ES341 Fundamentals of GIS
Midterm Study Guide Winter 2011

Study Tips
-Read all chapters in work book, study figures and tables, compare chapters to notes
-Use study guide as a check list for knowing key terms, key concepts, key skills
-Go back through the class / lab exercises, make sure you can do the math work
-Go back through the key skills emphasized in the tutorials, make sure you know the software skills
-I would study for a minimum of 10-12 hours if I wanted to do well on this exam.
-Create a 1 page sheet of key ArcMap / Arc/Catalog commands - bring to exam
-Bring a calculator to the exam.
-Review the class slide shows on the web site for visualizations
-Meditate before exam and become one with software

Key Words

Intro to GIS
GIS defined
(list key components)
map features
points, lines, polygons
layers, themes
coverage
shape file
attributes
GPS
geodesy
spatial coordinate system
lat / long
UTM
state plane
map projection
discrete spatial features
continuous spatial features
feature attributes
vector data model
topological vector model
non-topological vector model
raster data model
attribute data
database
digitization
database tables
fields
records
data query
spatial interpolation
spatial query
symbol maps
line maps
area maps
volume maps

Intro to Topo Maps Notes
equivalence
conformality
cylindrical projection
conical projection
georeference
lat - long
meridians
parallels
equator
prime meridian
north pole
south pole
great circles
small circles
degrees-minutes-seconds
decimal degrees
magnetic north
true north
fractional scale
small scale
large scale
azimuth
compass bearing
aspect
relief
Eastings and Northings
UTM projection system
Contour lines
Index contours
Contour intervals
benchmark

Map Projections
data points
x,y coordinates
map projection
map layers
georeference system
map registration
map resolution
conformal projection
equivalent projection
polar projection
tangent vs. secant projectsion
equatorial projection
cylindrical projection
conical projection
tangent projection
standard parallel
standard meridian
central parallel and meridian
false easting , false northing
metadata
transmercator
lambert
geoide
spheroid
ellipsoid
datum

Vector Data models
points
lines
arcs
vertex
node
line segments

polyline
line
polygon
contiguous polygon
donut
island
attributes
topology
left/right poly topology
topological errors
dangling nodes
undershoots
overshoots
leaky polygons
snapped nodes
metadata
digitizing
RMS error

Raster Data Structure
grid data
raster data
grid cell
DEM
orthophoto
columns-rows / x-y
pixel resolution
vector-raster representation
cell values
integer
floating point
world file
remote sensing
satellite imagery
em spectrum
spectral bands
multispectral image
wavelength
color bands
tiff, gif, jpeg, MrSID
vectorization
rasterization

Overview of ArcGIS
ESRI
ArcInfo
ArcView
ArcGIS
GIS defined
Aspatial data
Spatial data
Database management system
GIS components
    Hardware
    Software
    Data storage/input
    Output
    Personnel
GIS Functions
    Data entry
    Data management
    Thematic mapping
    Data Analysis
    Cartographic output
Data structure
    Vector model
    Raster model
Georeferencing
    Projection
    x-y coordinates
    Cartesian coordinates
Feature Objects
    Points
    Lines/polylines
        Vertex
        node
    Polygons
Feature Attributes
Feature class
    Themes
    Layers
Vector Models
    Topological
    Spaghetti Models
Raster Models
    Grid / matrix
    Columns / rows
    Cells / pixels
    Pixel resolution
    Discrete Raster vs.
    Continuou Raster
ArcGIS Sofware Components
    Arc Catalog
    ArcMap
    Arc Toolbox
ArcGIS Datafiles
    Shapefiles
ArcGIS Datafiles (cont.)
Coverages
Geodatabases
Layer files
Raster (grid) files
Tables
Metadata
    FGDC Standards
File Types
    *.mxd (map document)
    *.lyr (layer file)
    *.shp (shape file-vector)
    *.coverage (vector)
    *.grd (grid file)
    *.jpg (jpeg – image)
    *.tiff (tiff-image)
    *.tfw (tiff world file)
    *.e00 (arc/info export)
    *.mdb (access database)
    *.xml (metadata)

Class Speakers
Based on the three class presentations by outside speakers, can you describe 4 or 5 applications of GIS for use in geologic research, forensic science, coastal managements, and/or state data infrastructure?

Lab Skills - In-Class Exercises
Can you work with paper maps?
What about topographic maps (contour intervals, declination, scale)
fractional scale
graphical scale
can you convert from map units to ground distance units?
Can you calculate grid resolution from column-row and easting-northing data?
What about the structure of raster models vs. vector models.
What does a coded polygon look like in the raster model vs. the vector model?
Can you relate real world spatial features to GIS map features (points, lines, polygons)?
Can you locate positions of points of longitude and latitude? UTM? State Plane?
Can you convert from degrees to minutes to seconds? How about to decimal degrees from minutes and seconds?

ArcMap Software Skills
can you open a view and add themes (vector and raster?)
can you create a layout and print?
can you set the map units and use the measure tool?
can you open a table and view the database?
can you project themes from one projection to another?
can you save a project?
can you work with feature class data? image data? grid data?
can you zoom in and out of a view?
can you use the query/identify tool?
can you change the legend colors and symbols?
can you determine the coordinates of points on a theme?
can you use metadata with your map themes?
can you define projections and change projections?
Can you load a map template and print out a final product with your name?
Can you work with tables and conduct basic statistical summaries?

Summary of Key Concepts from Price Workbook / Tutorials

Price Chapter 1 – Introduction / GIS Data
- ArcGIS Intro Skills
  - Use Identify tool
  - Use Find tool
  - Open and save map document (*.mxd) files
  - Use measure tool (measure feature, length, area)
  - Add and remove layers from display window
  - Use rt-click properties pop up window
  - Use zoom tool / Use pan tool
  - Zoom to active layer, Zoom to full extent
  - Save and open view bookmarks
  - Set and reset symbols for layers in table of contents (rt-click layer properties)
  - Select and unselect elements of feature classes
- Using ArcCatalog

- Connecting to network drives
- Copying and saving data
- Use ArcCatalog to preview layers and show metadata
- Preview layer contents
- Preview data tables and map element files
- Sorting table data
- View metadata

Price Chapter 2 – Working with ArcMap / Mapping GIS Data

- ArcMap Software Environment
  - Using data frames
  - File types and folder paths
  - Table of Contents/Data Frame
    - Layer listing
    - ! exclamation point icon = broken folder paths
      - Rt-click – set data source – point to new path
  - Toolbars - standard (zoom, pan, etc.)
    - View – toolbars – check list on/off
    - Add data button (add layers of information)
    - Moving toolbars / using handles to expand and anchor
  - Context menus – right click on objects
  - Table of contents – layer management in display or map window
    - Set symbols, reveal layer properties
    - Turn layer visibility on /off
  - Map Window – display of map
  - Zooming in map window
    - Zoom to extents
    - Zoom to active layer
    - Zoom to previous view
    - Bookmarks – save views in the map window to return later
  - Scaling view in map window
  - Identifying feature attributes with identify tool
  - Measure distances and areas with measure tool
  - Rt-click on layer name in table of contents
    - Open attribute table
    - Zoom to layer
    - Export data
    - Label features
  - Display View vs. Layout View
  - Layout View
    - Map templates
    - Printing map products
    - Exporting layout / map products to files (*.pdf, *.jpg)

Price Chapter 11 – Coordinates and Projections

Concepts

- Coordinate Pairs – Cartesian coordinates
- Origin of coordinates
- Map units
- Coordinate space
- Coordinate systems

- GCS – geographic coordinate system
    - Equator-prime meridian
    - 3-d angular measurement
    - Parallels, merdians
    - Prime meridian
    - Latitude / longitude
- Shape of Earth
    - Spheroid
    - Datum
    - Ellipsoid
    - Geoid
- Projections
    - 2-d georeferencing
    - Projections – cylindrical, planar, conical
    - Tangent vs. secant projections
    - Orthographic projections
    - Polar vs. oblique projections
    - Projection parameters
        - Central meridian
        - Latitude of origin
        - Reference latitude
        - Standard parallels
        - False easting and northing
    - UTM – State Plane – GCS
    - UTM zones
    - State Plane Zones
    - Custom projections

    - Accuracy and precision

ArcGIS and Map Projection Functions

- ArcToolbox-Data management Tools-Projections and Transformations
    - Define projection tool (specify coordinates, creates a projection file)
    - Project tool (actively change coordinates)
- On-the-fly projection
- ArcGIS projection files

ArcCatalog and Projection Tools

- Properties – coordinate sytems tab
- Define projections

Price Chapter 3 – Presenting GIS Data / Drawing and Symbolizing Features

Concepts

- Map Types
    - Categorical (nominal) vs. numeric
    - Ordinal Data (rankings)
    - Interval Data (ranges of measurements)
    - Chloropleth – zone maps
- Single Symbol Maps
- Quantities Maps
- Dot Density Maps
- Chart Maps
- Map Classification – frequency distributions of data

- attributes

ArcMap Functions

- Map layer files *.lyr
- Symbol editing
- Table of contents
- Displaying rasters
- Map Labels
- Symbol Properties Editor
- Legend properties

Handout GIS Tutorial 3 – (GIS Outputs)

Map Layouts and Production

- Objectives and map layout – what is the map for?
  - Who is the target audience for the map?
  - How will the map be used?
- Data layers to include?
- Colors and symbols – artistic design
  - Map symbols
  - Solid vs. transparent colors
- Planning the Layout
  - Map Title – authors – year
  - North arrow
  - Scale (verbal vs. graphical)
  - Explanation / legend
  - Metadata
  - Projection and datum information
  - Graticules / location grids
- Map Templates
  - Maps – charts- data
- Scale Bars
  - Divisions – units – width
- Map Production
  - Export to image file format (*.pdf, *.jpg)
  - Print to printer

ArcMap Functions

- Layout view
- Map page / page setup
- Adding legend box
- Placing and adjusting scale bars
- Inserting north arrows
- Inserting pictures
- Adding neatlines
- Adding background colors
- Placing graphs and reports