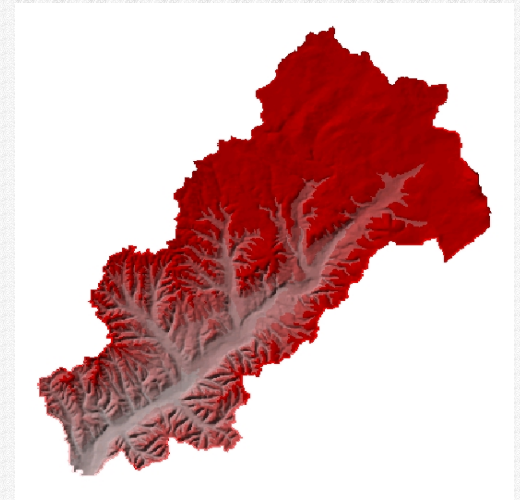


Data in a GIS ...



What is spatial data?

- Any data that is associated with a specific geographic location
 - Aerial photography
 - Remotely sensed imagery
 - Road networks
 - Wetlands delineation
 - Stream gauges
 - Dam sites



Spatial Data

- Representation of the physical or social world in which the complexity of the real world is simplified
 - Simplifying features
 - Eliminating features
- Scale, as it exists on maps, applies to spatial data
 - Sampling of data
 - Controls degree of simplification and the selection of features to eliminate

Spatial Data Types

- Raster
 - Remotely Sensed Imagery (with data for individual bands), DEMs
- Vector
 - Points
 - Lines
 - Polygons
- Image
 - (scanned images, georeferenced)

Raster data

- Matrix of numbers (or cells)
- Represents the entire area, whether any of the map phenomena exists or not
- Best representation for phenomena that varies continuously over the surface of the earth (rainfall, elevation)

ASCII storage of raster data

```
230 230 232 234 236 238
229 230 231 232 235 237
228 229 230 232 234 236
226 228 230 232 234 235
224 227 229 230 232 234
```

X1 = -72.2, Y1 = 41.0, cell size = 30 meters

Display of raster data



A portion of a USGS DEM

Each “cell” in the database represents a single elevation.

The cell size is 30 meters. The elevation is the average of all samples within the cell.

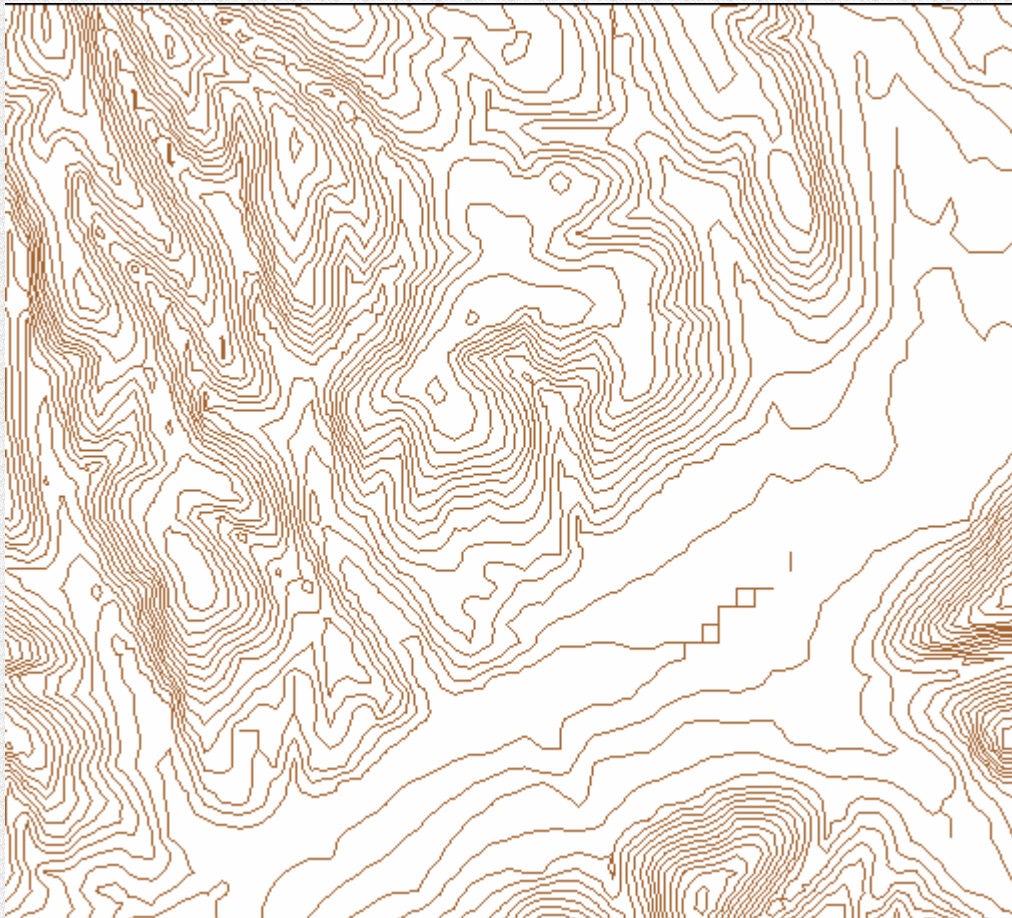
Vector data

- A network of points, lines, or polygons
- Points are the basic unit
- Lines connect points
- A group of lines enclose a polygon
- Represents where phenomena exist
- Best representation of discrete data (roads, wells, utility lines)

ASCII storage of vector data

```
230  
-72.2 41.0  
-72.1 40.9  
-72.0 40.8  
-71.9 40.7  
-71.8 40.6
```

Display of vector data



Contour lines
created from the
DEM

Each line represents
a line of equal
elevation.

The elevation value
is stored as an attribute
of the line.

Image data

- Reference for other data
- Data source – digitize directly from scanned, georeferenced image

Display of Image Data

Both images are georeferenced (can be viewed with other spatial data)

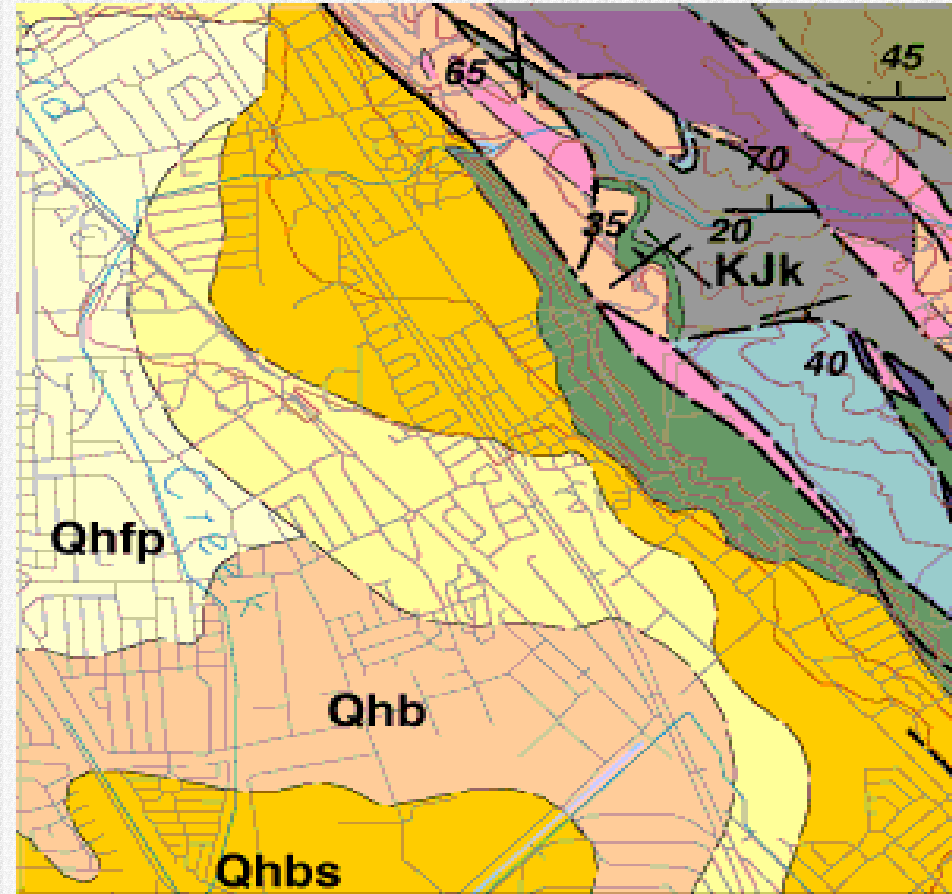
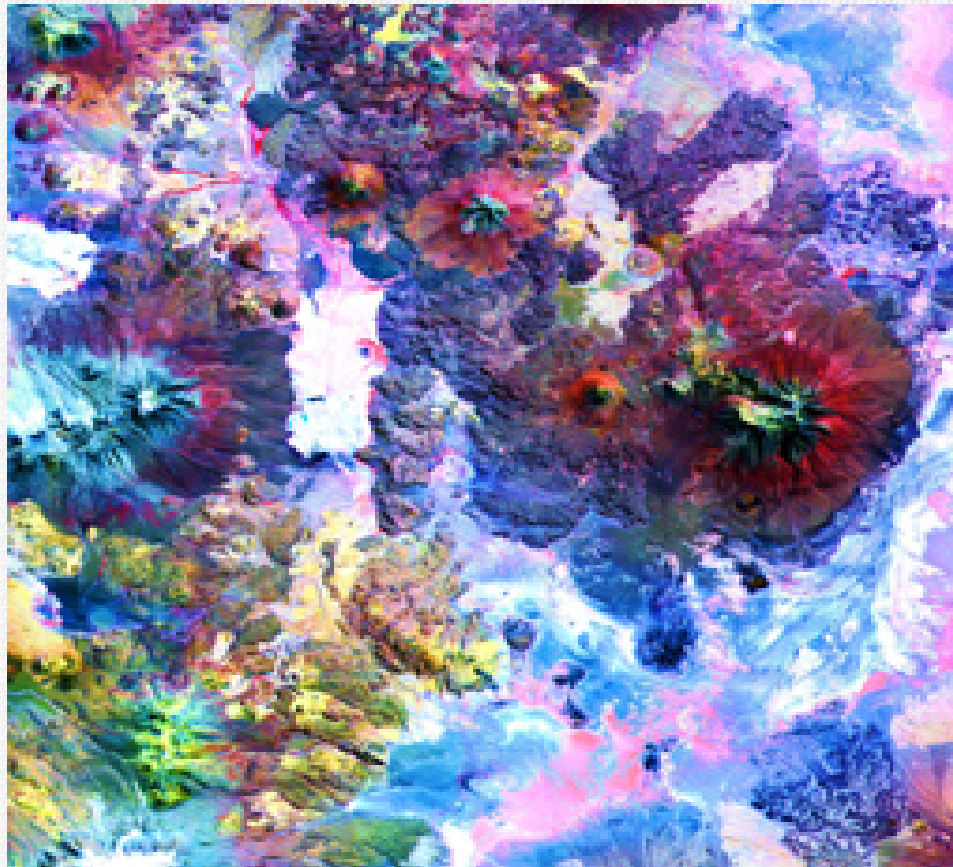
Orthophoto of part of MIT Campus



Scanned image of part of U.S.G.S Topographic map

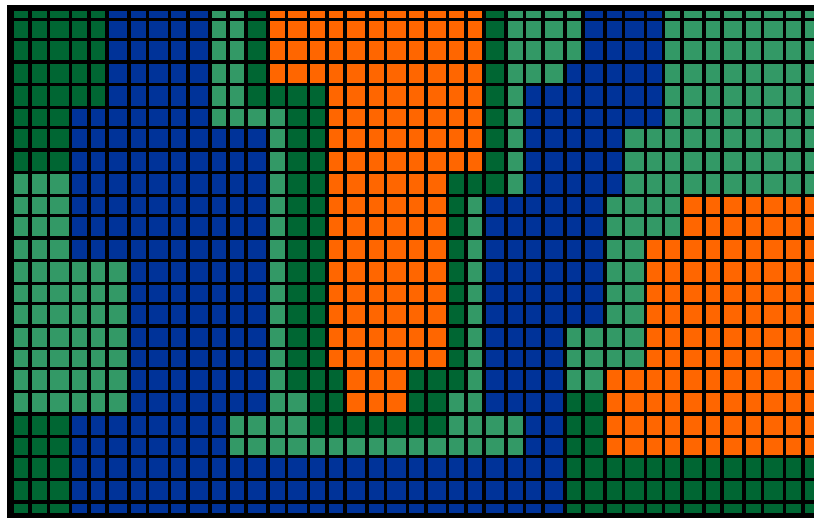


Raster (image) vs Vector data



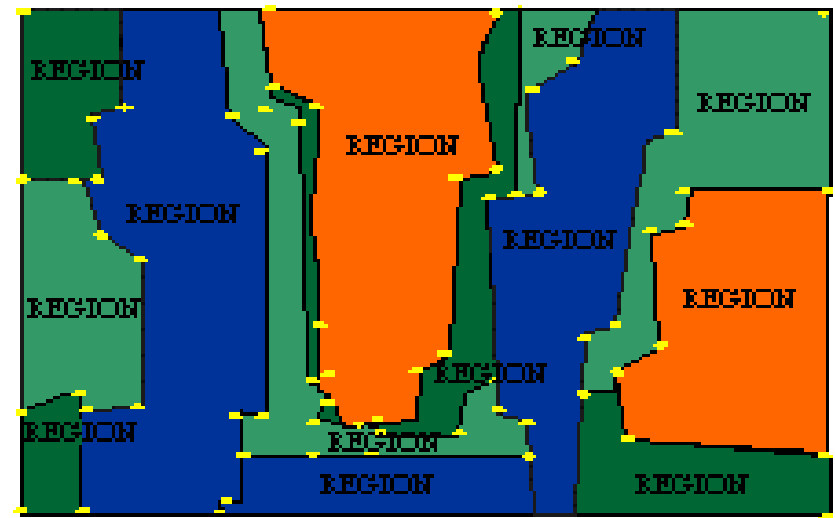
Raster vs Vector data

Raster View



Urban land use Water Forest Grassland

Vector View



Points

Lines

Polygons

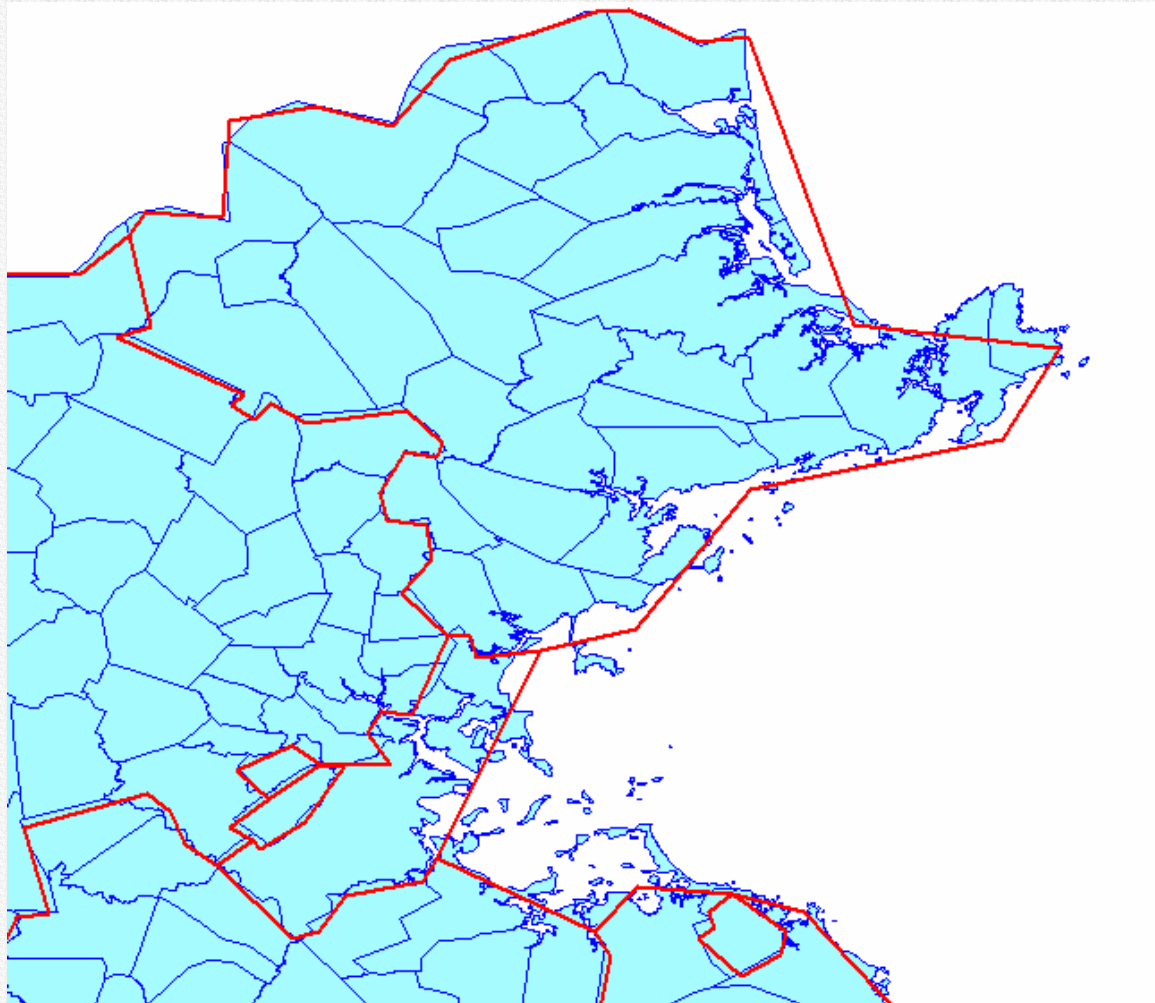
Raster vs Vector data

- Precision of geographic representation
- Processing speed
- Data storage requirements
- Characteristics of the data
- Sampling requirements

Data Issues in a GIS

- Scale problems
 - Scale based on presumed use
 - Different scales lead to different precision of data
- Database tiling
 - Data is available in different geographic units

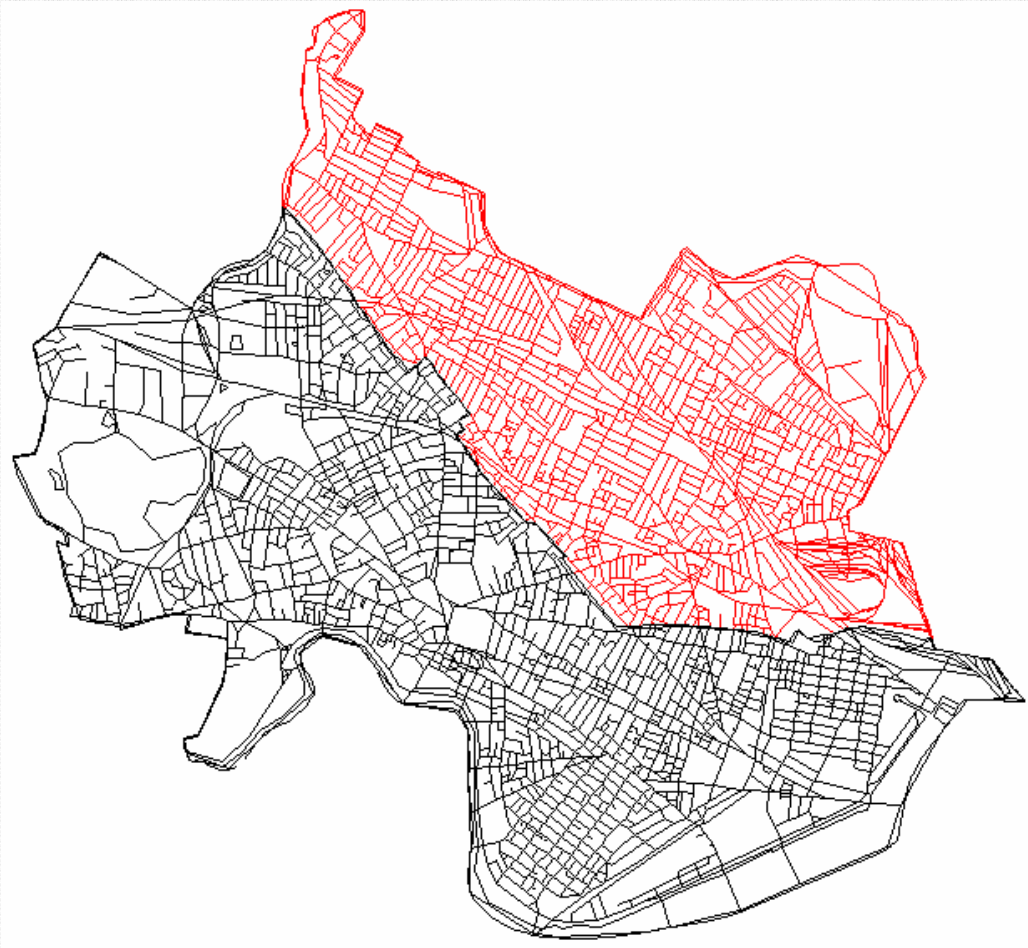
Scale problems



Massachusetts towns (blue) and county outlines (red).

Town data was Digitized at 1:250,000 scale. County data was Digitized at 1:6,000,000

Database tiling issues



Cambridge (black)
and Somerville (red)
street network.

Census street files are
distributed by town.

What is ArcGIS and ArcMAP?

- A desktop GIS software that:
 - Displays spatial and tabular data
 - Uses SQL to query spatial data
 - Finds attributes of spatial features
 - Classifies features for mapping
 - Selects features based on its attributes or proximity to other features
 - Finds places where different features overlap

Basics of ArcGIS

- Map is the “view” of data
- Data are added to the map view as “layers”
- A layer can be used for analysis whether or not it has been added to the map

What data can be used in ArcGIS?

- Vector data
- Image data
 - Air Photos
 - Remotely sensed imagery
- Raster data

On to the exercise