BELARUSIAN STATE UNIVERSITY
DEPARTMENT OF GEOGRAPHY

GIS-Analysis and Modeling
The Program of the University Course for Master Students

Lections   34 academic hours

Laboratory GIS Projects   32 academic hours

Controlled Personal GIS Projects   68 academic hours

Minsk, 2009

Course Objectives

The overall goals of the course "GIS-Analysis and Modeling" are to:
- Promote understanding of the geographic information science and technology enterprise;
- Allow students to choose and apply of appropriate methods for the GIS-analysis and modeling of the spatial data often encountered in applied geography;
- Allow students to formulate a research problem in a topic area of their own choosing, to gather and organize appropriate available datasets, and to understand how a variety of GIS-methods among those covered in the course can be applied in combination to thoroughly explore real questions.

The particular objectives of each chapter of the course text and associated GIS-projects are outlined below.

Chapter 1. Introduction in GIS-Analysis and Modeling
Main objectives of GIS-analysis and modeling. GIS software for GIS-analysis and modeling. Options and tools of vector and raster GIS-analyses. Spatial modeling in GIS.

Chapter 2. Creating a Geodatabase
Geodatabase. Feature datasets. Feature classes. Topologies of geodatabase. Subtypes and attribute domains. Defining relationship classes. Building a raster geodatabase.
GIS project: Building a geodatabase (ArcGIS).

Chapter 3. Vectorization in GIS
Conversation raster data into vector-based feature in GIS. Understanding a raster dataset. Preparation a raster dataset to vectorization. Tracing raster cells (interactive vectorization). Batch vectorization.
GIS project: Conversation raster data into vector-based feature in GIS (ArcScan for ArcGIS).

Chapter 4. Editing Vector Features in GIS
An overview of the editing process. Creating new vector features in GIS. Editing topology. Creating features from other features. Editing existing features. Spatial adjustment. Editing attributes. Editing relationships and related objects. Editing annotation.
GIS project: Methods of spatial adjustment in GIS (ArcGIS).

Chapter 5. Vector Analysis in GIS: the Basic
Elementary spatial analysis in GIS. Spatial statistics in GIS. Advanced spatial analysis in GIS. Network analysis in GIS.
GIS projects: Overlay analysis (ArcGIS), buffer analysis (ArcGIS), generalization (ArcGIS), creating a hydrological network dataset (ArcGIS).

Chapter 6. Working with Geodetic Data in GIS
Survey data in the geodatabase. Using computations. Editing feature geometry. Analyzing and editing survey data. Managing shared survey data. Creating new parcels in fabric jobs. Working with parcel construction tools.
GIS project: Survey Analyst and Cadastral Editor (Survey Analyst and Cadastral Editor for ArcGIS).

Chapter 7. Working with Temporal Data in GIS
Simple and complex temporal events. Symbolizing temporal data in GIS. Displaying temporal data in GIS. Working with real-time data.

GIS project: Adding, symbolizing and replaying temporal data in GIS. Applying actions (Tracking Analyst for ArcGIS).

Chapter 8. Spatial GIS-Analysis
Understanding rasters and analysis. Interpolating to raster. Performing surface analysis. Mapping density. Mapping distance. Cell statistics. Reclassification. The raster calculator.
GIS projects: Surface generation and surface analysis in GIS (Spatial Analyst for ArcGIS), mapping distance in GIS with straight line distance and cost weighted distance functions (Spatial Analyst for ArcGIS).

Chapter 9. Geostatistical GIS-Analysis
The principles of geostatistical analysis. Understanding deterministic methods. Understanding geostatistical methods. Creating a surface with geostatistical techniques. Using analytical tools when generating surfaces. Displaying and managing geostatistical layers.
GIS project: Creating a surface with geostatistical techniques (Geostatistical Analyst for ArcGIS).

Chapter 10. Hydrological Modeling in GIS
Understanding drainage systems. Exploring DEM. Deriving runoff characteristics (flow direction, flow accumulation, stream order, flowlength, watersheds).
GIS project: Performing hydrological modeling in GIS (Spatial Analyst for ArcGIS).

Chapter 11. 3D Modeling in GIS
Creating 3D surface models. Displaying 3D surfaces. Analyzing 3D surfaces. 3D visualization. Animation. 3D symbology. 3D graphics and text.
GIS project: 3D modeling in GIS (3D Analyst for ArcGIS).

Chapter 12. Geoprocessing in GIS
Introducing geoprocessing methods. Working with toolboxes. Working with toolsets and tools. Using the Command Line window. Using the ModelBuilder window.
GIS project: Geoprocessing in GIS (ArcGIS).

Chapter 13. Mapmaking, Mapping and GIS-Design of Maps
Basic mapping principles. Map elements. Mapping and GIS. Basic of GIS-design of maps. Laying out and printing maps.
GIS project: Mapmaking in GIS (ArcGIS).

Chapter	All academic hours	Lections	Laboratory GIS-projects	Controlled personal GIS-project
Chapter 1. Introduction in GIS-Analysis and Modeling	2	2		
Chapter 2. Creating a Geodatabase	10	2	2	6
Chapter 3. Vectorization in GIS	12	2	4	6
Chapter 4. Editing Vector Features in GIS	12	4	2	6
Chapter 5. Vector Analysis in GIS: the Basic	14	4	4	6
Chapter 6. Working with Geodetic Data in GIS	8	2	2	4
Chapter 7. Working with Temporal Data in GIS	8	2	2	4
Chapter 8. Spatial GIS-Analysis	14	4	4	6
Chapter 9. Geostatistical GIS-Analysis	10	2	2	6
Chapter 10. Hydrological Modeling in GIS	12	2	4	6
Chapter 11. 3D Modeling in GIS	10	2	2	6
Chapter 12. Geoprocessing in GIS	10	2	2	6
Chapter 13. Mapmaking, Mapping and GIS-Design of Maps	12	4	2	6
All	134	34	32	68

Literature for Reading:

1. Getting Started With ArcGIS. – Redlands, USA: ESRI, 2004.
2. Using ArcCatalog. – Redlands, USA: ESRI, 2004.
3. Building a Geodatabase. – Redlands, USA: ESRI, 2004.
4. Using ArcMap. – Redlands, USA: ESRI, 2004.
5. Editing in ArcMap. – Redlands, USA: ESRI, 2004.
6. Using ArcGIS Spatial Analyst. – Redlands, USA: ESRI, 2004.
7. Using ArcGIS 3D Analyst. – Redlands, USA: ESRI, 2003.
8. Using ArcScan for ArcGIS. – Redlands, USA: ESRI, 2003.
9. Using ArcGIS Geostatistical Analyst. – Redlands, USA: ESRI, 2003.
10. Using ArcGIS Survey Analyst. – Redlands, USA: ESRI, 2003.
11. Using ArcGIS Tracking Analyst. – Redlands, USA: ESRI, 2004.
12. Geoprocessing in ArcGIS. – Redlands, USA: ESRI, 2004.