Model Answers

M.Sc. –Rural Technology (Third Semester)
Examination, 2013
RT-901R: Geographical Information System

Q.1. Multiple choice questions

1. (a) Large scale map
2. (a) Cartography
3. (c) Both
4. (a) Shape index
5. (b) Project on the sky
6. (d) All
7. (d) All
8. (a) Contours
9. (a) Band interleaved by pixel
10. (c) Both

Q.2.

(a) The raster data model uses a regular grid to cover the space and the value in each grid cell to correspond to the characteristic of a spatial phenomenon at the cell location. Conceptually, the variation of the spatial phenomenon is reflected by the changes in the cell value. Raster data have been described as field-based, as opposed to object-based vector data. A wide variety of data used in GIS are encoded in raster format. They include digital elevation data, satellite images, digital orthophotos, scanned maps, and graphic files. Most GIS packages can display raster and vector data simultaneously, and can convert from raster to vector data or from vector to raster data. Raster data also introduce a large set of data analysis functions to GIS. Integration of both vector and raster data is a common feature in a GIS project. A grid consists of rows, columns, and cells. The origin of rows and columns is at the upper left corner of the grid. Rows function as Y coordinates and columns as X coordinates in a two-dimensional coordinate system. A cell is defined by its location in terms of row and column. The cell size determines the resolution of the raster data model. A cell size of 30 meters means that each cell measures 30 × 30 meters. Raster data represent points by single cells, lines by sequences of neighbouring cells, and areas by collections of contiguous cells. Each

cell in a grid carries a value, either an integer or a floating-point value (a value with decimal digits). Integer cell values typically represent categorical data (i.e., nominal or ordinal data). For example, a land cover model may use 1 for urban land use, 2 for forested land, 3 for water bodies, and so on.

(b) The database management system is a program that lets the user add, delete and modify records in the database. Hence the DBMS is a general purpose software that facilitates the process of defining constructing and manipulating the database for different applications.

Types of DBMS structure

Hierarchical system-When the data have a parent child or one to many relations it is called as hierarchical model. This is widely used in environmental sciences and soil classification.

Network database system- The basic objective of this model is to separate data structure from physical storage and eliminate un necessary duplication. This considered as an improvement over the hierarchical system

Relational database system – These concept was first set by Codd as a means of describing data with their natural structure. These systems are based on the concept of a relation which is set of tuples. Due to its flexible approach it has become most popular form of a database.

(c) Map scale refers to the relationship (or ratio) between distance on a map and the corresponding distance on the ground. Statement scale it represent the ratio between the map and the ground distance in words. Representative fraction is a simple ratio between the map distance and the ground distance . For example it is written as 1:1000. Graphical scale is a representation of the RF and drawn to facilitate the estimation of ground distances from measurement made on the map.

(d) Data is a collection of attributes about entities. Data are stored on hard disc of varying capacity normally 20 giga bytes or above. Beside this it is also stored on secondary storage. In GIS there are two types of data spatial and attribute therefore GIS should provide a storage space for both of this data individually or separately In addition GIS should have a capacity of linking spatial as well as attribute in order to establish topology. Models used for this are

- Hybrid data model
- Integrated data model
- Object based data model

(e) The process of representing an analogue signal or an image by a discrete set of its points is known as Digitizing **Digitizing** is the process by which coordinates from a map, image, or other sources of data are converted into a digital format in a GIS. Manual Digitizing In this method, the digitizer uses a digitizing tablet (also known as a digitizer, graphics tablet, or touch tablet) to trace the points, lines and polygons of a hard-copy map. This is done using a special magnetic pen, or stylus, that feeds information into a computer to create an identical, digital map. Some tablets use a mouse-like tool, called a puck, instead of a stylus. Heads-up Digitizing This method involves scanning a map or image into a computer. The digitizer then traces the points, lines and polygons using digitizing software. This method of digitizing has been named "heads-up" digitizing because the focus of the user is up on the screen, rather than down on a digitizing tablet.

(f)

The **Global Positioning System** (**GPS**) is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. The GPS project was developed in 1973 to overcome the limitations of previous navigation systems. GPS is used in different fields. Some common applications are

Cartography: cartographers use GPS extensively

Disaster relief Depend upon GPS for location and timing capabilities

Navigation: Navigators value digitally precise velocity and orientation measurements

Geotagging Applying location coordinates to digital objects

Surveying: Surveyors use absolute locations to make maps and determine property boundaries

Tectonics: GPS enables direct fault motion measurement in earth quakes

Telematics: GPS technology integrated with computers and mobile communications technology

Q.3.

1)Map Overlay is an important technique for integrating data derived from various sources. Map overlay is a process by which it is possible to take two or more different thematic layers of the same area and overlay them on top of the other to form a composite new layer. The ability to integrate a variety of data sources using overlay operation is a key analytical capability of a GIS. Overlay analysis integrate spatial data with attribute data by combining information from one GIS layer with another GIS layer. Map overlay analysis has its origin in the work. It acts as a sieve for mapping.

Vector over lay operation

Topological Overlay

The process of topological overlay is the combining of two or more coverage's into a single coverage and the creation of topology for the single coverage. Line intersections in the single coverage are detected, all polygons are identified and attributes for the new polygons are carried over from the previous coverages. The most common are.

Point in polygon It is a spatial operation in which one point coverage is overlaid with polygon coverage to determine which point falls within the polygon boundaries.

Line in polygon- spatial operation in which arc in one coverage are overlaid with polygon of coverage to determine which arc or portin of arc are contained within the polygon of the analysis layer.

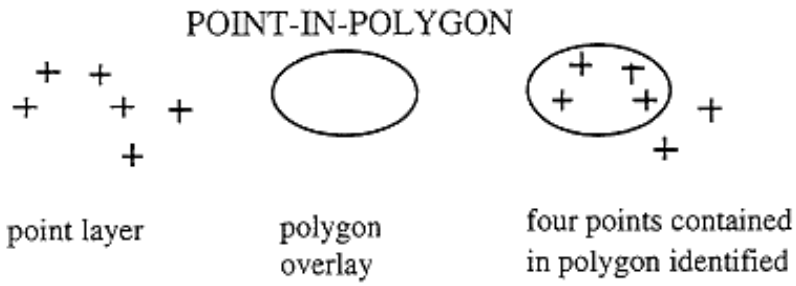
Polygon on polygon – A process that merges spatially coincident polygon from two coverage and their attribute to create a third coverage.

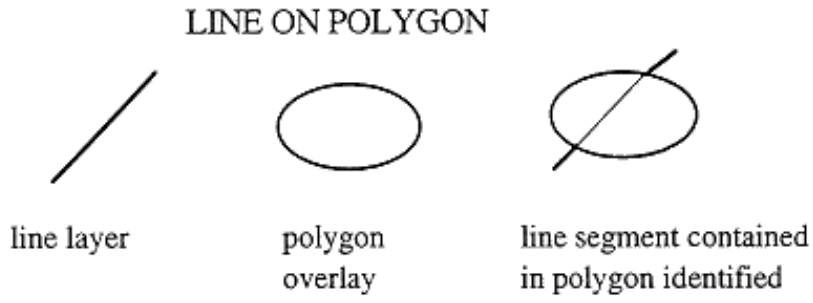
In the raster data structure everything is represented by cells. Most sophisticated spatial modelling is undertaken by within the raster domain. Thus the raster data processing methods can be classified in to following categories

Local operations – are based on point by point or cell by cell analysis

Neighbourhood operations- are also known as focal operations.

Regional operation - are also known as zonal operations.





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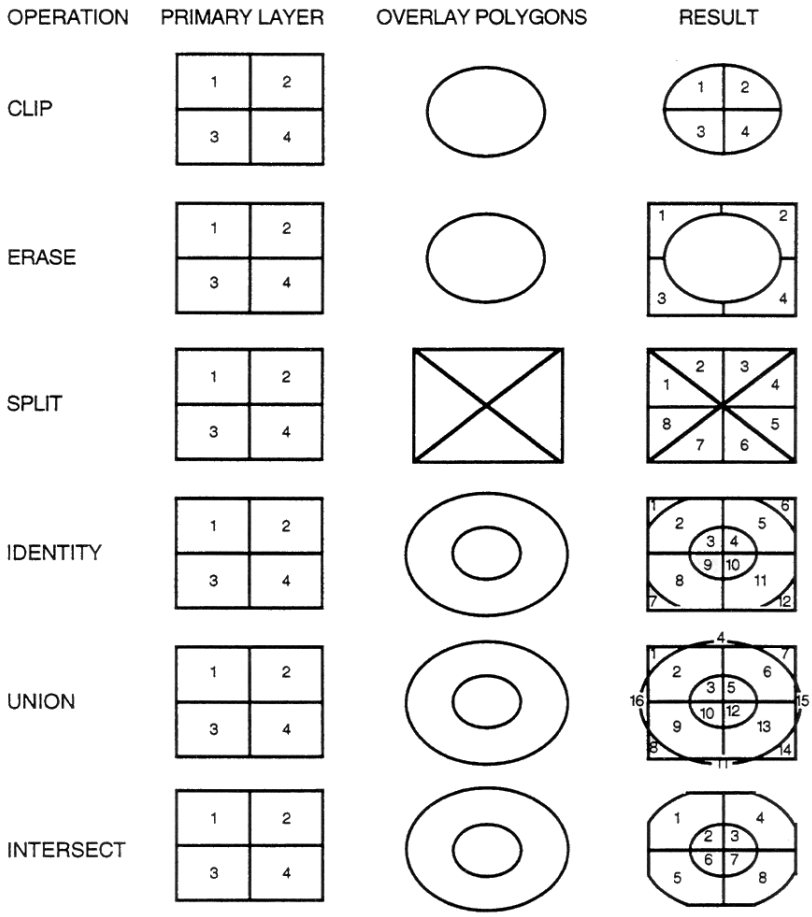
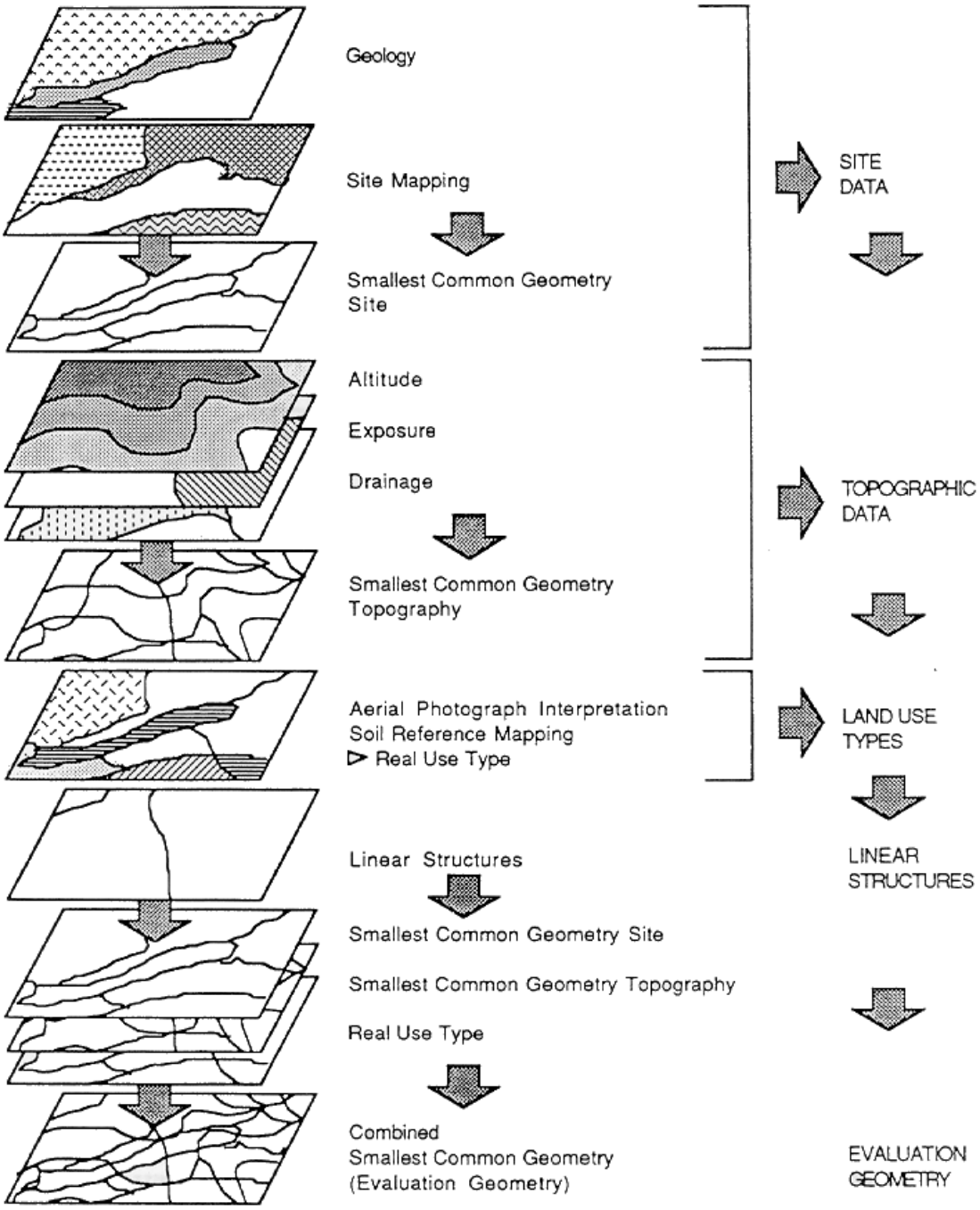

OPERATION
PRIMARY LAYER
OVERLAY POLYGONS
RESULT
CLIP
ERASE
SPLIT
IDENTITY
UNION
INTERSECT


Geology
Site Mapping
Smallest Common Geometry
Site
SITE
DATA
Altitude
Exposure
Drainage
Smallest Common Geometry
Topography
TOPOGRAPHIC
DATA
Aerial Photograph Interpretation
Soil Reference Mapping
Real Use Type
LAND USE
TYPES
Linear Structures
LINEAR
STRUCTURES
Smallest Common Geometry Site
Smallest Common Geometry Topography
Real Use Type
Combined
Smallest Common Geometry
(Evaluation Geometry)
EVALUATION
GEOMETRY

2)Image file formats are standardized means of organizing and storing digital images. Image files are composed of digital data in one of these formats that can be rasterized for use on a computer display or printer. An image file format may store data in uncompressed, compressed, or vector formats. Once rasterized, an image becomes a grid of pixels, each of which has a number of bits to designate its color equal to the color depth of the device displaying it. **Lossless compression** algorithms reduce file size while preserving a perfect copy of the original uncompressed image. Lossless compression generally, but not always, results in larger files than lossy compression. Lossless compression should be used to avoid accumulating stages of re-compression when editing images.

Lossy compression algorithms preserve a representation of the original uncompressed image that may appear to be a perfect copy, but it is not a perfect copy. Often lossy compression is able to achieve smaller file sizes than lossless compression. Most lossy compression algorithms allow for variable compression that trades image quality for file size.

Image file compression

There are two types of **image file compression** algorithms.

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Major graphic file formats

Including proprietary types, there are hundreds of image file types. The PNG, JPEG, and GIF formats are most often used to display images on the Internet. These graphic formats are listed and briefly described below, separated into the two main families of graphics: raster and vector.

Raster formats

JPEG/JFIF

JPEG 2000

Exif

TIFF

GIFBMP

PNG

PPM, PGM, PBM, PNM and PFM

PAM

WEBP

HDR Raster formats

RGBE (Radiance HDR)

3)Scanning is a method that converts the analog map into scanned file which is then converted back to vector format. A scanner convert an analog map in to a binary scanned image file in raster format. Each pixel has a value o f 1 or 0. The pixel size depend on the resolution of the scanner. Normally scanner uses a pixel size of 25,50 or 100um. Scanning produces a large amount of data. Scanner is hardware for conversion. The on screen digitisation may be manual or semi automatic.

There are three different types of scanner

Flat bed scanner- provides a flat glass surface on to which original is placed.

Rotating drum scanner- This type of scanner provides the highest level of image quality.

Large format feed scanner

Scanner capabilities – colour depth and resolution

Colour depth – determines the number of different colours the scanner can record

Resolution are of two types – optical and interpolated resolution

The resolution of a scanner affects the quality and quantity. The low end scanners have a resolution of between 5- 200 dpi where as the high end scanners have a resolution of of 500-2500dpi.

There are some practical problems associated with scanning these may be

- Complex line work can produce error in scanning
- Text may be scanned as line feature
- Contour line cannot broken with text
- Automatic scanning of u n wanted information

4)A **map projection** are systematic transformation that allow the orderly representation of the Earth's spherical graticule on a flat map. Map projection are transformations of geographic co ordinates of latitudes and longitudes in to the Cartesian (x,y) coordinate space of the map. A map projection is the manner in which the spherical surface of the earth is represented on a two dimensional surface.. All map projections distort the surface in some fashion. Depending on the purpose of the map, some distortions are acceptable and others are not; therefore different map projections exist in order to preserve some properties of the sphere-like body at the expense of other properties. There is no limit to the number of possible map projections. Map projections can be constructed to preserve one or more of these properties, though not all of them simultaneously. Each projection preserves or compromises or approximates basic metric properties in different ways. The purpose of the map determines which projection should form the base for the map. Because many purposes exist for maps, many projections have been created to suit those purposes.

Classification on the basis of plane of projection

First order

Planer it is accomplished by drawing lines from a given perspective point through the globe on to a tangent plane.

Conical are accomplished by intersecting or touching a cone with the global surface and mathematically projecting lines on to this developable surface.

Cylindrical are obtained by intersecting or touching a cylinder with the global surface.

Second order

Tangent

Secant

Poly superficial

Third order

Normal

Transverse

Oblique

Properties of map projection

Homolographic

Orthomorphic

Azimuthal.

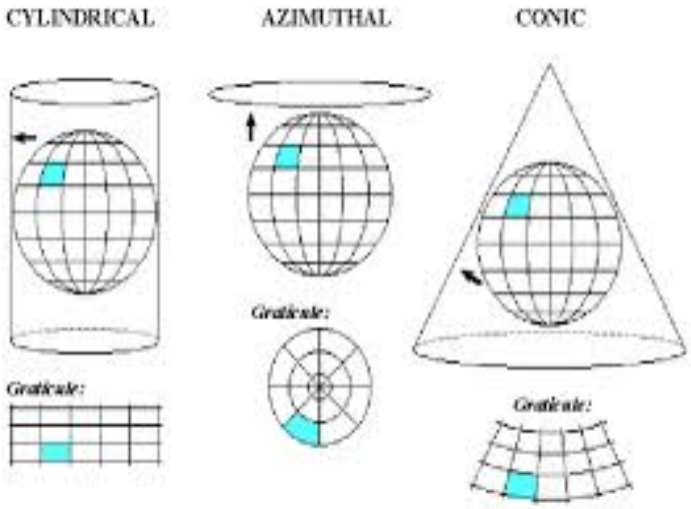
Equidistant

Map projections

Universal Transverse Mercator projection

The Lambert Conformal Conic Projection

Polyconic projection



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