Traveling Carnival

Brief Description:
There are twelve poles, each marked with the name of a hypothetical city. Visitors try to plan the shortest route that visits all twelve cities in a loop, ending where it started. Using the surveyors' wheels, they then walk the route and measure the distance. The shortest route is posted and subsequent participants try to find a shorter route.

Objectives:
Students can learn about the basics of networks and optimization at this exhibit based on a very practical real-world problem. Activities include identifying the route that appears optimal, measuring the total distance traveled, and estimating distances to assess the reasonableness of their result.

Links to Websites:
http://mathmidway.org/Training/carnival.php

http://maps.google.com

Vocabulary:

Circuit	Distance between two points
Dodecahedron	Euler's circuit
Graph	Hamiltonian path
Path	Platonic solid
Vertex	

Before:
- ⊙ (*Level 1, 2, 3*) Discuss forming your own path.

- ⊙ (*Level 2, 3*) A great topic to explore before seeing the Traveling Carnival is the **Hamiltonian circuit**. This is a path that visits every vertex of a graph once and only once. The end point must be the same as the starting point in order to form a circuit. The route students take at the Traveling Carnival exhibit will also involve visiting every location in space exactly once and then returning to the start point.

- ⊙ A fun Hamiltonian puzzle known as the Icosian game can be found on the following sheet. Icosian Game: Find a path around the shape so that you visit every vertex (the lettered points) exactly once and end at the starting point.
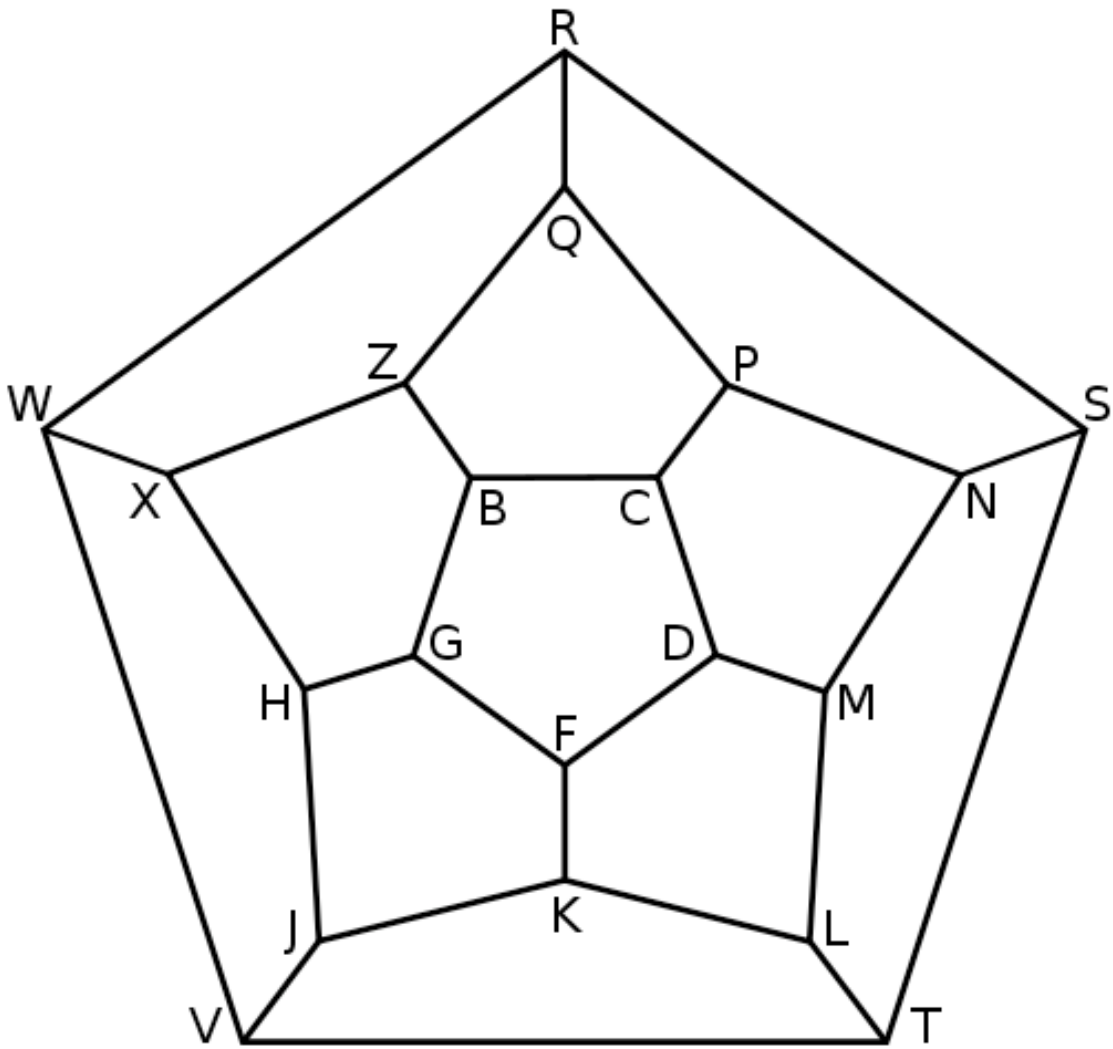
During:

⊙ (*Level 2, 3*) Have each student or small groups of students plan a route and walk it. Record the routes and distances to examine whose route is the shortest. *Does the starting location affect the efficiency of the route?*

After:

⊙ (*Level 1, 2, 3*)Using the map on the following page, visit each city on the list below. Make sure to return to the starting city. Calculate the total mileage by using the ruler on the map. Measure straight as if you were flying directly between the cities. Google Maps, http://maps.google.com, can be used to calculate the total mileage. Use "Get directions" function to find the mileage between the cities if you drive. Use the first suggested route when getting the mileage from Google Maps.
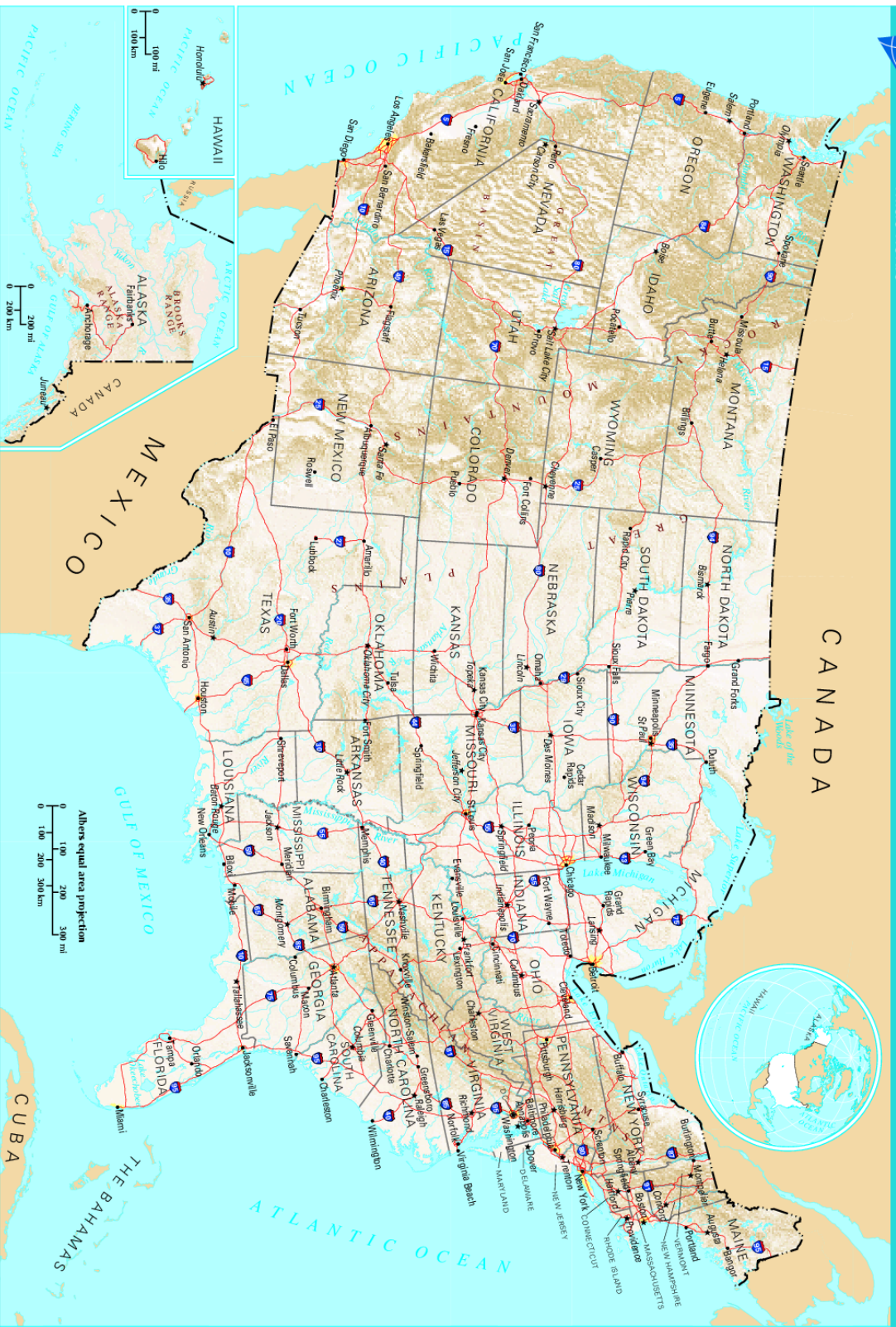
Here are the cities you need to visit:

Albuquerque, NM
Atlanta, GA
Denver, CO
Houston, TX
Philadelphia, PA
Seattle, WA
Wichita, KS

nationalatlas.gov™
Where We Are

GENERAL REFERENCE

Albers equal area projection

0 100 200 300 mi
0 100 200 300 km

Oceans and regions: PACIFIC OCEAN, ATLANTIC OCEAN, GULF OF MEXICO, ARCTIC OCEAN, BERING SEA, GULF OF ALASKA, CANADA, MEXICO, CUBA, THE BAHAMAS

States: WASHINGTON, OREGON, CALIFORNIA, NEVADA, IDAHO, MONTANA, WYOMING, UTAH, ARIZONA, NEW MEXICO, COLORADO, NORTH DAKOTA, SOUTH DAKOTA, NEBRASKA, KANSAS, OKLAHOMA, TEXAS, MINNESOTA, IOWA, MISSOURI, ARKANSAS, LOUISIANA, WISCONSIN, ILLINOIS, MICHIGAN, INDIANA, OHIO, KENTUCKY, TENNESSEE, MISSISSIPPI, ALABAMA, GEORGIA, FLORIDA, SOUTH CAROLINA, NORTH CAROLINA, VIRGINIA, WEST VIRGINIA, PENNSYLVANIA, NEW YORK, MAINE, VERMONT, NEW HAMPSHIRE, MASSACHUSETTS, RHODE ISLAND, CONNECTICUT, NEW JERSEY, DELAWARE, MARYLAND, ALASKA, HAWAII

GREAT BASIN, GREAT PLAINS, BROOKS RANGE, ALASKA RANGE

Cities (selection): Seattle, Olympia, Spokane, Portland, Salem, Eugene, Boise, Pocatello, Helena, Missoula, Butte, Billings, San Francisco, Oakland, San Jose, Sacramento, Fresno, Los Angeles, San Diego, San Bernardino, Bakersfield, Reno, Carson City, Las Vegas, Phoenix, Tucson, Flagstaff, Salt Lake City, Provo, Albuquerque, Santa Fe, Roswell, El Paso, Denver, Colorado Springs, Pueblo, Fort Collins, Cheyenne, Casper, Rapid City, Pierre, Bismarck, Fargo, Grand Forks, Sioux Falls, Sioux City, Lincoln, Omaha, Des Moines, Cedar Rapids, Topeka, Wichita, Kansas City, Lubbock, Amarillo, Oklahoma City, Tulsa, Fort Smith, Little Rock, Springfield, Jefferson City, St. Louis, San Antonio, Austin, Fort Worth, Dallas, Houston, Shreveport, Baton Rouge, New Orleans, Jackson, Meridian, Memphis, Nashville, Minneapolis, St. Paul, Madison, Milwaukee, Green Bay, Duluth, Chicago, Peoria, Springfield, Indianapolis, Fort Wayne, Evansville, Louisville, Lexington, Frankfort, Cincinnati, Columbus, Cleveland, Toledo, Detroit, Lansing, Grand Rapids, Pittsburgh, Harrisburg, Philadelphia, Baltimore, Washington, Dover, Richmond, Norfolk, Virginia Beach, Charleston, Charlotte, Raleigh, Greensboro, Winston-Salem, Columbia, Greenville, Wilmington, Savannah, Atlanta, Macon, Columbus, Montgomery, Birmingham, Tallahassee, Jacksonville, Orlando, Tampa, Miami, Mobile, Buffalo, Syracuse, Albany, New York, Trenton, Hartford, Providence, Boston, Springfield, Montpelier, Concord, Portland, Augusta, Bangor, Burlington

Alaska: Fairbanks, Anchorage, Juneau
Hawaii: Honolulu, Hilo

Scale bars:
Hawaii: 0 100 mi / 0 100 km
Alaska: 0 200 mi / 0 200 km