**Preview Questions**

1. What is representation?
2. Why is representation important?
3. What are fields and objects?
4. What is the difference between raster and vector representations?
5. What are the similarities and differences between online and paper maps?
6. What are map generalization methods?
7. What is representational scale?

**Summary Notes**

* Representations are constructions of a digital model of some aspect of the Earth’s surface.
* Representations enable us to learn, think, and reason about places and times outside of our immediate experience.
* Generalizations remove unnecessary detail for a particular application.
* Data models are formalized concepts in digital representations that fit with our mental concepts of the Earth.
* Ontologies are frameworks used for acquiring knowledge about the world.
* Almost all human activities require knowledge about the Earth’s past, present, or future.
* Representations occur in various forms:
  + In the human mind.
  + In photographs.
  + In spoken descriptions.
  + In text descriptions.
  + In numbers from measurements.
* Digital representations have become very important in our society.
* We see views that present the contents of the representation in a form that is meaningful to us.
* Advantages of digital representations:
  + We can use the same inexpensive devices to handle every type of information.
  + Digital data is easy to copy.
  + Digital data is quickly transmitted.
  + Digital data can be stored with high density in small physical spaces.
  + Digital data is less susceptible to physical deterioration.
  + Digital data is easy to transform, process, and analyze.
* Geographic representations are representations of some part of the Earth’s surface or near-surface and can be of varying scales from micro to macro.
* Paper representations were flat but enormously effective because they were cheap, light, and durable.
* The Age of Discovery was the period of European history that led to the accumulation of large amounts of information about other parts of the world.
* The key geospatial information (GI) representation issues:
  + What to represent.
  + How to represent it.
* Accuracy is an important criterion for evaluating the usefulness of a representation.
* Representations are used for training, exploring future scenarios, and re-creating the past.
* An atom of geographic data (i.e., geographic datum) links a place, a time, and some descriptive property (i.e., attribute).
* The world is infinitely complex and the number of geographic datum required for a complete representation is similarly infinite.
* Representations must limit the amount of detail captured.
  + Don’t look too closely.
  + Don’t waste effort representing properties that remain constant over large areas.
* Discrete objects have well-defined boundaries and can be counted.
* The ability of GI systems to handle three-dimensional objects as volumes with associated surfaces is limited.
* Continuous fields have a finite number of variables with each one defined at every possible position.
* Continuous fields are distinguished by what varies and how smoothly.
* What varies in a continuous field can be nominal, ordinal, interval, ration, or cyclic.
* Vector fields assign magnitude and direction and are used to represent flow phenomena.
* Scalar fields have only one variable.
* Discrete objects and continuous fields are conceptualizations; each may require an infinite amount of information for a full description.
* Both rasters and vectors can be used to code both continuous fields and discrete objects.
* There is a strong association between continuous fields and rasters.
* There is a strong association between discrete objects and vectors.
* Rasters divide the world into arrays of cells and assigns attributes to the cells.
* Rasters require the Earth to be flattened as such the cells in a raster can never be perfectly equal in shape because of distortion.
* Raster cells tile an area and a raster is an instance of tessellation.
* All detail about a cell in a raster is lost.
* In vector data lines are captured as points connected by precisely straight lines.
* In vector data, curves are approximated by increasing the density of points.
* A polyline is a curved line represented by a series of straight segments connecting vertices.
* Raster data may be more honest to the inherent quality of the data.
* Commonly implement alternatives for representing continuous fields:
  + Regularly spaced sample points.
  + Irregularly spaced sample points.
  + Single value of the variable for a regularly shaped cell.
  + Single value of the variable for an irregularly shaped cell.
  + Capture the linear variation of the field variable over an irregularly shaped triangle.
  + Capture isolines of a surface as digitized lines.
* Representation affects the conception of spatial autocorrelation.
* Many of the ideas associated with GI are inherited directly from paper maps.
* A digital line graph (DLG) is a vector representation.
* Digital representations can include information that would be difficult to show on maps.
* Generalizations carefully select what information to include in a geographic database to fit within the limited capacity of computer storage devices.
* A map specification defines how real features on the ground are selected for inclusion on the map.
* McMaster and Shea generalization rules:
  + Simplification creates a simpler shape.
  + Smoothing replaces sharp and complex forms with smoother forms.
  + Collapse replaces an area object with a combination of point and line objects.
  + Aggregation replaces a large number of distinct symbolized objects with a smaller number of new symbols.
  + Amalgamation replaces several area objects with a single area object.
  + Merging replaces several line objects with a smaller number of line objects.
  + Refinement replaces a complex pattern of objects by something the preserves the pattern’s general form.
  + Exaggeration is the relative enlargement of an object to preserve its characteristics.
  + Enhancement alters the physical sizes and shapes of symbols.
  + Displacement moves objects from their true positions to preserve their visibility and distinctiveness.
* Two forms of generalization of attributes:
  + Classification generalization reclassifies the attributes of objects into a smaller number of classes.
  + Symbolization generalization changes the assignment of symbols to objects.
* Weeding simplifies a line or area by reducing the number of points in its representation.
* OpenStreetMap < [www.openstreetmap.org](http://www.openstreetmap.org) > is a crowd-sourced digital map of the world.

**Additional Questions of Interest**

1. What is the definition of “near-surface”?
2. What is the definition of spatial autocorrelation?