Instructions

To earn credit toward grade advancement, this project must be

- completed and turned in by Monday, February 15 at 4pm.

- typed, though hand-drawn figures are allowed.

- show firm grasp of the mathematics by being complete and correct.

These are non-negotiable requirements. A paper which makes a good effort but falls just short will be given one opportunity to be revised and resubmitted. This decision will be at the discretion of the instructor.

The Assignment

On the second page is a picture for the game board for the popular tabletop game *Ticket to Ride*. This game is played on a multigraph! Here the cities are the vertices and the edges represent train lines between different cities.

The details of the game are not important for this project, we just want the graph. So, please ignore the colors on the edges. Also, the lengths of the individual edges is really important in the game, but please ignore that detail for now. All that is important is that some cities are connected and some are not.

But there is an important detail you should be sure to note: Several of the edges are *doubled* — that is there are really two routes between certain pairs of cities. For instance, there are two routes between Portland and San Francisco, and there are two routes between Duluth and Omaha. There are several of these. We will consider each of these routes as edges, so this is a multigraph.

- Explain why this multigraph is not Eulerian.

- Find the chromatic number of this multigraph. Explain how you know for sure your answer is the correct one.

- We are really interested in making an Eulerian circuit, so we will add edges representing plane flights! Describe a set of such additional edges which will allow you to find an Eulerian circuit. Write an itinerary for an Eulerian circuit on your new graph. There are no vertices in Iowa, so pretend that your home base (the starting point for your journey) is Chicago.