Programs in Geographic Information Systems and Science at AUM

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What Is GIS?

• **Intergraph**
  - A data management system that allows you to capture, store, analyze, and display geographic information.

• **ESRI**
  - A collection of computer hardware, software, geographic data, personnel and processes designed to efficiently capture, store, update, manipulate, analyze, and display different forms of geographically referenced information.
What Does A GIS Do?

• Maps represent where features or entities exist in the real world. (SPATIAL)

• All maps provide relative locations. (SPATIAL)

• Some maps provide both relative and absolute locations of entities. (SPATIAL)

• A GIS organizes information about locations (attributes) according to location. (ASpatial)
  – Links geographic locations with information about locations so you can create maps, make decisions, identify spatial relationships, and analyze information.
  – For example, where do we find the highest frequencies of water jars at a particular site?
A GIS Has Relational Databases

### Quadrats Table

<table>
<thead>
<tr>
<th>Quadrat no.</th>
<th>Collector</th>
<th>Collection date</th>
<th>Site no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Smith</td>
<td>6/10/96</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Jones</td>
<td>7/01/96</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Species Code Table

<table>
<thead>
<tr>
<th>Quadrat no.</th>
<th>Species no.</th>
<th>Latitude</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>35.19°N</td>
<td>106.10°W</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>35.20°N</td>
<td></td>
</tr>
</tbody>
</table>

### Species Table

<table>
<thead>
<tr>
<th>Species no.</th>
<th>Species name</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Conomyrma insana</td>
<td>Generalist</td>
</tr>
<tr>
<td>2</td>
<td>Pogonomyrmex rugosus</td>
<td>Specialist</td>
</tr>
</tbody>
</table>
**How Does A GIS Really Work?**

Topology: a mathematical model used to define spatial relationships.

Topology is like the icing between layers of a cake. It binds them together as one.

Arc: a series of points that start and end at a node.

Node: an intersection point where two or more arcs meet or they can occur at the end of dangling arcs.

Polygons: a closed chain of arcs representing the boundaries of an area.

Topology is stored in three data tables, one for each type of element. Coordinate data are stored in a fourth table.

Advantage: contiguity (adjacency) and connectivity (networks, optimum routes) analyses can be accomplished without using coordinate data.
What Could You Do With A GIS?

- **Visualize geospatial data**... assess information by seeing it in virtual space.
- **Organize data**... structure data according to geographic coordinates and logical spatial relationships.
- **Integrate data**... combine geographic data from a variety of sources such as maps, air photos and tabular information in a coherent and compatible (geo-referenced) manner.
- **Merge data**... join a-spatial data (attributes) to spatial data (objects).
- **Analyze**... infer meaning from data.
- **Predict**... model the future from patterns in the spatial distribution of data.
- **Question**... ask questions about features in the database or the distribution of attributes.
- **Discover**... find relationships that are unperceivable in other expressions.
An Application in GIS: Archaeological Research
An Application in GIS: Hazards Emergencies

- What happens after a hazardous materials spill?
- How do public safety officials choose to reroute traffic?
- Where do evacuees in a hazardous materials spill actually go?
- In a hazardous materials spill, what’s the proper evacuation distance?
- What are the possible evacuation shelters and how will evacuees get to them?
- What roads will need to be closed near the spill?
- How will traffic get around the spill area?
- How many evacuees will there be?
An Application in GIS: Law Enforcement

- Focus on the distribution of crime in Houston.
- Look at the different factors that affect crime in a large city.
- Analyze which parts of the city need additional police presence.
- Where are the crime “hot spots” in Houston?
- Are different types of crimes concentrated in different neighborhoods?
- How are the police distributed in Houston?
- Are there better ways to distribute the police presence in Houston to combat crime?
An Application in GIS: Population Distribution

Total Population by County, Alabama
An Application in GIS: Population Ethnicity

Kaiser Blocks 50% African American
An Application in GIS: Location Decisions

- Identify the best locations given different criteria.
- Explore what happens when different decision criteria have greater or lesser importance.
- Use GIS to aid in spatial decision making.
- How do you choose appropriate criteria to make a spatial decision?
- What is the best scale to use to compare disparate measures (distance to a location versus median home value)?
- What is the appropriate weight to give each decision factor?
- Where can you obtain data to support spatial decision making?
An Application in GIS: Marketing Strategies

- Create map symbology to display population demographics
- Select target families for advertising and direct mail components of a promotional campaign using appropriate geographic units and demographic attributes
- Select area recreational stores with outdoor shows based on their location relative to target market households
- Design maps to communicate and support your recommendations.
An Application in GIS: Population Economics

1. Block Group Percent of Population Below Poverty (Highest Percentage Below = RED)
2. Block Group Median Income (Lowest Median Income = RED)
An Application in GIS: Real Estate
An Application in GIS: Mapping Operations

Laser Total Station

Trimble GPS

Map of the Site of Dos Quebradas

Our Standard is Excellence
An Application in GIS: 3D Visualizations

Chichén Itza, Yucatan, Mexico
Options

- Certificate in Geographic Information Systems (Five Courses – non-matriculating)
- Bachelor of Liberal Arts - Geographic Information Systems (120 hours)
- Master of Liberal Arts - Geographic Information Systems (30 hours Thesis)
- The Course of Study
- Catalog Listings
  - GEOG 3940 / 6340 Cartography with Lab (4CR)
  - GEOG 3950 / 6350 Introduction to Geographic Information Systems with Lab (4CR)
  - GEOG 4950 / 6450 Advanced Geographic Information Systems with Lab (4CR). Prerequisites - GEOG 3940, GEOG 3950
  - GEOG 4960 / 6460 Remote Sensing and GPS Applications in Geographic Information Systems with Lab (4CR). Prerequisites - GEOG 3950 and GEOG 4950
  - GEOG 4990 / 6990 Applied Research in Geographic Information Science and Systems with Lab (4CR). Prerequisites - GEOG 3940, GEOG 3950, GEOG 4950, and GEOG 4960
- Software
  - Intergraph GeoMedia Professional 6.1, GeoMedia Grid 6.1
  - ESRI ArcGIS 9.3, ArcPad 7.2
  - Auto Desk Map 3D
  - Surfer 9.0
  - Trimble Pathfinder Office
  - ENVI 4.6.1