

Spatial Modelling and Analysis

End of Semester Examination

Questions + Answers

Answer all five questions

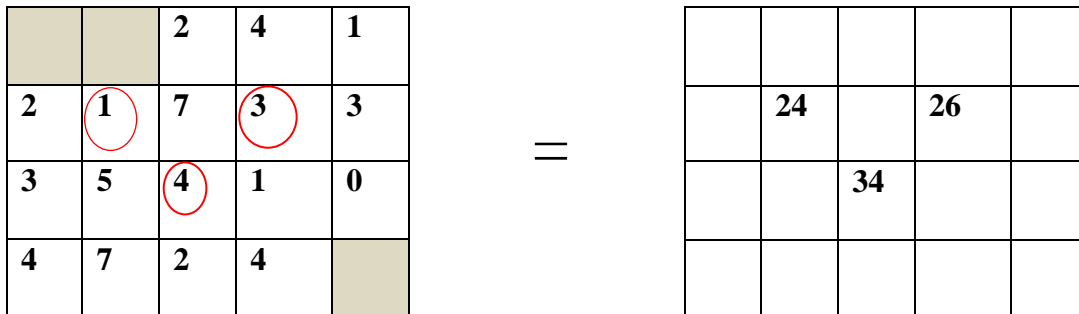
Question 1: _____ **Marks: 8 + 5 + 7**

(a) Discuss with diagrams and examples how you understand Local and Neighborhood operations.

Local: Operations performed on a cell by cell basis

Neighborhood: Operations performed using a moving group of cells

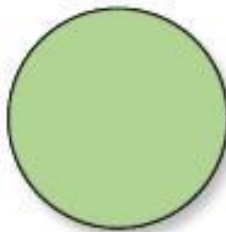
Taking into consideration the Neighborhood size: 3x3 rectangle, red circle = focal cell and grey cells = no value



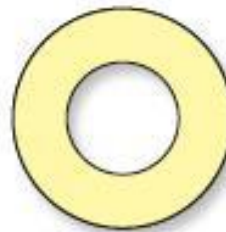
(b) List down the common shapes use for neighborhood operation.



Rectangle



Circle



Annulus



Wedge

- (c) Discuss in your own words with the help of diagram, what is contour, why do we create contour and how do we create contour.

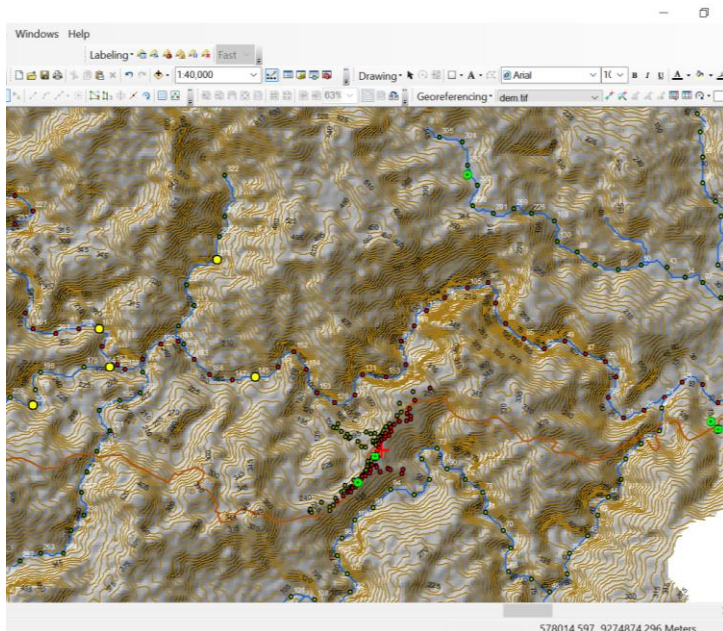
The contour is created using mass points collected on the ground during field survey. The contour is also created using Digital Elevation Model. The contour lines are purposely to communicate topographic information of an area. Both minor and major contour lines are created to represent topographical surfaces.

Contours can be viewed as polylines connected by points that have equal values.

Such as:

- Elevation
- Precipitation
- Temperature
- Pollution
- Atmospheric Pressure

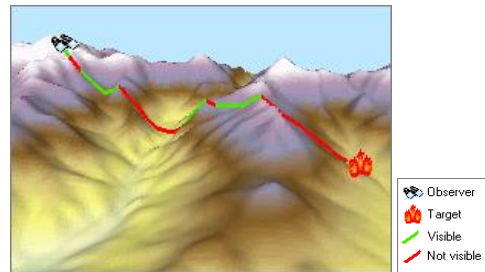
The distribution of the polylines shows how values change across a surface.



Question 2:**Marks: 5 + 5 + 10**

- a) Discuss with diagram how you understand viewshed surface analysis. (Provide one application part of it).

How visible an object will be from a point is determine by calculating viewshed.



1. You might want to find the location with the most expansive view in an area because you want to know the best location for a lookout.
2. Finding well exposed places for communication towers.

- b) In your own words, discuss with diagrams how you understand Aspect. (Provide one application part of it).

Aspect identifies the steepest down slope direction from each cell to its neighbors. It can be thought of as slope direction or the compass direction a hill faces. Aspect is measured clockwise in degrees from 0, due north, to 360, again due north, coming full circle.

The value of each cell in an aspect dataset indicates the direction the cell's slope faces. Flat areas having no downslope direction are given a value of -1.



Application part of it:

You may be a farmer interested in locating a field on an area with a Southerly aspect.

Find all north-facing slopes on a mountain as part of a search for the best slopes for ski runs.

Calculate the solar illumination for each location in a region as part of a study to determine the diversity of life at each site.

Find all southerly slopes in a mountainous region to identify locations where the snow/ice is likely to melt first as part of a study to identify those residential locations likely to be hit by runoff first.

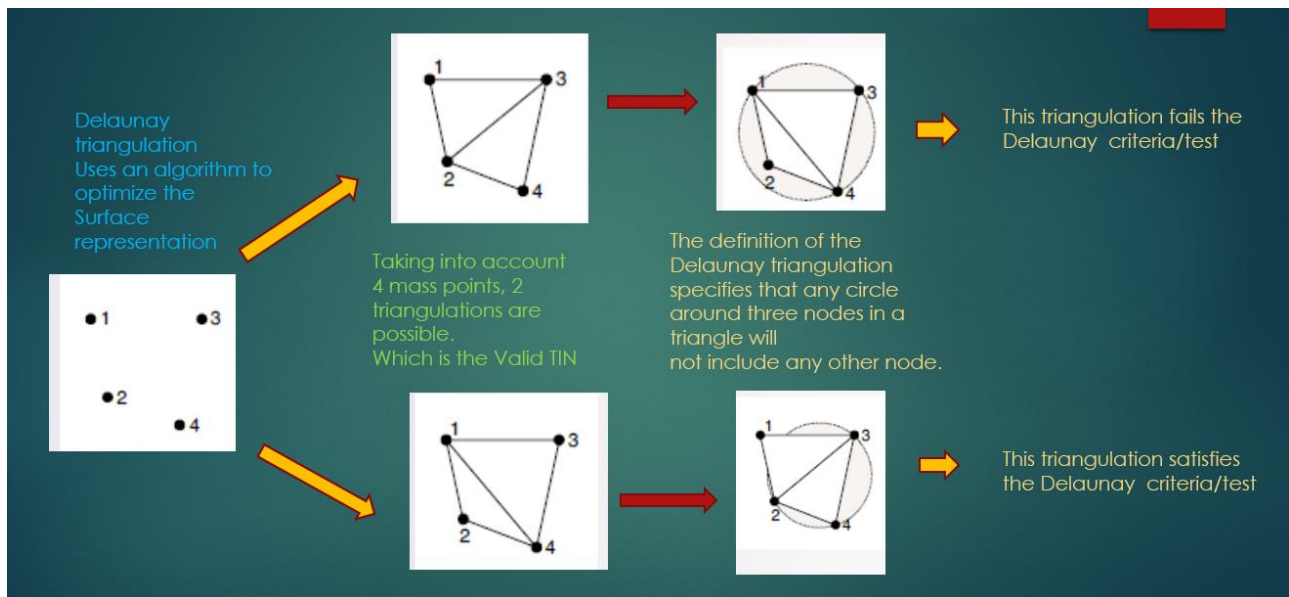
Identify areas of flat land to find an area for a plane to land in an emergency.

c) In your own words, fully discuss how TIN is created and what are the topological structure of TIN that make up TIN.

Firstly, the mass point or contour lines with x,y,z coordinate data of a particular area are needed.

The create TIN tool in ArcMap can be used to create TIN using the data mentioned above as an input.

The TIN is created within the concept of Delaunay Criteria. The concept of Delaunay criteria is address as follows:



The topological structure of a TIN is defined by maintaining information defining each triangle's nodes, edge numbers, type, and adjacency to other triangles.

For each triangle, a TIN records:

- The triangle number
- The numbers of each adjacent triangle
- The three nodes defining the triangle
- The x,y coordinates of each node
- The surface z-value of each node
- The edge type of each triangle edge (hard or soft)

Question 3:

Marks: 5 + 9 + 6

- a) Discuss in your own words what do we mean by saying ‘cost or cost to meet’ when doing least cost path analysis.

The cost represents, area to avoid while construction. For example;

- High Slopes
- Unsuitable land use
- Cemetery
- High crime zones

The Cost values assigned by a user is just like a suitability values that user assigned to each thematic layers.

- b) The input data to create cost weighted distance raster are ‘cost raster’ and the ‘source data’. Discuss with diagram, what is cost raster and how do we go about creating ‘cost raster’.

The cost Raster identifies cost of travel to every cell. Weight values assigned to each class level. Higher the weight value, more the cost.

When adding the weighted data sets together, the result is the final cost raster

The cost raster below is the result of;

- reclassifying done between two data sets (Ex: Slope and Land use).
- weighting each by % influence
- finally combining them using Weighted sum/weighted overlay/union tool in ArcGIS.

- c) List down any three (3)-raster data type that you can think of and provide discussion for each.

1. Satellite Imagery (Lansat and SPOT, Quick bird, Geoeye)
2. Digital aerial photographs (from drone, Plane and Helicopter)
3. Digital Elevation Model
4. Scanned Maps
5. Digital Graphics Files,
6. NETCDF Files (Satellite data)

Question 4:

Marks: 10 + 6 + 4

- (a) In your own understanding, discuss with diagrams and examples how you understand vector data model and raster data model.

- There are two main data models or conceptualizations used for spatial data:
 - Vector data model
 - Raster data model
- “*raster is faster but vector is corrector*” Joseph Berry
- **Vector data model** use discrete objects such as point, lines and polygons to represent the geometry of the real-world entities, discrete entities

E.g. a road, river, city and towns, lakes or wetlands, farm land, etc.

- **Raster data model** represents continuous phenomena that may change continuously across a region
E.g. Elevation, rainfall, temperature, soil moisture, etc.

- (b) When doing digitization in ArcGIS software, we create a vector data formats. The most common vector data formats created was shapefile (ESRI Shapefiles).

The shapefile we just created, consist of multiple files. Two (2) of these are. avl (Arcview legend file) and. sbn (shapefile –internal).

Fully state down the most essential and important one that you can think of.

The Essential Parts are:

- .shp: Shapefile geometry data
- .dbf: database data
- . Shx: shapefile index

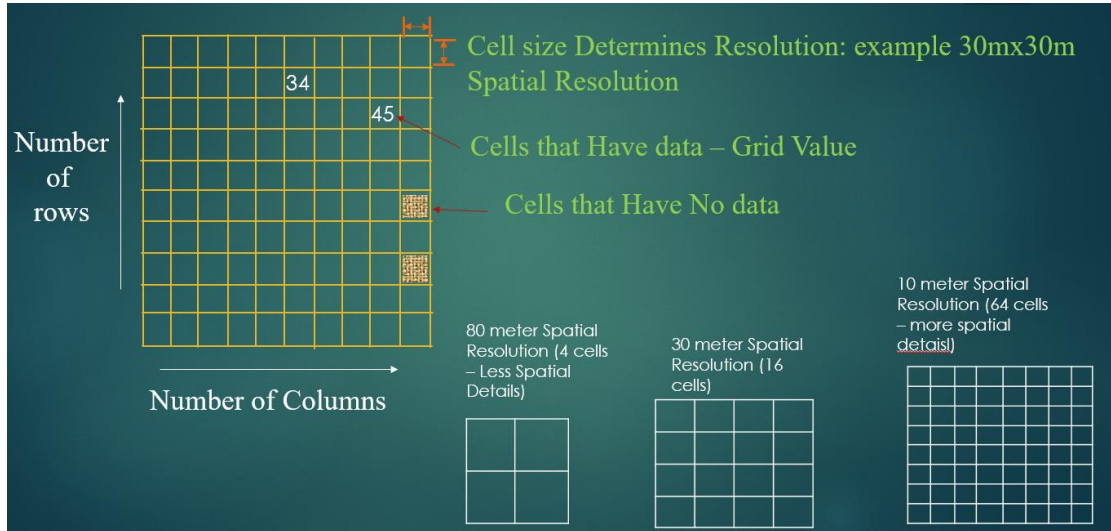
The Important parts is:

- prj: projection file with coordinate reference system info,

(c) In a raster data, discuss with diagram, how do you understand grid value or cell value.

The geographical features that are continuous in nature on the planet earth are represented by raster data model.

The raster data has a pixel/cell that has values that represents the features on the ground. The values in the raster pixel tells the story of the features on the ground or feature you are trying to represent.



Question 5:

Marks: 6+ 8 + 6

(a) In your own understanding, fully discuss Numeric and character attribute data type.

Numeric Data

Integer and floating are numerical values.

Difference between floating and integer values.

- ✓ Within the integer type, there is a further division between short and long integer values.
- ✓ As would be expected, short integers store numeric values without fractional values for a shorter range than long integers.
- ✓ Floating point attribute values store numeric values with fractional values. Therefore, floating point values are for numeric values with decimal points (i.e numbers to the right of the decimal point as opposed to whole values).

Character Data (Text)

- ✓ The character property (or string) is for text based values such as the name of a street or descriptive values such as the condition of a street.
- ✓ Character attribute data is stored as a series of alphanumeric symbols.
- ✓ Aside from descriptors, character fields can contain other attribute values such as categories and ranks.
- ✓ For example, a character field may contain the categories for a street: avenue, boulevard, lane, or highway.

(b) ArcMap provides two methods to associate data stored in attribute tables with geographic features. These two (2) methods are Join and Relates.

Differentiate between these two methods and fully list and discuss the type of relationship exist in each of these two (2) methods.

1. **Joins**
2. **relates.**

Joins are used for 1-to-1 relationships, or many-to-1 relationships between the attribute table and an external table.

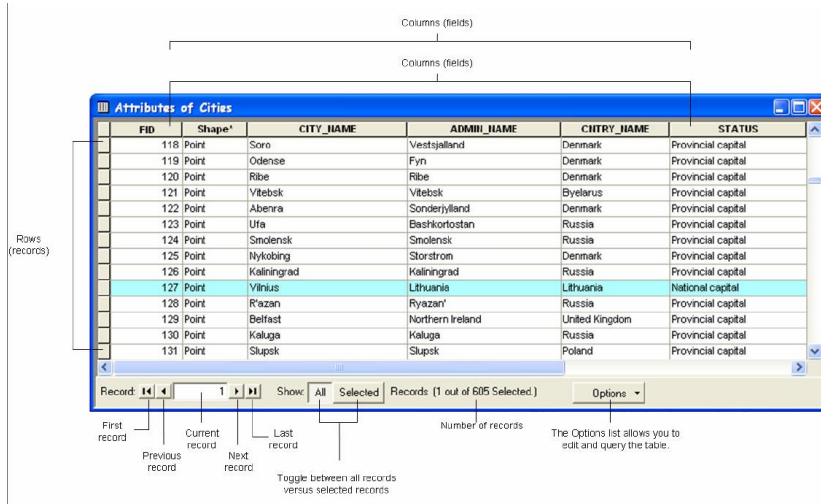
Relates are used for 1-to-many relationships, or many-to-many relationships between the attribute table and an external table.

When you join two tables, you append the attributes from one onto the other based on a field common to both.

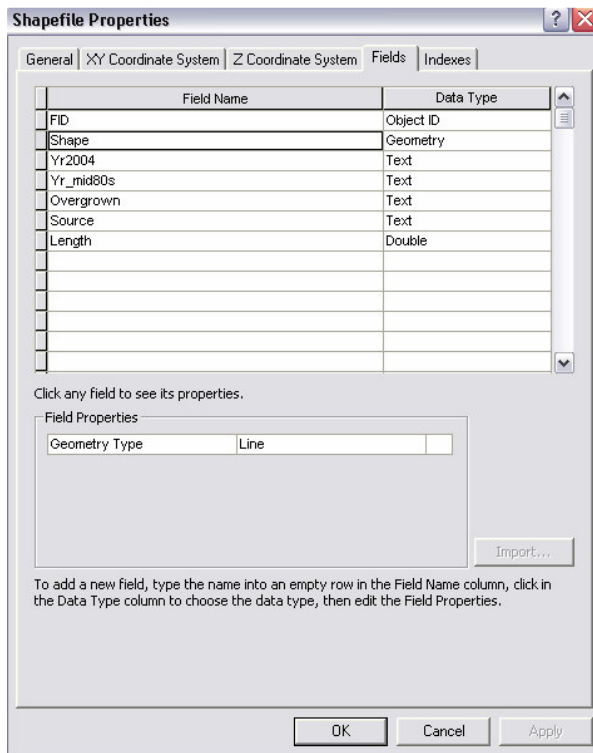
Relating tables defines a relationship between two tables—also based on a common field—but doesn't append the attributes of one to the other; instead, you can access the related data when necessary.

(c) List down any three (3) elements of attribute table that you can think of. Also briefly discuss with examples how you understand attribute table field properties and how it is created.

Elements of Attribute Table



Attribute table field properties



When trying to creating new features in the GIS software, the field name is to be specified including data type and others.

When you create a new table or feature class you can specify the number of fields to be included in an attribute table through a properties dialog box.

You can also specify settings for fields, such as the field type and the maximum size of the data that can be stored in the field.

-----End of question-----