Introduction to the 176A labs and ArcGIS

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Purpose of the labs

- Hands-on experience with a leading software package
- Introduction to issues and problems of software use
- Reinforce lecture topics
- Learn more about theory by practice
- Means to assess student achievement
ArcMap
Create maps
View and edit data
Analyze data (Geoprocessing)

ArcCatalog
View data (like Windows Explorer)
Graphical previews
Metadata
Tables
Arc ToolBox
Map Projections
Tools for commonly used tasks

ArcTools
Geoprocessing
Models
Geovisualization
Geodatabase
Maps
Databases

Arc Map
Arc Catalog
Using ArcCatalog

ESRI GIS History

Arc/Info (coverage model)
Versions 1-7 from 1980 – 1999
Arc Macro Language (AML)
ArcView (shapefile model)
Versions 1-3 from 1994 – 1999
ArcGIS (geodatabase model)
Version 8.0, …, 9.3 (and 10.+)
from 2000 – Visual Basic for Applications. After 9: Python

160,000 licenses
1,200,000 users as of 2004

Data Models

• A geographic data model is a structure for organizing geospatial data so that it can be easily stored and retrieved.

File-based Data Models

Geographic coordinates and attributes are stored in separate but linked files

• Coverages
  – Developed for workstation
  – Arc/Info ~ 1980
  – Complex structure, proprietary format
  – Attributes in Info tables
  – .e00 export format still common

• Shapefiles
  – Developed for ArcView ~ 1993
  – Simpler structure in public domain
  – Attributes in dBase (.dbf) tables
Storing Data

Coverages
- California
  - Counties
  - Census
  - Info

Shapefiles
- California
  - Counties.shp
  - Counties.shx
  - Counties.dbf
  - Tracts.shp
  - Tracts.shx
  - Tracts.dbf

Geodatabases and Feature Datasets
- A **geodatabase** is a relational database that stores geographic information.
- A **feature dataset** is a collection of feature classes that share the same spatial reference frame.

Geodatabase model
- Stores geographic coordinates as one attribute (shape) in a relational database table
- Uses MS Access for “Personal Geodatabase” (single user)
- Uses Oracle, SQL/Server, dB2 or other commercial relational databases for “Enterprise Geodatabases” (many simultaneous users)

ArcGIS Geodatabase
- Workspace
  - Geodatabase
  - Feature Dataset
    - Feature Class
      - Geometric Network
        - Relationship
          - Object Class

Ex: Data.mdb
- Texas
  - Counties
  - Evap
**Object Class**

- An **object class** is a collection of objects in tabular format that have the same behavior and the same attributes.

An object class is a table that has a unique identifier (ObjectID) for each record.

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**Feature Class**

- A **feature class** is a collection of geographic objects in tabular format that have the same behavior and the same attributes.

Feature Class = Object class + spatial coordinates

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**Relationship**

- A **relationship** is an association or link between two objects in a database.
- A relationship can exist between spatial objects (features in feature classes), non-spatial objects (objects in object classes), or between spatial and non-spatial objects.
### Relationship

**Relationship between spatial and non-spatial objects**

- **Water quality data** (non-spatial)
- **Measurement station** (spatial)

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### Network

- A **network** is a set of edges (lines) and junctions (points) that are topologically connected to each other.
- Each edge knows which junctions are at its endpoints.
- Each junction knows which edges it connects to.

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### Licenses and Keycodes

License manager keeps track of number of simultaneous users and limits them to allowable number. Licenses are checked out on a first come-first-serve basis.

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### ArcGIS Extensions

**ArcView, ArcEditor, and ArcInfo**
- Advanced raster modeling
- ARC/INFO calculator with ARC/INFO algebra
- VISA for raster analysis

**ArcGIS Spatial Analyst**
- ArcScene – real-time interactive three-dimensional scenes
- Scene views in ArcCatalog
- Three-dimensional modeling tools
- ARC/INFO tools

**ArcGIS 3D Analyst**
- Advanced analysis and surface modeling
- Expansive spatial data analyst tools
- Probability, threshold, and error mapping

**ArcInfo only**
- ARC/INFO commands in Arc program
- Surface analysis command

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Spatial Analyst

- Analysis of land surface terrain as a grid
- Key means of defining drainage areas and connectivity to stream network

Geostatistical Analyst

- Interpolation of points to a grid using statistical correlation
- Produces a standard error of estimate of each map location

Grid Datasets

- Grid datasets

Image Datasets

- Digital Orthophotos and satellite imagery
  - Image datasets
3-D Analyst

- Analysis of land surface terrain as triangulated irregular network (TIN)
- Visualization in 3-D using ArcScene

Stream channel of Pecan Bayou, TX

TIN Datasets

- TIN datasets

Points and breaklines from which a TIN is constructed

ArcGIS Server: Interactive Campus Map

ESRI Software/Reference

- http://www.esri.com/library/ - Reference material and brochures about ESRI products
- ESRI Virtual Campus – provides online training http://campus.esri.com
- Free ArcExplorer spatial browser http://www.esri.com/software/arcexplorer/