Assignment One - Due Tuesday April 26, 2004

September 9, 2967

In this assignment you shall record the development of our moon. The moon itself contains three different polygonal region types: ore fields, ice fields and mountain ranges. There are circular dome cities and point based space ports as well. Finally transport tunnels are paths that connect dome cities to space ports, space ports to space ports and dome cities to dome cities. All the coordinates are specified in 90 to -90 degree latitude and -180 to 180 longitude. The radius of the moon is 1737.4 kilometers. With the exception of the mountain ranges, each object has a valid start date and a valid end date as well.

1 Tasks

1.) Define an EER diagram modeling moon colonization.

2.) Translate the EER diagram to a PostgreSQL schema.

3.) Inserts:
   a. Insert at least 3 mountain ranges, 3 ore fields and 3 ice fields.
   b. Insert the initial space port (named 'Usov SP') and dome city in 2050.
   c. Insert 3 subsequent space ports, cities, and transport tunnels over the next 100 years.
   d. Record the shrinkage of an ore and ice field in the next 100 years.
   e. Between year 2500 and 2600 one thousand dome cities were started on the moon.

4.) Queries

Colonization started in 2050 and, last we checked, it is still going strong.

Use the conventions in the course notes. You may ignore complications arising from temporal variables.
a. Fetch the space ports active in year 2100. Repeat query for year 2700.
b. Fetch all the dome cities within 300 km of 'Usov SP' in year 2100. Repeat query for year 2700.
c. Fetch all the ore fields within 300 km of 'Usov SP' in year 2100. Repeat query for year 2700.
d. Fetch all the dome cities within 300 km of an ice field in years 2100. Repeat at query for year 2700.
e. Fetch the closest ore field to 'Usov SP' in year 2100. Repeat query for year 2700.

2 Extra Credit

5.) Block the placement of dome cities or space ports in the mountains and block the overlap of dome cities with themselves or space ports.
6.) Display the answers to the select queries above on a map.
7.) Back the map with an image of the lunar surface.
8.) Build a web interface to your system, but only if you have a map to show.
9.) Fetch the dome cities connected via (a single hop) transport tunnels to 'Usov SP'.
10.) Fetch the dome cities recursively connected via (multiple hops) transport tunnels to 'Usov SP'.
11.) Use spatial indexing (rtrees) to improve the performance of the queries in task 4. Document performance in contrast to sequential scanning.

3 What to hand in

Hand in a paper copy with the above problems documented. Place in the proper box on the 4th floor of MIT huset. Be able to demonstrate the system if called upon to do so.