# INSTITUTE OF REMOTE SENSING

## ANNA UNIVERSITY, CHENNAI - 600 025.

# LAB MANUAL

## SPATIAL ANALYSIS AND APPLICATION LABORATORY

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| Ex.No. 1 | Raster Analysis (Data Properties, Map Algebra Reclassification) | Date |
|---|---|---|

**Aim:**
To perform raster analysis such as checking raster properties, mosaic analysis, and reclassification.
**Software:**
ArcMap 10.2.2
**Procedure:**

- Create a folder with your roll number as name.
- Copy Spatial93 folder from share folder
- Create a folder named "EX-1" and a subfolder named "SCRATCH" under the folder "EX-1".
- Open the ArcMap software 10.2.2
- Add Data -> Spatial93-> Elevation, Landuse
- Set the environment settings:
    - Workspace folder for Current & Scratch for scratch ws.
    - Raster Analysis Cell size: Select same as layer elevation.
    - Check raster, workspace, cell size

**Environment settings**

Add data -> Spatial 93 Elevation

- Geoprocessing -> Environment -> workspace -> add ws for current working and scratch for scratch workspace
- Raster Analysis -> cell size -> select same as data
- Check OK

**Layer Properties**

- Right click Elevation/Landuse layer -> Properties ->Note Extent, cell size, statistics, projection, rows & columns.

**Note the raster information (Elevation and Landuse)**

- No. of Columns and Rows:
- Cell size (x,y) :
- Extent:
    - Top :
    - Left :
    - Right :
    - Bottom :
- Spatial Reference :
- Datum :
- Statistics:
    - Min:
    - Max:
    - Std Dev:
    - Class:
- Right click on dataset -> Properties

**Map Algebra:**

- Enable Extension -> Spatial Analyst Extension
- Enable Spatial Analyst tool bar
- Open the ArcToolbox -> Spatial Analyst Tools -> Raster Calculator
- Raster Calculator: select layesr and do arithmetic and logical operations
- For the layer if required Stretch data to display

    - Using Identify toolto find point details each pixel and note

**Raster Calculator**

- Extension -> Spatial Analyst Tools -> Raster Calculator
- Input layer :Elevation
- Enter the expression: "Elevation" – 50
- Output file name : Elevation-50
- Click OK

Original elevation values will be modified to "Elevation-50"

Using Identify tool find point details each pixel between the two elevation data and note

**Reclassification**

- Binary Marking**:** Setting some threshold and classify
- Regrouping: Grouping the values
- Ranking: good, better, best
- Scale changing or Class Reduction (reducing the no. of classes)

Reclassification can be carryout by changing symbology for just printing or by tool if required for data for further processing

- Right click the layer -> properties, By changing symbology we reclassify (classified, classified, under major values) Can also change no. of classes & classification method (manual, equal interval)
- Another way ,ArcToolbox -> Spatial Analyst tool ->Reclassify -> Reclassify, we can save another file.
- In Raster Calculator, we can also do Binary marking using logical condition

**Binary Masking (Map Algebra)**

- Spatial Analyst Tools -> ArcToolbox -> Map Algebra -> Raster Calculator
- Input layer :Elevation
- Enter the expression: **:** "Elevation" ≥ 1500
- Output file name : binary_mask.tif
- Click OK

Original elevation values will be classified into 2 classes"

**Binary Masking (By Reclassify Tools)**

1. ArcToolbox -> Spatial Analyst Tools -> Reclassify -> Reclassify
2. Input: Elevation
3. Parameters: Reclass field: value
4. Classes: 2
5. Method: equal interval
6. Output Raster: binary_mask1.tif

Original elevation values will be classified into 2 classes"

**Class Reduction**

1. ArcToolbox -> Spatial Analyst Tools -> Reclassify -> Reclassify
2. Input: Elevation
3. Parameters: Reclass field: value
4. Classes: 3
5. Method: equal interval
6. Output Raster: Class-Restriction.tif

**Scale Changing**

- Right click layer -> Properties -> Symbology
- Classes: 3
    - Low: 438 - 2393.333333 - suitable
    - Moderate: 2393.333333 - 3053.333333 - moderate
    - High: 3053.333333 - 4361 - non-suitable
- Method: equal interval

**For every layer create a simple Layout :**

- At bottom we have data view and layout view
- Insert -> Title, scale bar, north arrow
- At bottom, insert north arrow, scale bar, and legend for threshold value
- File -> Layout map to A4, save, and save in jpg format

| Ex. No. 2 | Raster Analysis (Arithmetic and Logical Overlay) and Surface Analysis (Slope, Aspect, Viewshed) | Date |
|---|---|---|

**Aim:**
To understand and perform DEM analysis (Elevation, Slope, Aspect)
**Software:**
ArcMap 10.2.2
**Procedure:**

- Create a folder EX2 under your roll number folder.
- Create a ws and scratch folders under named "EX2"
- Add layers to ArcMap from spatial93 folder (Elevation & Landuse)
- Set the environment settings:
    - Workspace folder for current & scratch for scratch ws, Extent same as Landuse
    - settings Cell size: Same as the elevation
- Slope: Slope gives the slope in the height levels
- Aspect: Aspect gives the direction (degrees)
- HillShade: Visualisation of the slope
- Viewshed: Visible and invisible line of sight locations/regions

**Slope:**
Open ArctoolBox -> SpatialAnalyst tools->Surface->Slope

Input raster :elevation
Output raster :slope_elev
Measurment :degree
Zfactor :0.3048 ;(ft to m)

- View and explore the slope layer properties, legend etc.
- Prepare a simple layout and export as jpeg file

**Aspect:**
Open ArctoolBox -> SpatialAnalyst tools->Surface->Aspect

Input raster :elevation
Output raster : aspect_elev

- View and explore the aspect layer properties, legend etc.
- Prepare a simple layout and export as jpeg file

**Hillshade:**
Open ArctoolBox -> SpatialAnalyst tools->Surface->Hillshade

Input raster :elevation
Output raster :Hillshade
Azimuth : default
Altitude: : default
Zfactor :0.3048 ;(ft to m)

- View and explore the hillshde layer properties, legend etc.
- Prepare a simple layout and export as jpeg file

**Drape landuse over hillshade**

We can view the landuse with a 3D like image by draping it over the hilldshade

- In the table of content deselect all other layers except landuse and hillshade
- Reorder the layers such that hillshade just below landuse
- In the Effects toolbar adjust the transparency of landuse to 50%

We can see the display landuse with hillshade effect

- Prepare a simple layout and export as jpeg file

**Viewshed**

Gives the details about the line of sight / region from the given point

- Add "School" vector point data
- Using selection tool select one or few schools

Open ArctoolBox -> SpatialAnalyst tools->Surface->Viewshed

Input raster :elevation
Input point feature: school
Output raster :Viewshed
Zfactor :0.3048 ;(ft to m)

- View and explore the viewshed layer properties, legend etc.
- Prepare a simple layout and export as jpeg file

**Overlay :**

**Reclass**_landuse and slope each having tw classes of equal interval
ArcToolbox -> Spatial Analyst Tools -> Reclassify -> Reclassify

Input: Slope
Method: Equal Interval
No. of classes: 2/10
Output: E:\Geo6\roll.no\EXI\SCRATCH\Reclass_slope.tif

Input: Landuse
Method: Equal Interval
No. of classes: 2/10
Output: E:\Geo6\roll.no\EXI\SCRATCH\Reclass_land.tif

**Logical Overlay:**

Spatial Analyst Tools -> Map Algebra -> Raster Calculator
Input layer : Reclass_slope.tif, Reclass_land.tif
Enter the expression: **:** : Reclass_slope.tif & Reclass_land.tif
Output file name : logical_over.tif

- View and explore the logical_over layer properties, legend etc.
- Prepare a simple layout and export as jpeg file

**Arithmetic Overlay:**

Spatial Analyst Tools -> Map Algebra -> Raster Calculator

Input layer : Reclass_slope.tif, Reclass_land.tif

Enter the expression: **:** : (Reclass_slope.tif *100)+ Reclass_land.tif

Output file name Arith_over.tif

- View and explore the Arith_over layer properties, legend etc.
- Prepare a simple layout and export as jpeg file

| Ex. No. 3 | Raster Analysis (Distance, Weighted Overlay) | Date |
| --- | --- | --- |

**Aim:** To understand the weighted overlay and distance raster processing

Problem definition
Identify a new school site that fulfils the following criteria:

- Should be near to the recreation sites
- Away from the existing schools
- Suitable land use
- Plain terrain
- Road connectivity.

**Software Used:**
ArcMap 10.2.2

**Procedure:**

- o Create a folder EX3 under your roll number folder.
- o Create a ws and scratch folders under "EX3"
- o Open the ArcMap software
- o Add data from spatial93 folder (Landuse, Elevation, recreation sites and schools).
- o Set the environment settings:
  - o Workspace folder for current & scratch for scratch ws, Extent same as Landuse
  - o settings Cell size: Same as the elevation

**Slope**
For Plain terrain
Open ArctoolBox -> SpatialAnalyst tools->Surface->Slope

Input raster :elevation
Output raster :slope_elev
Measurment :degree
Zfactor :0.3048 ;(ft to m)

**Near Analysis: Distance Raster**
Open ArctoolBox -> SpatialAnalyst tools->distance->Euclidian distance

Input : rec_sites
Output : rec_dist

View and explore the rec_dist layer properties, legend etc

Open ArctoolBox -> SpatialAnalyst tools->distance->Euclidian distance

Input : school
Output : sch_dist,

View and explore the sch_dist layer properties, legend etc

**Reclassify:**

To normalise reclassify the three layers slope_elev rec_dist and sch_dist
Weighted Overlay needs discrete values so reclassification is needed
Normalization: By converting all values into one scale. For this, reclassification is needed.

- Here, all the three layers slope_elev rec_dist and sch_dist values in are different scales, so reclassification is needed to bring into the common scale. The scale range is 1 to 10. We will assign new required value class is 10 and unwanted class value is 1
- Reclassify Input (slope) -> Method (equal) -> Slope:0-10 -> unwanted (0) 10+Required (1)
    - Instead of manually entering, we can use the Reverse the values option.
- Reclassify Input (rec_distance) -> Output... Method (equal) ->
    - Required (closer sites) – so new value 10
    - we can use the Reverse the values option
- Reclassify Input (sch_distance) -> Output... Method (equal) ->
    - Condition away: so last group belongs to 10 no need to reverse the values option.

**Reclass Slope:**

- Open ArctoolBox -> Spatial Analyst tools-> Reclassify -> Reclassify
    - Input Raster: slope_elev
    - Method: equal interval
    - Classes: 10
        - (our requirement is plain terrain, in slope analysis first group, i.e. 0-5° belongs to plain terrain, so we can fix it at 10 (plain terrain = 10). So using reverse option, we can numbers to nearest from 10 to 0) (plain to steep) = [10 - 1] (reverse)
    - Output Raster: Reclass_slope

View and explore the Reclass_slope layer properties, legend etc

**Reclass Rec distance**

- Open ArctoolBox -> Spatial Analyst tools-> Reclassify -> Reclassify
    - Input Raster: rec_dist
    - Method: Equal Interval
    - Classes: 10
        - Our requirement is nearest to recreation sites. So again fix 10 as number for nearest and 10 as farthest.
        - Click reverse option.
    - Output: Reclrec_dist

View and explore the Reclrec_dist layer properties, legend etc

**Reclass School distance**

- Open ArctoolBox -> Spatial Analyst tools -> Raster -> Reclassify
    - Input Raster: sch_dist
    - Method: Equal Interval
    - Classes: 10
        - Our requirement is away so no need to reverse the values.
    - Output: Recl_sch_dist

View and explore the Recl_sch_dist layer properties, legend etc

**Weightage of influence**

For finding the required site each condition is having different weightage an is given below

Distance from recreation sites : 50%
Distance from school 25%
For Plain terrain 13%
For the suitable landuse 12%

**Weighted Overlay**

Open ArctoolBox -> Spatial Analyst tools-> Overlay -> Weighted Overlay

- First set Evaluation Scale: From 1 to 10 by 1
- Using Add option, add Reclass_slope, Reclrec_dist, Recl_sch_dist and landuse.
- Reclass of slope values from 1 to 3 restricted
- For landuse set the values as below
  - Brushland: 5
  - Barrenland: 10
  - Built up: 9
  - Agriculture: 3
  - Forest: 4
  - wetlands, water areas are not suitable for building school, set them as restricted.
- Set influence as
  - 50 for recreation sites
  - 25 for school
  - 13 for slope
  - 12 for landuse
- Output: weighted.tif

View and explore the weighted.tif layer properties, legend etc

Selecting the maximum value data from weighted overlay (ie.9)

**Conditional**

Open ArctoolBox -> Spatial Analyst tools-> Conditional->Con tool

- Input: weighted
- Value: 9
- Output: con-weighted.tif

View and explore the con-weighted.tif layer properties, legend etc

**Majority filter**

To get a contiguous area we run this tool

Open ArctoolBox -> Spatial Analyst tools-> Generalisation->Majority tool

- Input: con-weighted.tif
- Output: majority
- Number of neighbors to use : Eight
- Replacement threshold :Majority

View and explore the majority layer properties, legend etc

Using ArcCatalog, Create a geodatabse on your folder name it result.gdb

**Convert raster to vactor**
Open ArctoolBox ->Conversion tool-> From raster -> Raster to polygon

- Input: majority
- Field: value
- Output: majority_vec (save on result.gdb)

**Road connectivity**
Add road layer to Arcmap

Open from menu selection->selection by location
Method : Select feature from
Target layer : majority_vec
Source layer :roads
Spatial selection method for target layer features : intersect the source layer features

Few polygons from majority_vec layer get selected that have connectivity with roads

**Choose area abovet 10 acre**

Right click on majority_vec layer and open attribute table
Open Option->select by attribute
Method : select by current selection
Condition : shape_area > 40469

**Create layer**
Right click on majority_vec->slection->create layer from selection

**Save the layer as data**
Open ArctoolBox ->Data management tools ->Features->Copy features tool
Input: Majority_vec_selection
Output: final_site (save on result.gdb)

Note the area of the final site

- Prepare a simple layout and export as jpeg file

| Ex. No. 4 | Raster Analysis (Least Cost Path) | Date |
|---|---|---|

**Aim:**
To understand the least cast path analysis on raster data

**Problem definition**
Identify a route which is least cost path from recreation site Town land to Moscow field.
**Software Used:**
ArcMap 10.2.2
**Procedure:**

- Create a folder EX4 under your roll number folder.
- Create a ws and scratch folders under "EX4"
- Open the ArcMap software
- Add data from spatial93 folder (Landuse, Elevation and recreation sites ).
- Create a geodatabase in your folder “result.gdb”
- Set the environment settings:
    - Workspace folder for current & scratch for scratch ws, Extent same as Landuse
    - settings Cell size: Same as the elevation

**Slope**

Open ArctoolBox -> SpatialAnalyst tools->Surface->Slope

Input raster :elevation
Output raster :slope_elev
Measurment :degree
Zfactor :0.3048 ;(ft to m)

View and explore slope_elev layer properties, legend etc

**Reclass Slope:**

- Open ArctoolBox -> Spatial Analyst tools-> Reclassify -> Reclassify
    - Input Raster: slope_elev
    - Method: equal interval
    - Classes: 10
        - (our requirement is plain terrain, in slope analysis first group, i.e. 0-5° belongs to plain terrain, so we can fix it at 1 (plain terrain = 1). and steep terrain 10. So no change in new values.
    - Output Raster: Reclass_slope

View and explore Reclass_slope layer properties, legend etc

**Weighted Overlay**
Open ArctoolBox -> Spatial Analyst tools-> Overlay -> Weighted Overlay

- First set Evaluation Scale: From 1 to 10 by 1
- Using Add option, add reclass of slope and landuse
- Set equal influence (ie.50%)
- For landuse set the values as below
    - Brushland: 5
    - Water: 10

    - Barrenland: 2
    - Built up: 9
    - Agriculture: 4
    - Forest: 8
    - Wetlands:10
- Output: cost

View and explore the cost layer properties, legend etc

- **Using selection tool select Mascow field rec site**

**Cost Distance**
Open ArctoolBox -> Spatial Analyst tools-> Distance -> Cost distance
- Input vector: rec_sites
- Cost raster: cost
- Output: cost_distance
- Output Back Link : backlink

View and explore the cost_distance, backlink layers properties, legend etc

- **Using selection tool select Town Land rec site**

**Cost Path**
Open ArctoolBox -> Spatial Analyst tools-> Distance ->Cost path
- Input vector: rec_sites
- Cost distancer: cost_distance
- Back linkt: backlink
- Output raster : cost_path

View and explore the cost_path layer properties, legend etc

**Convert raster to vactor**
Open ArctoolBox ->Conversion tool-> From raster -> Raster to polyline
- Input: cost_path
- Output: path (save on result.gdb)

**Unsplit line**
Open ArctoolBox ->Data management tools ->Features->Unsplit line
- Input: path
- Output: final_path (save on result.gdb)

Note the length of the final_path

- Prepare a simple layout and export as jpeg file

| Ex. No. 5 | Raster Analysis (Watershed and Basin) | Date |
|---|---|---|

**Aim:**
To perform watershed delineation for the given raster data using hydrology tools from Spatial analysis tool.
**Software Used:** ArcMap version 10.2.2
**Theory:**

- **The hydrology tools are used to model the flow of water across a surface.** They can be applied individually or used in sequence to create a stream network or delineate watersheds.

**Fill:**

- o Fills sinks in a surface raster to remove small imperfections in the data. They can also be used to remove peaks.

**Flow Directions:**

- o Flow direction creates a raster of flow direction from each cell to its steepest

**Flow Accumulation:**

- Flow accumulation creates a raster of accumulated flow into each cell. A weight factor can optionally be applied.
- The result of flow accumulation is a raster of accumulated flow to each cell, as determined by accumulating the weight for all cells that flow into each downslope cell.
- It does not honour the compression environment setting. The output raster will always be uncompressed.

**Snap Pour Point:**

- Snaps pour point to the cell of highest flow accumulation within a specified distance.
- It is used to ensure the selection of points of high accumulated flow when delineating drainage basins using watershed tool. It will search within a snap distance around the specified pour point for the cell of highest accumulated flow and move the pour point to that location.
- In output, original pour point locations have been snapped to locations of higher accumulated flow.

**Basin:**

- Basin creates a raster delineating all drainage basins.
- The drainage basins are created within the analysis window and are delineated by locating pour points at the edges of analysis window as well as sinks. Then identifying contributing area above each pour point. This results in raster of drainage basins.
- All cells in raster will belong to a basin, even if that basin is only one cell.

**Watershed:**

- Watershed determines the contributing area above a set of cells in a raster. The value of each watershed will be taken from a raster dataset. When pour point is used, the values will come from the specified field.

**Procedure**

- o Create a folder EX5 under your roll number folder.
- o Create a ws and scratch folders under "EX5"
- o Open the ArcMap software
- o Add data from spatial93 folder (Elevation).
- o Create a geodatabase in your folder “result.gdb”
- o Set the environment settings:
  - o Workspace folder for current & scratch for scratch ws, Extent same as Landuse
  - o settings Cell size: Same as the elevation

**Fill:**

Open ArcToolbox -> Spatial Analyst tool -> Hydrology -> Fill

- Input raster: elevation
- Output raster : fill_ras
- (Z-limit - not needed )

View and explore the fill_ras layer properties, legend, changing symbology etc

**Flow Direction:**

Open Arc Tool Box -> Spatial Analysis Tools -> Hydrology -> Flow Direction.

- Input raster: fill_ras
- Output raster : flowdir

View and explore the flowdir layer properties, legend, changing symbology etc

**Flow Accumulation:**

Open Arc Tool Box -> Spatial Analyst tool -> Hydrology -> Flow Accumulation.

- Input raster: flowdir
- Output raster : flowacc
- Data type : Float

Right click on 'flowacc' -> Properties -> Symbology -> Stretched -> Stretch type - Histogram equalization -> Apply -> okay. (Select required colours)

View and explore the flowacc layer properties, legend, changing symbology etc

**Pour Point:**

- Using ArcCatalog create a point feature class name as 'pourpoint' under result.gdb
- Create a point feature on pourpoint layer using editing tools at a required location along the stream end on flowacc

**Snap Pour Point:**

Open Arc Tool Box -> Spatial Analysis tool -> Hydrology -> Snap pourpoint tool.

- Input raster/vector: pourpoint
- Pour point filed : Object ID
- Input accumulation layer:flowacc
- Output raster : snappour_pt
- Sanp distance: 100

**Watershed:**

Open Arc Tool Box -> Spatial Analyst tool -> Hydrology -> Watershed.

- Input flow direction raster: flowdir
- Input feature pour point raster: snappour_pt
- Pour point field : value
- Output raster : watershed

**Raster To Polygon Conversion:**
Open Arc Tool Box -> Conversion Tools -> From Raster -> Raster to Polygon

- Input raster: watershed
- Field : value
- Output: watershed (on result.gdb)
- check of simplify polygon

**Extraction:**
Extracting the elevation data for watershed area and may be used for layout preparation

Open Spatial Analysis tool -> Extraction -> Extract by Mask

- Input raster: elevation
- Feature mask: watershed (on result.gdb)
- Output raster: clip_elevation

**Basin:**
Open Spatial Analysis tool -> Spatial analyst tool -> Hydrology -> Basin

- In flow direction raster: flowdir
- Output raster: basin

**Raster To Vector Conversion:**
Open Arc Tool Box -> Conversion Tools -> From Raster -> Raster to Polygon

- Input raster: basin
- Field : value
- Output: basin_vec (on result.gdb)
- check of simplify polygon

Using selection tool select the biggest polygon on basin_vec save it as separate layer as basin_clip on result_gdb
(Recall the tools used for such task)

**Extracting Flow accumulation separately**.

**Calculation Of "Flowacc > 100":**
Open Arc Tool Box -> Spatial Analyst Tools -> Map Algebra -> Raster Calculator

- Input layer : flowacc
- Enter the expression: **:** : Flowacc > 100
- Output file name : flowacc_100

Convert the floacc_100 to vector and save it as flowacc100_vec on result.gdb

- Prepare a layout watershed (result.gdb), clip_elevation and flowacc100_vec
- Prepare a layout basin_clip, clip_elevation and flowacc100_vec

| Ex. No. 6 | Surface Analysis (Interpolation, Contour) | Date |
|---|---|---|

**Aim:**
To perform surface analysis with various interpolation techniques.
**Software Used:**
ArcMap 10.2.2
**Procedure**

- Create a folder EX6 under your roll number folder.
- Create a ws and scratch folders under "EX6"
- Copy the DIND_block gdb file from share and paste it in ws folder
- Open the ArcMap software
- Add point data from copied file
- Create new File Geo DB interpolation.gdb on ws folder
- Set the Environment:
  - Extent: same as layer points
  - Cell size: 30
  - Enable extension 3D Analysis and open Tool Bar

**IDW**
Open Arc Tool Box -> 3D Analyst Tools -> Raster interpolation -> IDW tool

- Input point feature : points
- z value : height
- Cell size: 30
- Output raster: idw-point (scratch folder)

View and explore the idw-point layer properties, legend etc

**Contour**
Create contour using idw-point
Open Arc Tool Box -> 3D Analyst Tools -> Raster Surface -> contour tool

- Input raster: idw-pont (scratch folder)
- z factor : 0.3048
- Base contour: (example value:611.0)
- Contour interval: 2
- Output raster: idw-contour (interpolation.gdb)

View and explore the idw-contour layer properties, legend etc

- Prepare a simple layout and export as jpeg file

**KRIGING:**
Open Arc Tool Box -> 3D Analyst Tools -> Raster interpolation -> kriging

- Input point feature : points
- z value : height
- Cell size: 30
- Output raster: kriging -point (scratch folder)
- Choose ordinary (also try other methods)

**Contour**
Create contour using kriging –point and save as kriging-contour (interpolation.gdb)

View and explore the kriging-contour layer properties, legend etc

- Prepare a simple layout and export as jpeg file

**NATURAL NEIGHBOUR**
Open Arc Tool Box -> 3D Analyst Tools -> Raster interpolation -> Natural neighbour tool

  - Input point feature : points
  - z value : height
  - Cell size: 30
  - Output raster: nn -point (scratch folder)

**Contour**
Create contour using nn –point and save as nn-contour (interpolation.gdb)

View and explore the nn-contour layer properties, legend etc

- Prepare a simple layout and export as jpeg file

**SPLINE:**
Open Arc Tool Box -> 3D Analyst Tools -> Raster interpolation -> Spline tool

  - Input point feature : points
  - z value : height
  - Cell size: 30
  - Output raster: spline -point (scratch folder)

**Contour**
Create contour using spline –point and save as spline-contour (interpolation.gdb)

View and explore the spline-contour layer properties, legend etc

- Prepare a simple layout and export as jpeg file

| Ex. No. 7 | Vector Analysis (Attribute Analysis and Data Extraction) | Date |
|---|---|---|

**Aim:**
To perform vector analysis (attribute analysis) on data - attributes.
**Software:**

- ArcMap 10.2.2

**Procedure:**

- o Create a folder EX7 under your roll number folder.
- o Copy the DIND_block gdb filefrom share and paste it in EX7 folder
- o Open the ArcMap software
- o Add all layers from DIND_block

1. **Select by Attributes**
   **Query:** Show me all the village blocks having area more than 100 sq.m
   - Right click village layer ->Open attribute table.
   - Table option -> select by attribute
     - o **<u>Method:</u>** create a new selection
     - o Expression : Shape: area > 1000
     - o Check the expression by clicking 'verfy'
     - o If no error Apply
     - o Note number of records get selected

2. **Create layer from selection**
   - Right click village layer ->Selection -> Create layer from the selected feature

3. **Export data**
   - Right click selected layer ->Data -> Export data
   - Save in Ex7 folder as shape file

**<u>Do the steps 1 to 3</u>** for the other selection methods in step 1 (given below) by forming your own meaning full **queries.**

- Add to the current selection
- Remove from the current selection
- Select from the current selection
- Switch selection (invert)

**Location Selection**
**Query:** How many villages have road facility?

Open menu Selection -> Select by location

- o **<u>Selection Method</u>** : select features from
- o Target Layer: Village
- o Source Layer : Roads
- o **<u>Spatial selection method for target feature layer</u>**: intersect
- o Note no of records get selected

In above you can apply different combination of selection method and spatial selection methods
Save the results as shape file in EX7 as you did in previous attribute selection.

| Ex. No. 8 | Vector Analysis (Buffer, Union and Analysis) | Date |
| --- | --- | --- |

**Aim:**
To perform Buffer, Union and statistical analysis

**Problem:**
Find out the required data and present it in the following form, towards acquiring the land by widening each panchayat road at 300 units on both sides with the given LANDUSE and ROAD feature classes.

**Procedure:**

- Create a folder EX8 under your roll number folder.
- Copy layer ANA1020.gdb to EX8 folder
- Open the ArcMap software
- Add road, landuse layers from THIRU dataset

**Road Buffer**

**Adding buf attribut**

- Open attribute table of road layer
- Add field
  - Name: buf,
  - Type :Short int
- Using select by attribute select roadtype = 'P.Road'
- Using Field calculator assign buf=300
- Do switch selection
- Using Field calculator assign buf=0
- Do clear selection (very important)

**Buffer:**

Open Arc Tool Box ->Analysis->Proximity->Buffer tool

- Input point feature : road
- Output feature: roadbuf_300 (save in THIRU dataset)
- Field: buf
- Side type: FULL
- End type: ROUND
- Dissolve type: NONE

View and explore the roadbuf_300 layer properties, legend etc

**Overlay-Union:**

Open Arc Tool Box ->Analysis->Overlay->Union tool

- Input feature : landuse, roadbuff_300
- Output feature: union (save in THIRU dataset)
- XY tolerance: 0.001

View and explore the union layer properties, legend etc

**Adding HA, cost fields:**

- Open attribute table of union layer
- Add field
  - o Name: HA
  - o Type : flost
- Add field
  - o Name: cost
  - o Type : flost
- Using Field calculator assign HA=(Shape_Area/10000)
- Using Field calculator assign cost=(ACQCOST*HA)

**Selecting buffer area**

- Open union attribute table (if not open yet)
- Using select by attribute select FID_roadbuff_300 <> -1 (Negative means outside the buffer area)

**Statistical analysis:**

Open Arc Tool Box ->Analysis->Statistics->Summery statistics tool

- o Input table : union
- o Output table: stat1(save in ANA1020.gdb)
- o Statistic filed Statistic type

| Statistic filed | Statistic type |
|---|---|
| HA | SUM |
| Cost | SUM |

- o Case Field: roadname
- o Do clear selection (very important)

**Join the union table and stat table get the buffer**

- Right click on union layer -> Join and relates
  - o Choose field in this layer that join will be based on: ROADNAME
  - o Choose table to join to this layer: stat1
  - o Choose field in table to base join on: ROADNAME

Now in union attribute table have stat1 data also. To find minimum cost, using select by attribute on union table with the expression 'STAT1,SUM_COST=(SELECT MIN(SUM_COST) FROM STAT1)

- On union layer <u>create layer from selected feature</u>, and save it as feature class name 'union_selection' under THIRU dataset.

Open Arc Tool Box ->Analysis->Statistics->Summery statistics tool

- o Input table : union_selection
- o Output table: stat2(save in ANA1020.gdb)
- o Statistic filed Statistic type

| Statistic filed | Statistic type |
|---|---|
| Union_HA | SUM |
| Union_Cost | SUM |

- o Case Field: UnionName

**Identifying the road that need least cost by using select by location**

Open menu Selection -> Select by location

- **Selection Method** : select features from
- Target Layer: Road
- Source Layer : union_selection
- Spatial selection method for target feature layer: have their centroid in source layer feature

On road layer create layer from selected feature, and save it as feature class name 'selected_road' under THIRU dataset.

- Prepare a simple layout and export as jpeg file

**Fill the details as in the table**

**Road and land details**

| Road ID | Road Name | Length | Total area to be acquired in ha | Total cost |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Suggested road and the landuse details

| **Road ID** | **Road Name** | **Length** |
|---|---|---|
| | | |
| **Landuse type** | **Area in ha** | **Cost** |
| | | |
| | | |
| | | |
| | | |
| | | |
| **Total** | | |

| Ex. No. 9 | Vector Analysis (Erase and Identify) | Date |
|---|---|---|

**Aim:**
To perform Buffer,Eerase, Identity and statistical analysis

**Problem:**
Identify the suitable aquaculture site satisfying the following criteria:

- Preferred Landuse is barren land
- Choose the SUIT is greater than or equal to 2
- Site must be within 300 m of existing sewer lines
- Site must be beyond 30 m of streams
- Site must contain an area of at least 1000 meters square
- Report the area in ha.

**Procedure:**

- o Create a folder EX9 under your roll number folder.
- o Copy layer ANA1020.gdb to EX9 folder
- o Open the ArcMap software
- o Add landuse, soil, sewers and streams layers from AQUA dataset

- Explore attribute table of all layers and find the required fields to meet the criteria.

**Buffer on sewers layer** (to meet within condition):
Open Arc Tool Box ->Analysis->Proximity->Buffer tool

- o Input point feature : sewers
- o Output feature: sewbuf_300 (save in AQUA dataset)
- o Linear unit : 300
- o Side type: FULL
- o End type: ROUND
- o Dissolve type: **ALL** (IMPORTANT)

**Buffer on streams layer** (to meet away condition):
Open Arc Tool Box ->Analysis->Proximity->Buffer tool

- o Input point feature : streams
- o Output feature: strbuf_30 (save in AQUA dataset)
- o Linear unit : 30
- o Side type: FULL
- o End type: ROUND
- o Dissolve type: **ALL** (IMPORTANT)

**Erase** (to get both away and within criteria)
Open Arc Tool Box ->Analysis->Overlay->Erase tool

- o Input feature: sewbuf_300
- o Erase Feature: strbuf_30
- o Tolerance: 0.001
- o Output: erase (save in AQUA dataset)

**Identity-1:** (spatial overlay landuse and soil to keep landuse extent)
Open Arc Tool Box ->Analysis->Overlay->Identity tool

- o Input feature: landuse
- o Identity Feature: soil

- Tolerance: 0.001
- Output: identity1 (save in AQUA dataset)

**Identity-2:** (spatial overlay landuse and soil to keep landuse extent)
Open Arc Tool Box ->Analysis->Overlay->Identity tool

- Input feature: identity1
- Identity Feature: erase
- Tolerance: 0.001
- Output: identity2 (save in AQUA dataset)

Open attribute table of indetity2 layer

- Add two fields
  - Name : HA, type : float
  - Name: cost, type float
- Use field calculator to calculate
  - HA=Shape_area/1000
  - Cost=ACQCOST*HA
- Table option -> select by attribute
  - Enter the sql: *LUSENAME='BARREN' AND SUIT >= 2 AND FID_ERASE <> -1 AND SHAPE_AREA >=1000;*

**Summary statistics:**
Open Arc Tool Box ->Analysis->Statistics->Summery statistics tool

- Input table identiy2
- Output table: aqua_stat(save in ANA1020.gdb)
- Statistic filed Statistic type

| Statistic filed | Statistic type |
|---|---|
| Union_HA | SUM |
| Union_Cost | SUM |

- Prepare a simple layout and export as jpeg file

| Ex. No. 10 | Vector Analysis (Ranking, Suitability Index, Eliminate and Dissolve) | Date |
|---|---|---|

**Aim:**
To perform Ranking, Suitability Index, Eliminate, Dissolve and statistical analysis

**Problem:**
Identify the suitable area for growing mulberry crop with the following feature classes: Soil, Landuse, and Geomor.

Look out the criteria listed below
WEIGHTAGE*:

- Soil: 40%
- Landuse: 40%
- Geomor: 20%

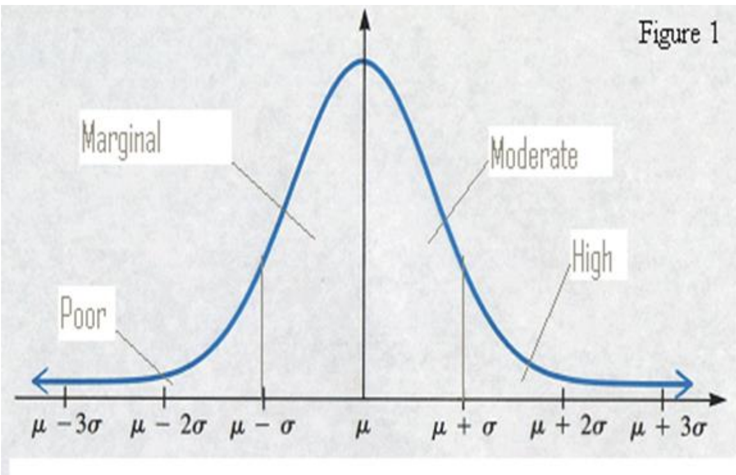
**Rank Table**

| **RANK** | **SOIL** | **LANDUSE** | **GEOMOR** |
|---|---|---|---|
| **1.** | - | 50 700 | 177 |
| **2.** | 109 110 | 190 729 | 180 190 |
| **3.** | 105 106 107 108 | 705 | 168 169 |
| **4.** | 101 102 103 104 | 703 718 | 170 |

* Consider the polygons having area >1000 Sq.m

- Group the resultant polygons area as:
  - Highly suitable: > mean CSI + 1 SD
  - Moderately suitable: mean CSI + 1 SD - mean CSI
  - Marginally suitable: mean CSI - 1 SD - mean CSI - 1 SD
  - Poorly suitable: < mean CSI - 1 SD

Furnish statistics such as Max CSI, Min CSI, mean, SD
Report the area in ha. under each suitability class.



**Procedure**

- o Create a folder EX10 under your roll number folder.
- o Copy layer ANA1020.gdb to EX10 folder
- o Open the ArcMap software
- o Add landuse, soil and geomor layers from MULB dataset
- o Explore attribute table of all layers and find the required fields to meet the criteria

**Landuse**

- Add field 'lrank', short int type
- Do select by attribute with query expression as per the data given for rank1 in the table
  - o LU_CODE = 50 OR LU_CODE = 700
  - o Note the number of records get selected
- Do filed calculator
  - o lrank=1
- Do it for other ranks in landuse layer
- Check for all records having rank value

**Soil**

- Add field 'srank', short int type
- Do select by attribute with query expression as per the data given for rank2 in the table
  - o SOIL_CODE = 109 OR SOIL_CODE = 110
  - o Note the number of records get selected
- Do filed calculator
  - o srank=2
- Do it for other ranks in soil layer
- Check for all records having rank value

**Geomor**

Add field 'grank', short int type

- Do select by attribute with query expression as per the data given for rank1 in the table
  - o GEOMOR_CODE = 177
  - o Note the number of records get selected
- Do filed calculator
  - o grank=1
- Do it for other ranks in geomor layer
- Check for all records having rank value

Do selection ->clear selection from main menu (it is very important)

**Overlay-Union:**

Open Arc Tool Box ->Analysis->Overlay->Union tool

- o Input t feature : ladnuse, soil, geomor
- o Output feature: union (save in MULB dataset)
- o XY tolerance: 0.001

Note number of records in union table

View and explore the union layer properties, legend etc

**Use polygons having area >1000 Sq.m:**

**Selection:**

- Do select by attribute on union layer with expression "Shape_area < =1000"
- If any such polygons are available merge them with neighbouring polygon with the largest area using Eliminate tool

**Eliminate:**

Open Arc Tool Box ->Data Management -> Generalisation ->Eliminate tool

- o Input feature: union
- o Output feature: eliminate_1 (save in MULB dataset)
- o **Uncheck** the check box : The selected polygon will be merged with the neighbouring polygon with the longest shared border.

**Selection:**

- Do select by attribute on eliminate1 layer with expression "Shape_area < =1000"
- If any such polygons are available merge them with neighbouring polygon with the largest area using Eliminate tool

**Eliminate:**

Open Arc Tool Box ->Data Management -> Generalisation ->Eliminate tool

- o Input feature: eliminate1
- o Output feature: eliminate_2 (save in MULB dataset)
- o **Uncheck** the check box : The selected polygon will be merged with the neighbouring polygon with the longest shared border.

Repeat the above selection and eliminate steps till the selection result become zero. Let us assume the finale eliminate output layer is eliminate_n.

Select clear selection from selection menu (important)

**Add fileds csi, ha, suitable and calculate values**

Open attribute table of eliminate_n layer

- Add two fields
  - o Name : HA, type : float
  - o Name: csi,, type float
  - o Name: suitable, type: short int
- Use field calculator to calculate
  - o HA=Shape_area/1000
  - o csi=(lrank*0.4)+(srank*0.4)+(grank*0.2)
  - o Right click on csi field choose statistics
  - o Note min, max, mean, std.div (for ex. Mean 3.23, SD 0.44)

Here boundary points are (3.23 - 0.44), 3.23, (3.23+0.44) which are 2.79, 3.23, 3.67

**Suitability:**
Do select by attribute on eliminate_n layer with expression given for each class and using filed calculator assign values to suitable field accordingly

- **High:**
    - Query expression: CSI > 3.67
    - suitable = 1
- **Moderate:**
    - Query: CSI > 3.23 AND CSI <= 3.67
    - suitable = 2
- **Marginal:**
    - Query: CSI > 2.79 AND CSI <= 3.23
    - suitable = 3
- **Poor:**
    - Query: CSI <= 2.79
    - suitable = 4

Select clear selection from selection menu (important)

**Summary statistics:**
Open Arc Tool Box ->Analysis->Statistics->Summery statistics tool

- Input table: union
- Output table: mulb_stat(save in ANA1020.gdb)
- Statistic filed    Statistic type
  HA    SUM
- Case field: suitable

Set symbology on union layer based on suitable field with no outline. This can be used for layout.

**Dissolve:**
Open Arc Tool Box ->Data Management -> Generalisation ->Dissolve tool

- Input feature: eliminate_n
- Output feature: dissolve (save in MULB dataset)
- Dissolve field: suitable

Open attribute table of dissolve layer add a text type filed size 15 called 'suitability' and enter description as below according to suitable

| suitable | suitability |
|---|---|
| 1 | High |
| 2 | Moderate |
| 3 | Marginal |
| 4 | poor |

- Prepare a simple layout using dissolve layer and export as jpeg file

| Ex. No. 11 | Network Analysis (Geocoding) | Date |
|---|---|---|

**Aim:** To perform geocoding process for the given data
**Software Used:** ArcMap 10.2.2
**Procedure:**

- Create a folder EX11 under your roll number folder.
- Copy layer CHE_ROADS10.gdb to EX11 folder
- Open the ArcMap software
- Add selected_roads layer from ROADS dataset , change symbol “Arrow at end” so we know the direction
- Explore attribute table of layer.

- Add field to selected_roads
    - Name: ‘streetname’
    - Type: text
    - Size: 30
- Using field calculator do streetname = roadname (ie copy)
- Modify the values in streetname like ST to Street, RD tor Road, remove alternative names if any
- Add short int type fields namely LF_ADD, LT_ADD, RF_ADD and RT_ADD to the selected_roads table. (Used to store door number left side starting, left side ending, right side starting and right side ending.)
- We assume odd numbers on left side and even numbers on right side and also assume 100 houses total per street name irrespective of number of segments of the street.
- Populate the door numbers as per the assumptions along the direction of the road

**Standardization**

Open Arc Tool Box ->Geocoding->Standardization tool

- Input feature: selected_roads
- Input address fields: Object_ID, streetname
- Address locator style: US Streets
- Output address fields: select all except House No
- Output feature : Std_Roads (in ROADS dataset)

- Open attribute table of Std_Roads and using field calculator do ID = Object_ID (ie copy)

**Creating address locator**

- Open ArcCatalog
- Right click on ROADS dataset -> New -> Address Locator
    - Address Locator style: US Streets
    - Reference Data: Std_Roads
    - House from left: LF_ADD
    - House to left: LT_ADD
    - House from right:RF_ADD
    - House to right:RT_ADD
    - Ouput Locator name: 123_add_locator (use your rollnumber)

**Geocoding properties:**

- Right click 123_add_locaator -> Properties->Geocoding options
    - Match with no zones: yes

**Find an address:**

- Close ArcCatalog and open ArcMap
- Add Std_roads data
- Add label and change symbol as Arrow at end
- Click find button, choose Locations tab
- Choose locator and give 123_add_locator
- Street or intersection: `enter an address` and click find. The matching addresses are listed below. Right click on the result choose flash o locate on the map, also explore other options

**Alternative Name to street:**

Close ArcMap and open ArcCatalog

Right click on CHE_ROADS10.gdb -> New Table

- Name:ALT_NAME
- Add following fields with data type
  - JoinID, Long Integer
  - PreDir, Text, Size 12
  - PreType, Text, Size 40
  - StreetName, Text, Size 60
  - SufType, Text, Size 40
  - SufDir, Text, Size 12

**Place Name:**

Right click on CHE_ROADS10.gdb -> New Table

- Name:PLACE
- Add following fields with data type
  - Name, Text, Size 15
  - Address, Text, Size 25

**Preparing tables for alternative street name and place name :**

- Close ArcCatalog and open ArcMap
- Add Std_roads layer, ALT_NAME, PLACE tables
- Add label and change symbol as Arrow at end on Std_roads
- Click Start Editing on editor toolbar
- Using identify tool note the ID of the street for which you need alternative name by clicking on the road
- Open ALT_NAME table, enter JoinID with the noted ID value, also fill StreetName with alternative name and fill other fields values if you have.
- Click Editor -> save edits
- Open PLACE table enter place name and address (one or more)
- Click Editor -> save edits and then Stop Editing
- Close ArcMap

**Creating alternative and place address locator**

- Open ArcCatalog
- Right click on ROADS dataset -> New -> Address Locator
  - Address Locator style: US Streets with alternate name
  - Reference Data:
    - Primary Table: Std_Roads

        - Alternative Table: ALT_NAME
        - Alias Table: PLACE
    - Primary Table House from left: Std_Roads : LF_ADD
    - Primary Table House to left: Std_Roads :LT_ADD
    - Primary Table House from right: Std_Roads :RF_ADD
    - Primary Table House to right: Std_Roads :RT_ADD
    - Primary Table JoinID : ID
    - Alternate Table JoinID: JoinID
    - Alias table Alias : PLACE:Name
    - Alias table Street :PLACE:Address
    - Ouput Locator name: 123Alt_add_locator (use your rollnumber)

**Geocoding properties:**

- Right click 123_add_locaator -> Properties->Geocoding options
    - Match with  no zones: yes

**Find an address with alternative street name or place name :**

- Close ArcCatalog and open ArcMap
- Add Std_roads data
- Add label and change symbol as Arrow at end
- Click find button,  choose Locations tab
- Choose locator and give 123Alt_add_locator
- Street or intersection: `enter an address or a place to locate` and click find

**Customer Table**

Close ArcMap and open ArcCatalog
Right click on CHE_ROADS10.gdb -> New Table

- Name:Customer
- Add following fields with data type
    - ID, Long Integer
    - Name, Text, Size 15
    - Address, Text, Size 30
- Close ArcCatalog and open ArcMap
- Add Customer table
- Editor->Start editing
- Populate some records on Customer table

**Address Geocoding from table**

- Open ArcMap if not in open
- Add Std_roads layer, Customer table
- Right click Customer table -> Geocode Addresses
- Choose address locator:  123Alt_add_locator
- Address table : Customer
- Street/Intersection: Address
- Output layer name: Geocoding_result.shp (EX11 folder)
- Click OK
- If any Unmatched results are there click Rematch, in the next window match manually nearest one by edit/find the address

| Ex. No. 12 | Network Analysis Route Analysis) | Date |
|---|---|---|

**Aim:** To perform the route analysis using ArcMap 10.2.2

**Procedure:**

- o Copy folder EX11 and paste then rename as EX12 under your roll number folder.
- o Open the ArcMap software
- o Enable Network Analyst Extension.
- o Add std_roads layer from ROADS dataset , change symbol "Arrow at end" so we know the direction

**Adding required fields**

- Add field to std_roads
  - o Name: Meters
  - o Type: double
- Using field calculator do Meters = Shape_length (ie copy)
- Add field to std_roads
  - o Name: Speed
  - o Type: Short integer
- Add field to std_roads
  - o Name: M_P_M
  - o Type: double
- Add field to std_roads
  - o Name: Minutes
  - o Type: double
- Add field to std_roads
  - o Name: Oneway
  - o Type: Text
  - o Size: 2
- Populate Speed field with value 10 if the Shape_length less than 600 else with value 20. Use Select by attribute and field calculator
- Using field calculator do M_P_M = Speed*16.667
- Using field calculator do Minutes = Meters / M_P_M

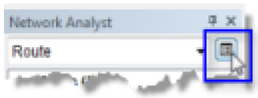
**Network dataset creation**

- Close ArcMap and open ArcCatalog
- Right click on ROADS dataset and select New > Network Dataset
- Type Roads_ND for the name of the network dataset, Click Next
- Check the std_roads feature class to use it as a source for the network dataset. Click Next
- Click Yes to model turns in the network. Click Next
- Connectivity No change. Click Next
- Elevation fields : None Click Next
- The page for setting network attributes is displayed. Click next
- Drving directions Yes. Click Next
- Summary screen, after viewing the setting click Finish
- Click YES to build Network dataset. After every modification the ND should be built

**Network path:**

- Close ArcCatalog and open ArcMap
- Enable Network Analyst Extension (if not yet)
- Add Roads_ND to Arcmap
- Click Yes to all the required layers
- **Oneway**
    - Select the street segment you want restrict one way.
    - Enter either FT or TF in Onway attribute 'for from to' or 'to from' according to the direction of the street.
    - Click the build button to build after every modification


- Click Network Analyst on the Network Analyst toolbar and click New Route
- Switch to Network Analyst window and select stops.
- Click Create new location tool  on the Network Toolbar
- Place(min 5) stops on the street as per your requirement.
- Use Select/Move location tool to move location if required  on the Network Toolbar
- **Analysis settings**
- Click the Analysis Layer Properties button on the Network Analyst window




- Click the Analysis Settings tab. Here we set the required setting for the route, explore it
- Leave Reorder Stops To Find Optimal Route unchecked
- **Solve**
- Click solve button  on the Network Toolbar. Now the route as per the stops is generated on the map
- Click the Directions Window button  on the Network Toolbar. The Directions dialog box opens. Explore it, note distance and time and save this as html with map document
- **Optimum path**
- Click the Analysis Settings tab. Check the Reorder Stops To Find Optimal option and preserve first and last stop
- Now again solve the route and note direction details. The system now shows the optimum route by reordering the intermediate stops
- Explore other network components like barriers, route etc.

| Ex. No. 13 | Network Analysis (Closest Facility, Service Area) | Date |
|---|---|---|

**Aim:**
To perform network analysis such as closest facility and service area.
**Software Used:**
ArcMap 10.2.2

**Procedure:**

- Copy folder EX12 and paste then rename as EX13 under your roll number folder.
- Copy CHE_FAC.GDB from share folder
- Open the ArcMap software
- Enable Network Analyst Extension.
- Add Road_ND layer, change symbol “Arrow at end” so we know the direction
- Add ATMs, FIRSERV, Supply layers from FACI dataset and change symbol for the layers

**Closest Facility:**

- Click Network Analyst on the Network Analyst toolbar and click New Closest Facility
- Click the Analysis Layer Properties button on the Network Analyst window.
- Open Analysis setting tab do the following settings
    - Travel from: **<u>Facility to incident</u>**
    - Cut-off: 10
    - Facilities to find: 7
    - U-Turn: Not allowed
    - Apply, OK
- On the Network Analyst window Right click on facilities -> load location -> Choose FIRSERV Load From drop-down list.
- On the Network Analyst window Right click on Incidents->Find Address
    - Choose address locator : 123Alt_add_locator
    - Intersection: 18, Prakasam Road (enter an address) and click find
    - Right click on the result location and choose add as Network analysis object option
- Click solve button  on the Network Toolbar. Now the route is generated on the map
- Click the Directions Window button  on the Network Toolbar. The Directions dialog box opens. Explore it, note distance and time, Change units as Kilo meters and save this as html with map document
- Do some changes if require on analysis settings like cut-off, facilities to find etc. and solve again check the results.
- Prepare a layout and export as jpeg file

Do the above steps with ATMs layer and in the setting Travel from as **<u>incident to facility</u>**

**Service Area:**

- Click Network Analyst on the Network Analyst toolbar and click New Service Area
- On the Network Analyst window Right click on facilities -> load location -> Choose Supply Load From drop-down list.
- Click the Analysis Layer Properties button on the Network Analyst window.
- Open Analysis setting tab do the following settings
    - Default barrier: 3.5,10
    - Impudent :Minutes
    - Direction: Away from facility

- U-turn: not allowed
- Check ✓ Oneway and ✓Ignore invalid locations

- Click the Polygon Generation tab.
  - Uncheck TrimPoly
- Click Line generation tab
  - Leave unchecked all
- Apply, OK
- Under facilities keep Main,Point4 and Point5 and remove others
- Click solve button  on the Network Toolbar. Now the service area is generated on the map
- Explore the polygons layer properties legend and do some spatial queries with facilities
- Do some changes if require on analysis settings like default barrier, add or change facilities etc. and solve again check the results.
- Prepare a layout and export as jpeg file

| Ex. No. 14 | Customization (Tool Bar, Scripts, Model) | Date |
|---|---|---|

**Aim:** To do customization, Scripting & modelling.

**Procedure:**

- Create a folder EX14 under your roll number folder.
- Copy folder aquashp to EX14 folder
- Open the ArcMap software
- Add landuse layer from aquashp folder
- Save ArcMap document as cust.mxd in EX14 folder

**User interface customizations:**

- Choose Customise mode from Customise menu
- Click New and give name as MyToolBar
- A empty toolbar added to ArcMap along with other toolbars
- Switch to Commands Tab
- Select Pan/Zoom under categories
- Drag and drop some tools like pan, zoom, full extent etc., from commands to MyToolBar
- Select [Menu] under categories
- Drag and drop some menus like File, Edit, Selection, etc., from commands to MyToolBar
- Close customise mode window
- Save Map Document
- The MyToolBar will be available when you open cust.mxd next time

**Scripting:**

Open a Notepad and type the following python script and save as buffer.py

```
# Name: buffer.py
# import system modules
import arcpy
from arcpy import env

# Set environment settings
arcpy.env.workspace = "C:/cust/aquashps"

# Buffer areas of impact around major roads
inp = "SEWERS.shp"
outp = "b2.shp"
dist= 100
print inp
print outp
print arcpy.env.workspace
arcpy.Buffer_analysis(inp, outp, dist,"FULL","ROUND","ALL")
```

Open a command window

- Type the set path command
- set path=c:\python27\ArcGIS10.2;%path%
- type buffer.py
- If no error the script will create a buffer layer b2.shp

**Adding Script to ToolBox:**

- Open ArcCatalog
- Right Click on EX14 folder -> New ToolBox and name it as MyToolBox
- Right click MyToolBox->Add ->script
- Add Name, Label and Description, Click Next
- Browse select buffer.py Click Next
- Click Finish

**Adding Scripting to toolbar**

- Open cust.mxd in ArcMap
- Choose Customise mode from Customise menu
- Click AddTool
- Browse to MyToolBox and add script
- It is added under Geoprocessing Tools category
- Drag and drop the script to MyToolBar
- You can change the icon by right click on script on MyToolBar then Change Button image
- Close customise mode window
- Like any other button tool now the script can also be executed

**Script with Paramenters**

Open a Notepad and type the following python script and save as buffer1.py

```
# Name: buffer1.py
# import system modules
import arcpy
from arcpy import env

# Set environment settings
env.workspace = "C:/GEO2017/aquashps"

# Buffer areas of impact around major roads
inp = arcpy.GetParameterAsText(0)
outp = arcpy.GetParameterAsText(1)
dist= arcpy.GetParameter(2)

arcpy.Buffer_analysis(inp, outp, dist,"FULL","ROUND","ALL")
```

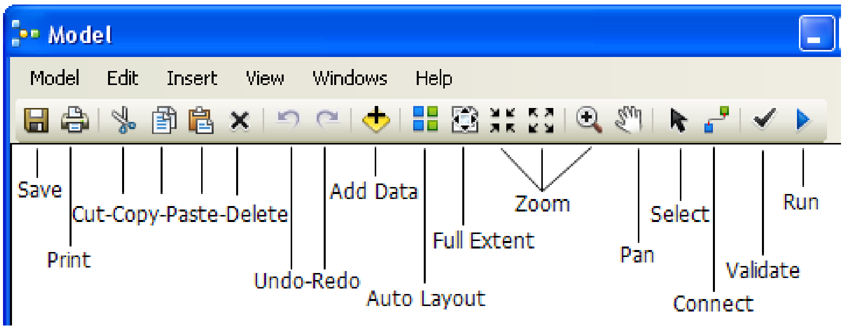
**Adding Script to ToolBox:**

- Open ArcCatalog
- Right click MyToolBox->Add ->script
- Add Name, Label and Description, Click Next
- Browse select buffer1.py Click Next
- | Display Name | Data Type | Direction |
  | --- | --- | --- |
  | Input Layer | Shape file | Input |
  | Output Layer | Shape file | Output |
  | Distance | long int | Input |
- Click Finish

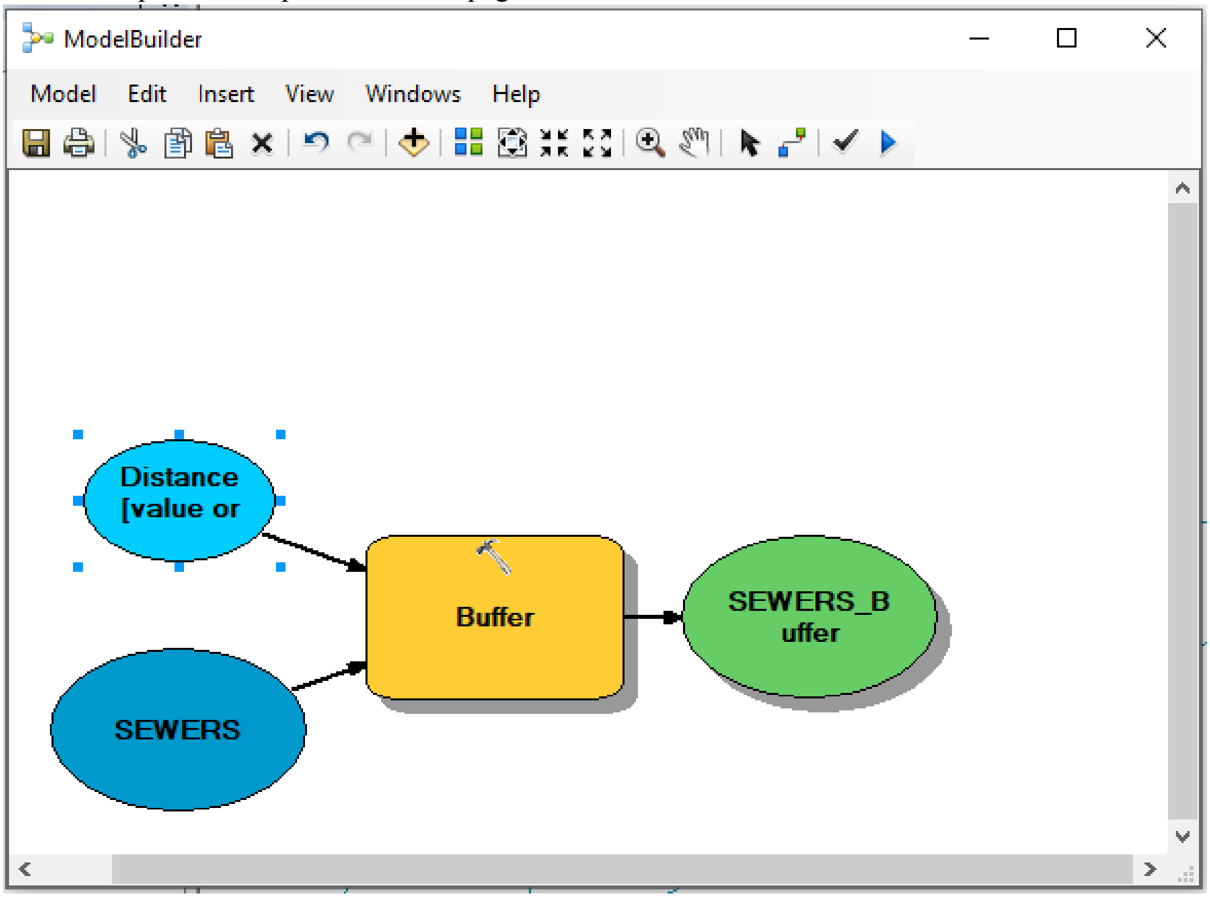
Add this script also to MyToolBar in cust.mxd

**Model Builder**

- Open ArcCatalog
- Browse to EX14 folder
- Right Click on MyToolBox -> New-> Model
- On Opened Model Builder Open Model->Model Properties
- Enter Name:MyModel, Lable:My Model, and description: Sew Buffer
- Drag ArcToolBox->Analysis Tools Box->Proximity Tool set-Buffer tool and drop in the Model builder window
- Drag sewers layer from TOC to Model Builder




- Using connect tool link sewers to buffer tool as Input feature
- Right Click on Buffer tool->Make Variable ->From Parameter ->Distance
- Open Distance variable and enter 300 as value
- Click Auto Layout button
- Save
- Run
- Model->Export->To Grphics.. save as Jpeg file



| Ex. No. 15 | WEBGIS (Demo) | Date |
|---|---|---|

**Aim:**

To understand the webgis concept.

**Applications:**

- Mapserver
- Geoserver

**Procedure**

Open web browser and try following urls

- http://hp210-pc/cgi-bin/mapserv.exe?map=/ms4w/apps/labmaps/landuse.mab&mode=map
- Output is with no color
- http://hp210-pc/cgi-bin/mapserv.exe?map=/ms4w/apps/labmaps/landuse1.mab&mode=map
- Change in the background color
- http://hp210-pc/cgi-bin/mapserv.exe?map=/ms4w/apps/labmaps/landuse2.mab&mode=map
- Polygons with different colors
- http://hp210-pc/cgi-bin/mapserv.exe?map=/ms4w/apps/labmaps/landuse3.mab&mode=map
- Polygons with different colors and landuse lables
- http://hp210-pc:8081/geoserver/web
- The geoserver java based mapserver

Explore the .map files in hp210 system and try with your own map to publish

**Result:**

Thus, the concept of webgis was understood by the use of MapServer Services.