GEOG3600. Geographical Information Systems

Lab 7. Spatial Analysis and Modelling

Objective

The exercise is designed to familiarize students with the creation and use of raster datasets. Topics include the use of ArcView Spatial Analyst, vector to raster conversion, zonal statistics, mapping distance and surface, etc.

Preparation

1. A new shapefile '11swatpu.shp' is needed for you task 1 and 2, please import it (from y:\geog3600) into your personal geodatabase.

2. Start ArcMap, before you process raster dataset, you need to activate the Spatial Analyst Extension in ArcMap. Click 'Extensions…' command from 'Tool' menu, tick the 'Spatial Analyst' box and then click 'Close'. Then activate the 'Spatial Analyst' toolbar by clicking 'Toolbars' command from 'View' menu.

Zonal statistics

You were requested by the Building Department that doing a survey on area of temporary structures in TPUs of the northwest Hong Kong. You decided to accomplish this using GIS.

1. You need to convert the dataset to raster format before you proceed further. Firstly convert the TPU feature class. Click the 'Spatial Analyst' button, select 'Convert' → 'Features to Raster…', select the TPU feature class as the input layer, and the TPU_NO as field. Set the output cell size to be 5(m) and give the output raster file a meaningful name (say 11swatpu).

   Do the same thing to the '11swabldg' feature class (use TYPE as field, keep the output cell size the same as TPU). But before you do that, you need to select all temporary structure from the feature class by using 'select by attribute' method.

2. Reclassify the two rasters so as to make the value meaningful. Click 'Reclassify…' command from 'Spatial Analyst' button. Following the following reclassify scheme:

   TPU (Reclass Field: TPU_NO)

Old Value	*New Value*
1.1.1	111
1.1.2	112
1.1.3	113
1.1.5	115
1.1.6	116
1.4.1	141

TPUs that are not completely within the area (1.1.4, 1.2.1, 1.2.2, 1.4.2, 1.7.1, 1.8.1, 1.8.2)	No Data

Also reclass the value for all cells in temporary structures raster into 1 (except No Data cells)

3. You should able to generate the result by selecting 'Zonal Statistics…' from 'Spatial Analyst' button. Sort your table and submit it to your tutor in the following format:

TPU	*Area of Temporary Structure (m^2)*
1.1.1	50
…..	……

Estimate Risk

The Fire Department wants to rearrange the ambulance service in this area. Before doing that, they want to know the risk of different region in terms of proximity to fire station or hospital. Risky regions mean those regions are not close to either a fire station or a hospital. The weighting for fire station and hospital is the same.

You are assigned to do this task by using GIS.

1. Convert the facility type HOS (hospital) and FS (fire station) into two raster datasets.

   (Hints: You need to firstly select the features using 'Select by Attribute', then convert the selected features into raster by 'Convert' command from 'Spatial Analyst' button.)

2. Create layers that showing the distance to the hospital and police station.

   (Hints: Select 'Distance' command from 'Spatial Analyst' button, choose 'Straight Line', use 5(m) cell size and default settings.)

3. Reclassify the two rasters into a 10-class scheme by using Equal Interval Method.

   (Hints: Press 'Classify' button in 'set values to reclassify' box when doing reclassify.)

4. Type the following formula in the Raster Calculator:

   [reclass of 11swafsdist] * 0.5 + [reclass of 11swahosdist] * 0.5

   (11swafsdist and 11swahostdist are the rasters that created in the above procedure. You may name the files using your own naming scheme.)

   What is this formula means? What is the expected minimum and maximum value?

5. Reclassify the output

Old Value	*New Value*	*Risk*

0 – 4	1	Low Risk
4.5 – 8	2	Medium Risk
8.5 – 10	3	High Risk

6. Create a layout showing the risk of different regions and PRINT it out!

Surface Mapping

Remember you established a feature class that contains 5 air pollution observation stations in the Lab 4? Figure of pollution index are collected daily in these stations. The Environmental Protection Department wants to make a map that shows the air pollution situation in a particular day. They provided you the figures of these stations in that day:

Name of Station	*Pollution Index*
Hong Kong University	70
HK-Macau Ferry Terminal	55
Mount Davis	40
Kennedy Town	85
Victoria Peak Garden	30

What you need to do is to 'predict' the air pollution index over the surface from these sample points. We call this process 'interpolation'.

1. Add the layer (named pollution.shp in Lab 4) into ArcMap, add a field (named pi) in the table and type in the pollution index values.

2. Click 'Interpolate to Raster' button from 'Spatial Analyst'. Choose 'Inverse Distance Weighted' method. Input pollution.shp as input points and pi as Z value field. Other parameters remain default, and click OK.

3. Create isolines superimpose on the surface map, click 'Surface Analysis' from 'Spatial Analyst', choose 'Contour…', input the surface you created as input surface, try different combinations of contour interval, base contour and Z factor as so to produce the best result.

4. Produce the map with surface figures, isolines and PRINT it out!