

Quiz

CSC222 Geographic Information Systems

12 November 2014

1. Divides are invisible but important delineators of the structure of a continent.
 - (a) When rain falls on the Hill of Three Waters near Hibbing, Minnesota, where does the water go?
 - (b) When rain falls in the Red Desert of Wyoming, where does the water go?
2. Mining has shaped the landscape and economy of Iowa and nearby states. Mines have drawn immigrants to the region and thereby determined the composition of our population and our culture.
 - (a) Quarry Park and Nature Preserve in Waite Park, Minnesota contains flooded quarries. What product did these quarries yield in years past?
 - (b) Wazee Lake Recreation Area is near Black River Falls, Wisconsin. The lake is a flooded pit that miners excavated. Miners removed what kind of ore from here?
 - (c) The Keweenaw National Historic Park lies just north of Houghton and Hancock, Michigan. It preserves the history of what kind of mining that took place on the shores of Lake Superior?
 - (d) In Mineral Point, Wisconsin and in Galena, Illinois and at the Mines of Spain State Recreation Area near Dubuque, Iowa you can find reminders of an industry that once produced ore of what metal?
 - (e) Buxton, Iowa was a center for what other kind of mining?
3. Although we are a thousand miles from any ocean, that transport of goods over water has been and remains a very important component of our region's economy. Enormous ships come and go from ports in Minnesota. Barges carry Iowa's grain to seaports.
 - (a) Identify a port in Iowa.
 - (b) Identify a port in Minnesota.
4. We all carry in our heads pictures of the world. Some of these mental maps might be misleading.

- (a) Which state has the most lighthouses?
 - (b) The capitals of how many states lie west of Los Angeles?
 - (c) How many states include points that lie farther north than the most southerly point in Canada?
5. A map-maker cannot measure the height of the land at every point. If we wish to draw contour lines, a shaded image, or some other kind of map that shows the shape of the earth's surface in three dimensions, we must interpolate between measured points.

A spline is a kind of interpolating curve. Points on a spline can be found by computing weighted averages of the vertices of a polygon. The curve will lie within the polygon. Computer scientists usually prefer to define splines with polygons that have four vertices because that choice strikes a good balance between the amount of computation we must do and the ease with which we connect curves in a smooth way.

The computation of the y coordinates of points on a curve is just like the computation of the x coordinates. Here you see the computation of just the x coordinates.

- x_0, x_1, x_2, x_3 are the x coordinates of the points that define a polygon.
- x_{01} is a weighted average of x_0 and x_1 .
- x_{02} is a weighted average of two weighted averages, x_{01} and x_{12} .
- x_{03} is a weighted average of weighted averages of weighted averages—it is the x coordinate of a point on the interpolating spline.

In these equations...

- (a) which variable represents the weight?
- (b) what range of values will we assign to that weight?

$$x_{01} = (1 - t) \cdot x_0 + t \cdot x_1$$

$$x_{12} = (1 - t) \cdot x_1 + t \cdot x_2$$

$$x_{23} = (1 - t) \cdot x_2 + t \cdot x_3$$

$$x_{02} = (1 - t) \cdot x_{01} + t \cdot x_{12}$$

$$x_{13} = (1 - t) \cdot x_{12} + t \cdot x_{23}$$

$$x_{03} = (1 - t) \cdot x_{02} + t \cdot x_{13}$$