each pair of schools; label each edge with the distance Google Maps gives us. (Use the first route suggested, even if a shorter route exists.)

*Visit in Order*

Start here at Wake Forest, and make a Hamilton circuit by first traveling to the #1 ranked school, then #2, then #3, and so forth until #7; finally come back to Wake Forest. Calculate the total length of this circuit. Draw the resulting circuit on a separate copy of the US map, again using a ruler.

*Nearest Neighbor Algorithm*

Start here at Wake Forest, and apply the algorithm to find a Hamilton circuit. Calculate its total length. Draw the resulting circuit on a separate copy of the US map, again using a ruler.

*Repetitive Nearest Neighbor Algorithm*

For each of the other 7 schools, start there and then run the nearest neighbor algorithm. Calculate its total length. The winner of this algorithm is the one with the shortest length among all 8. Draw the resulting circuit on a separate copy of the US map, again using a ruler.

*Cheapest Link Algorithm*

Use the algorithm to find a Hamilton circuit. Calculate its total length. Draw the resulting circuit on a separate copy of the US map, again using a ruler.

**WRITTEN PROJECT**

Your project should consist of a written document, plus 5 maps (one with all the distances, and one each for the four circuits you find). The written document should begin with a summary of what distances you found; which method produced the shortest length circuit? In particular, how much further was the “Visit In Order” circuit than the optimal one you found.

Then, in a separate section per algorithm, write out what circuit you found and discuss how you found it. Show how you calculated its length.

Writing this document will be a challenge. You will need to convey a lot of information in an efficient way that is appealing to read. You are encouraged to type everything; if you must hand-write computations, do so in ink. You are encouraged to use tables and abbreviate the school names.

**GRADE**

This project is worth 100 points towards your “Projects and Group Work” grade. (We will have at least one item from almost every topic in this category.) I reserve the right to give different group members different grades, though this rarely is an issue.

The project will be graded on a letter scale (e.g., A-, B+, …) If you do all computations correctly and I can understand your project, you will earn at least a B. To earn an A, your project should look good and be well-written and easy to follow. You will be graded on how neat and professional your maps appear. Every day late is a letter-grade deduction; a project submitted on Wednesday after class begins will get a 1/3 letter-grade deduction.

*Note:* You must do all computations by yourselves; no working with other groups or using web applications for minimizing distances. You may ask me, the TA’s, and the Math Center for help.