UNIVERSITY OF MUMBAI



Teacher's Reference Manual

USIT6P4 (Discipline Specific Elective Practical) Principles of Geographic Information Systems Practical

with effect from the academic year

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Prerequisites to GIS Practical

What is a Geographic Information System (GIS)?

A Geographical Information System (GIS) is an organized collection of computer **hardware**, **software** and **data** used to link, analyze and display geographically referenced information.



The foundation of GIS is the ability to locate objects and events (streams, villages, disease cases) and link them with appropriate information in order to identify patterns and provide a basis for map making and analysis. Key types of geographical data, represented as separate map layers in a GIS, are outlined in the table below.

Sr.	Data Type	Example	Layer on Map	
No				V
1	POINT	Building, Hospital, City, Well.	Points	customers customers streets
2	LINE	River, Road	Lines	r s t e
3	POLYGON	Administrative Boundaries, Census tacts.	Areas	r real world
4	RASTER	Pixel or grid data		

Vector data: A representation of the world using points, lines, and polygons. Vector models are useful for storing data that has discrete boundaries, such as country borders, land parcels, and streets.

Point features: A map feature that has neither length nor area at a given scale, such as a city on a world map or a building on a city map.

Line features: A map feature that has length but not area at a given scale, such as a river on a world map or a street on a city map.

Polygon features: A map feature that bounds an area at a given scale, such as a country on a world map or a district on a city map.

Raster data. A representation of the world as a surface divided into a regular grid of cells. Raster models are useful for storing data that varies continuously, as in an aerial photograph, a satellite image, a surface of chemical concentrations, or an elevation surface.

With a GIS application you can open digital maps on your computer, create new spatial information to add to a map, create printed maps customised to your needs and perform spatial analysis.

Understanding QGIS

What is Quantum GIS?

Quantum GIS (QGIS) is a user friendly Open Source GIS application licensed under the GNU General Public License. QGIS is an official project of the Open Source Geospatial Foundation (OSGeo). It runs on Linux, Unix, Mac OSX, Windows and Android and supports numerous vector, raster, and database formats and functionalities.

Like all GIS applications, QGIS provides a graphical user interface allowing display of map layers and manipulation of data for analyses and map-making.

A Geographical Information System (GIS) is a collection of software that allows you to create, visualize, query and analyze geospatial data. Geospatial data refers to information about the geographic location of an entity. This often involves the use of a geographic coordinate, like a latitude or longitude value. Spatial data is another commonly used term, as are: geographic data, GIS data, map data, location data, coordinate data and spatial geometry data. Applications using geospatial data perform a variety of functions. Map production is the most easily understood function of geospatial applications. Mapping programs take geospatial data and render it in a form that is viewable, usually on a computer screen or printed page. Applications can present static maps(a simple image) or dynamic maps that are customized by the person viewing the map through a desktop program or a web page.

Many people mistakenly assume that geospatial applications just produce maps, but geospatial data analysis is another primary function of geospatial applications. Some typical types of analysis include computing:

- 1. Distances between geographic locations
- 2. The amount of area (e.g., square meters) within a certain geographic region
- 3. What geographic features overlap other features?
- 4. The amount of overlap between features
- 5. The number of locations within a certain distance of another
- 6. and so on...

These may seem simplistic, but can be applied in all sorts of ways across many disciplines. The results of analysis may be shown on a map, but are often tabulated into a report to support management decisions. The recent phenomena of location-based services promises to introduce all sorts of other features, but many will be based on a combination of maps and analysis. For example, you have a cell phone that tracks your geographic location. If you have the right software, your phone can tell you what kinds of restaurants are within walking distance. While this is a novel application of geospatial technology, it is essentially doing geospatial data analysis and listing the results for you.

System Requirements

Windows OS:

Minimum: Pentium III / 256 MB RAM.

Recommended: 1 GB of RAM and 1.6 GHz processor.

Operation System: Platforms Windows and Linux (Win XP or newer, Linux Suse 8.2/9.0/9.2, Linux Debian (Lliurex))

MAC OS:

PC/Desktop with at least Pentium IV

Tiger OS, Leopard OS.

Installation of QGIS

Step By step procedure

- **1)** Create a folder on your D:/ drive on your computer called QGISlab by right clicking on the D: drive and navigating down to the New / Folder.
- **2)** Go to the QGIS download page and download the latest 64bit version of QGIS for windows which is QGIS 3.4 'Madeira' by clicking once.
- **3)** If you have a 32 bit machine or using another operating system search the bottom of the page for your operating system and download the correct operating system version of QGIS. http://www.qgis.org/en/site/forusers/download.html

3.4.2 (new LTR) 2.18.26 (old LTR)	DISCOVER QGIS FOR USERS GET INVOLVED DOCUMENTATION Search	
	SGeo4W Network Installer (64 bit)	a
	SGeo4W Network Installer (32 bit)	a'
	In the installer choose Desktop Express Instali and select QGIS to install the <i>latest release</i> . To get the <i>long term release</i> (that is not also the latest release) choose Advanced Instali and select qgis-tr-ful To get the <i>bleeding-edge development build</i> choose Advanced Instali and select qgis-dev-fuli	I
	Standalone installers from OSGeo4W packages	
	Latest release (richest on features):	
	CGIS Standalone Installer Version 3.4 (64 bit)	ಡೌ
	md5	a ⁷
	AGIS Standalone Installer Version 3.4 (32 bit)	a"
	md5	C ⁷

- 4) You browser will download the file to the browsers default download directory. By pressing the control key and the letter J at the same time a popup window will show you the folder where the QGIS file has been downloaded. The QGIS file will be called: QGIS-OSGeo4W-3.4.2-1-Setup-x86.exe
- **5)** Move or copy the above file to your C:/QGISlab folder and double click on the file. You will get a popup window with a security warning.
- 6) Hit the run button to start the installation process and follow the prompts. There is no need to install the data sets suggested by QGIS.



- 7) From the above window, click Next button and continue with the installation.
- 8) Please go through the license agreement and click on the button> I agree and proceed with the installation as shown in the screen.

QGIS 3.4.2 'Madeira' Setup -	×			
License Agreement Please review the license terms before installing QGIS 3.4.2 'Madeira'.	Q			
Press Page Down to see the rest of the agreement.				
License overview: 1. QGIS 2. MrSID Raster Plugin for GDAL 3. ECW Raster Plugin for GDAL 4. SZIP compression library 5. Oracle Instant Client	^			
1. License of 'QGIS'	~			
If you accept the terms of the agreement, click I Agree to continue. You must accept the agreement to install QGIS 3.4.2 'Madeira'.				
< Back I Agree Ca	incel			

9) As the software is very heavy it is advisable to install it in the different drive other than the windows drive. As per our example, we will be installing in QGIS folder on D:\ drive.

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 QGIS 3.4.2 'Madeira' Setup

 Choose Install Location

 Choose the folder in which to install QGIS 3.4.2 'Madeira'.

 Setup will install QGIS 3.4.2 'Madeira' in the following folder. To install in a different folder, click Browse and select another folder. Click Next to continue.

 Destination Folder

 D:\QGIS\

Space required: 1.8GB Space available: 122.8GB

Nullsoft Install System v2.50				
	< Back	Next >	Cancel	

- **10**) After browsing the folder click the Next button and proceed with the installation as shown in above figure.
- **11**) By default QGIS component is selected. Do not install any other data set at this point. Click Install to proceed with installation.

3	C	GIS 3.4.2 'Madeira' Setup	o – □ <mark>×</mark>	
Choose (Choose	Components which features of QGI	S 3.4.2 'Madeira' you want to inst	all.	ł
Check th install. C	e components you wa lick Install to start the	ant to install and uncheck the comp installation.	ponents you don't want to	
Select co	omponents to install:	QGIS North Carolina Data Set South Dakota (Spearfish)	Description Position your mouse over a component to see its description,	
Space re	quired: 1.8GB	< >		
Nullsoft Inst	tall System v2.50 ——	< Back	Install Cancel]
) You will s	see the progress of t	he installation on the screen.		
	ର	QGIS 3.4.2 'Madeira' Setup	- U ×	
	Installing Please wait while QGIS	3.4.2 'Madeira' is being installed.	Q	
	Extract: test_build.py			
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13) Please reboot your machine once the installation is completed. Click finish to complete the installation.



14) After machine is restarted, type QGIS on Run and open QGIS Desktop 3.4.2.



15) It will open a new wizard for the first time after installation as shown in the figure below.

Let's get started!
ngs and click on let's get started butto Desktop.



Quantum GIS interfaces change from one project to another depending on the required interface of the project. Below are the basic menus that you will encounter in Quantum GIS during the practicals.

- 1. *Title of the Project* Shows the title of project that you are going to view.
- 2. *Menu Bar* This provides access to various Quantum GIS features using a standard hierarchical menu.
- **3.** *Toolbars* These provide access to most of the same functions as the menus, plus additional tools for interacting with the map. It shows the command for zoom in, zoom out, pan, back to original view, go back to previous extent, go to next extent, object-information, coordinate read-out, measure, print and help.
- **4.** *Table of Contents/Map Legend* (TOC) Shows the layers that can be turned on or off and the legend, attributes symbols and query symbols available for the corresponding project.
- 5. *Display Window* Shows the feature/s that you have turn on from the TOC.
- 6. *Status Bar* Shows you your current position in map coordinates (e.g. metres or decimal degrees) as the mouse pointer is moved across the map view. To the left of the coordinate display in the status bar is a small button that will toggle between showing coordinate position or the view extents of the map view as you pan and zoom in and out.
- **7.** *Data sources browser* In previous versions, QGIS browser was only provided as an external application which enables us to explore our spatial data sets. In QGIS 2.0.1-*Dufour* this application is also integrated in the QGIS framework as an additional panel just below the Table of Contents.

Quantum GIS toolbars and some other components

Toolbars are divided by thematic (greyed icons means they are inactive because the appropriate conditions to use them are not fulfilled). Some of them are included by default in QGIS and others can be added/removed from the interface:

File	
Manage Layers (vertical)	シシ≋°°℃≈°°°°°°°°°°°°°°°°°°°°°°°°°°°°°°°°°
Map Navigation	S R R Q Q II @ R R R & B
Attributes	🔍 🔍 - 🔣 - 🌄 8 📰 🖾 - 🖵 🔥 🗂 🖉 🔌
Label	ake and ake and ake
Raster	L & L & & & & & & & & & & & & & & & & &
Editing/Digitizing	∥. / 8 ** 7 /2 /2 8 8 8
GRASS plugin	
Advanced Disitation	• 1 9 9 9 9 8 9 8 9 9 9 1 0

Key functions:

Here, you will learn how to QGIS" different mapping tools and other components that you''ll be using in this practical.

File Options	
New Project Enables you to create a new project.	
Open Project Tool use to open an existing/previous project created in Quantum GIS.	-
Save Project Enables you to save the project.	
Save Project As Enables you to save the project in another format.	
New Print Composer Enables you to print the map/layers including the title, TOC, map overview, scale bar, graph/attributes present in the layer, author and map information, logo, toolbar, and other components present in the main page of the project.	
Composer Manager Enables you to access to the different composition in progress and manage them; showing, removing, closing, and so on.	
Displaying Layers	
Add Vector Layer Enables you to add any readable existing vector format layer.	G
Add Raster Layer Enables you to add any readable existing raster format layer.	0

Table of Contents. Menu	
Turns layer on or off Click the box to turn on 🗷 or off 🗌 the layer/s.	×
Folder icon in the TOC This represents a group of layers in the TOC. Grayed colour means only selected layers are visible in the group of layers.	
Navigation toolbars	
Zoom in Click once in the map to zoom in or drag a box over the particular area.	Æ
Zoom out Click once in the map.	Þ
Panning Click in the map, hold down the mouse button, and drag in any direction.	$\sqrt[n]{}$
Zoom to Full Click to return to default view or view the full map layer/s.	20
Zoom to Selection Click to view the selected part of map layer/s.	Ç
Zoom to Layer Click to view a particular map layer.	\mathbf{p}
Object Information	
Identify Features Click to activate and point to the layers you want to view the information.	
Open Attribute Table Click to open the attribute table of a layer.	

Principles of GIS T. Y. B. Sc. IT Semester VI List of Sample/Data files used for Practical

Practical No.	Data set Name
1D	IND_rails.zip
	IND_adm0.zip
2A	gl_gpwv3_pdens_00_ascii_one.zip
	gl_gpwv3_pdens_90_ascii_one.zip
2C	FAS_India1.2018349.terra.367.2km.tif
	FAS_India2.2018349.terra.367.2km.tif
	FAS_India3.2018349.terra.367.2km.tif
	FAS_India4.2018349.terra.367.2km.tif
3B	Sample.csv
4A	ne_10m_populated_places_simple.zip
4B	GMTED2010N10E060_300.zip

5A	ne_10m_populated_places_simple.zip
64	IND_adm0.zip
UA	Bombay_1990.jpg
6B	GateWay_Aerial_Imagery.tif
6C	Christchurch Topo50 map.tif
7 A	tl_2013_06_tract.zip
	ca_tracts_pop.csv
7B	OEM_NursingHomes_001.zip
	nybb_12c.zip
7C	EarthQuakeDatabase.txt
	ne_10m_admin_0_countries.zip
	ne_10m_populated_places_simple.zip
7D	ne_10m_populated_places_simple.zip
	ne_10m_rivers_lake_centerlines.zip
8A	ca_tracts_pop.csv
	EarthQuakeDatabase.txt
	ne_10m_populated_places_simple.zip
	tl_2013_06_tract.zip
8B	us.tmax_nohads_ll_20140525_float.tif
	2013_Gaz_ua_national.txt
00	tl 2013_us_county.shp
٥٢	Boundary2004_550_stpl83.shp
٩A	ne_10m_admin_0_countries.shp
573	ne_10m_admin_0_District.shp
	ne_10m_admin_0_port.shp
	ne_10m_admin_0_railroads.shp
9B	LC_hd_global_2001.tif.gz
9C	HI_Wetlands.shp.zip
10	Kenya admin.shp
	Kenya_epidemiological_data.xls
	Kenya_epidemiological_dict.xlsx
	Kenya_school_dict.xlsx
	Kenya_school_location.csv

The above data can be downloaded from:

www.muresults.net \rightarrow TYBSc IT Sem VI eBooks \rightarrow GIS \rightarrow Practicals

Or directly from: <u>https://drive.google.com/drive/folders/191tJ4L7O-</u> VJm2Q2AB8dZDpIj7vyyPM3I?usp=sharing

PRACTICAL - 1

B. AIM : - Creating and Managing Vector Data:

- a) Adding vector layer
- b) Setting properties
- c) Vector Layer Formatting

Procedure:

- a. Adding vector layers (Polygon, Line, Points)
 - Polygon layers (We have taken 2 layers Matunga, Garden)
 - Line layers (We have taken **3** layers Small_Roads, Road, Flyover)
 - > Point layers (We have taken 4 layers bank,college,Restaurants,ATM)
- b. Setting properties (Labeling, Symbolism)

Layers	8	×
🎸 🥼 💽 ү 🖓 🕶 🔝		
🔽 🔍 bank		
🔽 🏫 college		
🔽 👭 Restaurants		
🗹 😫 ATM		
Small_Roads		
🔽 🔜 Road		
🔽 🗾 Flyover		
Garden		
Matunga		

Our aim is to create map representing a location and its surrounding as follows:





Q New Shapefile Layer	×	
File name File encoding	Matunga 🚳 🛄	
	Indude Z dimension Indude M values	×
New Field Name Type abc Text data	← → ∨ ↑ ▲ « Desktop » Practical 1 ✓ ♂ Search Practical 1 Organize ▼ New folder ■ ▼	م •
Length 80 Fields List Name Type id Integer	P This PC ③ 3D Objects ● ☑ Desktop ● ☑ Documents ● ☑ Downloads ● ☑ Music ● ☑ Videos ● ☑ Videos ● ☑ Videos ● ☑ Network ✓ File game: Matunga.shp Save as type: ESRI Shapefile ("shp *.SHP)	~
	∧ Hide FoldersCance	el

> Field Panel

- Add the **Attribute** you want to show. (**Column Name** for Table)
- b. Specify Type (DataType:Text Data/Decimal Data/Whole Number/Date) of Attribute c. Specify the Length of the Attribute. Specify Precision (If Data Type is Decimal)

le name			Matunga				■ …	
le encoding			System	~				
eometry type			Polygon	C Polygon				
			Include Z o	dimension	🗌 In	dude M values		
			EPSG:4326 -	WGS 84			~ 🌏	
New Field								
Name Name	1							
Type abc T	ext data						~	
Length 80		Precision						
		_	Add to Fie	elds List 🛛				
FIERIS LIST								

- Click on Add to Field List Button.
- You can add as many **fields** (**Column Name**) as you want for the layer.

File name		Matunga	3		€3
File encoding		System			
Geometry type		C Poly	/gon		
		Indu	de Z dimension	Include M values	
		EPSG:4	326 - WGS 84		~ 4
New Field					
Name Name	2				
Type abc	Text data				~
Length 80		Precision		-	
		🔚 Add	to Fields List		
Fields List					
Name	Type	Length	Precision		
id	Integer	10			

USIT6P4 (Discipline Specific Elective Practical) Principles of Geographic Information Systems Practical Select Geometry Type as follows Click on the following button • 🔇 New Shapefile Layer Matunga **43** ... File n File encoding System \sim Polygon etry type Include Z di Include M values EPSG:4326 - WGS 84 abc Text data Type Precision Add to Fields List Type Integer Length 10 Precision id Remove Field OK Cancel Help

➤ The CRS dialog box will appear on screen. Click on the WGS84 option and it will be selected as follows. click on OK

Q Coordinate Reference System Selector	×
Define this layer's coordinate reference This layer appears to have no projection specification. By of the project, but you may override this by selecting a di	e system: default, this layer will now have its projection set to that fferent projection below.
Filter	
Recently used coordinate reference systems	
Coordinate Reference System	Authority ID
WGS 84	EPSG:4326
< Coordinate reference systems of the world	> Li Hide deprecated CRSs
Coordinate Reference System	Authority ID
WGS 66	EPSG:4760
WGS 72	EPSG:4322
WGS 72BE	EPSG:4324
WGS 84	EPSG:4326
Selected CRS WGS 84	
Extent: -180.00, -90.00, 180.00, 90.00 Proj4: +proj=longlat +datum=WGS84 +no_defs	
	OK Cancel Help

- a) Follow the steps to plot **Polygon features.**
- Select the **Polygon Feature**(In our case it is **Matunga** for **background**) from layer panel

<u>P</u>lugins Processing Project <u>E</u>dit View Layer <u>Settings</u> Vect<u>o</u>r <u>R</u>aster <u>D</u>atabase <u>W</u>eb <u>H</u>elp (Im) 💭 🔍 🕎 a a Menu Toolbar 🚪 Ð 🗩 (11) থ্ 20 20 **6** 🛰 🖻 🗐 🔶 🤿 abc \overline{m}

Click Toggle Editing Button → Click on Add Polygon → Now place the cursor at the location where you want to place the polygon. for polygon layer minimum 3 points should be selected



Save the newly added polygon as follows.

Matung	ja - Feature Attributes		x
Actions			
id	1	•	
Name	Matunga	Ø	
		OK Cancel	

Set style for polygon by using property window(Right click on Matunga Layer)



Following screen will appear on the screen. Select **pattern** as you want and **click** on **OK**.

Q	Layer Properties - M	Matunga Symbology	×
Q		Single symbol	~
(ં) રેજે	Information Source	Fill Simple fill	
~	Symbology		
abc	Labels		
٩.	Diagrams		
Ŷ	3D View	Unit Milimeter Opacity 20.0	× % 🖾 🗘
ŧ.	Source Fields	Color	•
-8	Attributes Form		
	Joins	Q. Favorites	⊠ ∨ 👫
đ	Auxiliary Storage		^
٩	Actions		
9	Display	gradient gray 3 fill hashed black / hashed black \ hashed black X outline blue	
Ý	Rendering	plasma	
	Variables		
2	Metadata	outline green outline red outline vostern nattern det black nattern salda zimnle blue fil	v
	Dependencies	Save Symbol	Advanced 👻
	Legend	Layer Rendering	
		Style	Help

Same way we can add one more polygon layer for Gardens.



b) Creating Line vector layer

- Repeat the same steps as we have done for polygon layer.
- Select geometry type Line.

File encod	ing			System		
Geometry	type			V Line		
				invalid or	e 2 dimension	Include M values
New Fig	bld			arreadud pe	ojecouri	
Name	Name					
Type	abc Text d	lata				
Length	80		Precision			
				18 Add	to Fields List	
Fields L	ist					
Name		Туре	Leng	gth	Precision	
Id		Integer	10			



USIT6P4 (Discipline Specific Elections Actions id 1 Name Matu	ve Practical) <i>Principles</i> re Attributes Inga Pool	s of Geographic Information	Systems Practical
➤ set style for Roads in	the same way as we here is a same way as we he	Analysis of the second	



To label your roads Right click on Road layer .Go to properties window then select label and set single label property

Q Layer Properties -	Digitize_Road Labels
Q	No labels No labels Single labels
🗞 Source	Rue-based labeling
(abc Labels	

➢ Following window will appear on the screen

ଭ	Layer Properties - Road I	Labels				×
Q		🛲 Single labels				~
(i)	Information	Label with abc Name				3 ~
ગ્ન	Source	▼ Text Sample				
		Lorem Ipsum				^
×	Symbology					J.
ab	Labels	Lorem Ipsum			♦ 327796011 ∨	•
3	Diagrams	^{abc} Text	Text			
		<pre>+ab < c Formatting</pre>	Font MS Shell [Dlg 2		~ 🖶
×	3D View	abc Buffer	Style Regular			~ (=
	Source Fields	Background		198	B (E	
	Attributes Form	Placement	Size 10.0000			
		A Rendering	Size 10.0000			
	Joins		Points			
Ē	Auxiliary Storage		Color			
.0	Actions		Opacity		100.0 %	÷ E
			Type case No chang	je		~ 🕞
	Display		Spacing letter 0.0	0000		÷ 🗣
*	Rendering		word 0.0	0000		
3	Variables		Pland and a Namel			
			Biend mode INormal			Y + +
	Metadata		Apply label text sub	ostitutes		
Roads will loo	k like these	Style •		UK	Cancel Apply	Неір
		A CONTRACT OF CONTRACT.			Activate Windows	



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C. Create Point vector layer

> Repeat same steps to add point layers as we have done in previous layers.(For ATM, Restaurants, Banks, Bus Stops etc)



Final output:





> The display window will appear like



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123 FI	D_rai_d • =	8						
	FID_rail_d	F_CODE_DES	EXS_DESCRI	FCO_DESCRI	FID_countr	ISO	ISOCOUNTRY	Track_Len
	144645	Railroad	Operational	Single	102	IND	INDIA	29.01
	145991	Railroad	Operational	Single	102	IND	INDIA	66.13
	146001	Railroad	Operational	Single	102	IND	INDIA	2.33
	146008	Railroad	Operational	Single	102	IND	INDIA	63.81
	146096	Railroad	Operational	Single	102	IND	INDIA	92.71
	146394	Railroad	Operational	Single	102	IND	INDIA	22.24

- Press CTRL+S or click on Save Edits option on tool bar
- ▶ Close the attribute table window.

 \triangleright

- > For calculating the total length of Railway tracks in India.
- > Select Vector \rightarrow Analysis Tools \rightarrow Basic Statics for Fields

🔃 *calculating_line_lengths_and_statistics - QGIS								
Project <u>E</u> dit <u>V</u> iew <u>Layer</u> <u>Settings</u> <u>P</u> lugins	Vect <u>o</u> r	<u>R</u> aster <u>D</u> atabase	<u>W</u> eb	MMQGIS Processing Help				
🗋 📛 🖶 🔜 🔂 🕄 🚺 🍕	- ¢ 0	oordinate Capture		2 2 🗔 🖫 🖱 🎜 🔍 🤅				
🧏 🎕 Vi 🔏 🖏 🥢 🕖 B V	🥐 <u>G</u>	PS Tools		👆 🔿 🔤 🇌 🧰 🍓				
🙊 🛄	💓 To	opology Checker						
Lavers & X	<u>G</u>	eoprocessing Tools	•					
	G	<u>e</u> ometry Tools	- + .					
	A	nalysis Tools	•	🔀 Line Intersections				
	D	ata Management Tools	•	🐼 Mean Coordinate(s)				
V <u>F IND rails</u>	<u>R</u> e	esearch Tools	•	Σ Basic Statistics for Fields				

Select IND_rails layer from input layer. And select Track_Len in "Field to Calculate statistics on"

Input layer			
V IND_rails	[EPSG:4326]		• 🦻
Selected f	eatures only		
Field to calcula	ate statistics on	1	
1.2 Track_Le	n		
Statistics			
I:/GIS_Works	hop/Practicals/Pr	actical_01/D/Output	html 🦲





b) Raster Styling and Analysis

- > To start with analysis of population data, convert the pixel from grayscale to Color.
- > Select "glds90ag60.asc" Layer form layer Pane \rightarrow select property OR double click on it.

Layers	Image: Second to Layer Image: Second to Copy Layer Show in Overview Copy Layer Regame Layer Image: Zoom to Native Resolution (100%) Stretch Using Current Extent Image: Duplicate Layer Remove Layer Set Layer Scale Visibility Set CRS Export Styles
 Select Layer Properties - glds00ag60 Syn Information Information Source Symbology Transparency Histogram Histogram Value Rendering Wetadata Legend QGIS Server Mode Style 	Rendering ype Singleband pseudocolor Band 1 Band 1 Max 240 / Max Value Settings lation imp YIORd Color Label Color Label

- ➢ Press "APPLY"
- Repeat the same for "glds00ag60.asc" Layer



Layer output after applying style.

- The objective this experiment is to analyze raster data, as an example we will find areas with largest population change between 1990 and 2000, by calculating the difference between each pixel values.
- ▶ Go to Raster \rightarrow Raster Calculator



Raster Band	s			Result L	ayer			
glds00ag600	D1			Output la	yer	nop\Practicals	Practical_	02\B\Pop_Diff 🖾
glds90ag600	01			Output fo Selected X min Y min Columns Output C	rmat Layer Extent -180.00000 -58.00000 360 RS esult to project	GeoTIFF	X Max Y max Rows WGS 84	180.00000 85.00000 143
Operators +	*	sqrt	cos	sin	tan atan	log10		(
<	>	=	!=	<=	>=	AND		OR
	Ilator Expressio	n						
Raster Calcı 'glds00ag6	0@1" - "glds!	90ag60@1"						

Put the expression "glds00ag60@1" - "glds90ag60@1"

Select the output file location & name and Press OK.

33



- Set Render Type to "Single band Pseudo color", Interpolation as Discrete, and remove all classification and add as shown in figure above using button. After all settings press "OK".
- ≻ Layer will appear like



- Explore an area of your choice and check the raster band value using to verify the classification rule.
- \succ The red pixel shows negative changes and blue shows positive changes.

c) Raster Mosaicking and Clipping

A mosaic is a combination or merge of two or more images.

In GIS, a single raster dataset can be created from multiple raster datasets by mosaicking them together.



In many cases, there will be some overlap of the raster dataset edges that are being mosaicked together, as shown below.



These overlapping areas can be handled in several ways; for example, you can choose to only keep raster data from the first or last dataset, you can blend the overlapping cell values using a weightbased algorithm, you can take the mean of the overlapping cell values, or you can take the minimum or maximum value. When mosaicking discrete data, the First, Minimum, or Maximum options give the most meaningful results. The Blend and Mean options are best suited for continuous data. If any of the input rasters are floating point, the output is floating point. If all the inputs are integer and First, Minimum, or Maximum is used, the output is integer.

> Go to Layer → Add Layer → Add Raster Layer.

Q Data Source Manager Raster		x
Erowser	Source type	
V Vector	● File	
Raster	Source	7
Mesh	Raster Dataset(s) cticals\Practical_02\C\FAS_India4.2018350.terra.367.2km.tif 🛛 🖾	



- Press open
- > In data source manager | Raster window click Add.



→ Go to Raster → Miscellaneous → Merge


- Save the file to "GIS_Workshop/Practicals/Practical_02/C/" location with the name as Merge_Files.tif
- > Press Run and after completion of operation close the Merge window dialog box.



> You can now deselect individual layers from layer pane and only keep the merged raster file.



> Go to Layer → Add Vector Layer → Select \GIS_Workshop\Practicals\Practical_02\C\IndiaAdminBoundry\IND_adm0.shp file.





PRACTICAL - 3

a) Making a Map

- > Create a new Thematic Map or open and existing one
- Consider the following map as an example map





USIT6P4 (Discipline Specific Elective Practical) Principles of Geographic Information Systems Practic	al
Create print layout Title	
Enter a unique print layout title (a title will be automatically generated if left empty)	
Practical_3A	
OK Cancel	
A new Print Layout window will open	
Layout Edit View Items Add Item Atlas Settings	
J J J L	
Items	
Layout Item Properties Guides Item Properties	
×= x: 146.881 mm y: 25.9005 mm page: 1 29.7% ▼	
Select Add Item → Add Map	
Practical 3A	
Layout Edit View Items Add Item Atlas	
Add Map	
	_
T. Y. B. Sc. (Information Technology) SEMESTER VI Teacher's Reference Manual	



This will ensure that if any change in layers or change their styles, the Print Layout view will not change.

▶ Go to Add Item \rightarrow Add Picture \rightarrow Place a picture box at appropriate location.



	Layout	Item Properties	Guides	
It	tem Prop	oerties		ć
P	1ap 2			
	▼ 🔽 I	Frame		
	Color			
	Thickne	ess 0.30		
	Join st	yle 📊 Miter		•
	Thickne Join st	ess 0.30 yle Alter		• mm •

- > To highlight the area shown in Inset
- > Select the Picture representing main Map from Items pane.
- > In Item Properties \rightarrow Overviews \rightarrow using $\stackrel{\text{the}}{\longleftrightarrow}$ icon add an overview.
- Select the checkbox Draw Overview
- Name the Picture object representing inset (Map1 in our case).



➤ Change the Label text To "Mumbai Map", Set appropriate font size and color using Item Properties → Main Properties.

Li	ayout	Item Properties	Guides		
Ite	m Prop	erties		8	×
La	bel				
	Main Mumb Practi	n Properties nai Map cal No. 3A			*
	Rei	nder as HTML Ins	ert an Expr	ession	
ſ	Font co	earance ONT plor			
	Horizor Vertica Horizor	ntal margin Il margin ntal alignment		0.00 mm 😴	Ŧ
•			111	•	

- → Add Item → Add Legend → Place the legend indicator at appropriate location.
- Uncheck auto update and use suitable legend indicator label.

Layout	Item Properties	Guides		
Item Prop	erties			6
Legend				
▼ Lege	end Items			
🔲 Au	to update			Update all
	Country Border			
	🔪 Coastal Water			
🖌	Tourist Place			
•	Location			
	thane			
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<u>v</u>	Streets			
	<u>maharashtra ad</u>	ministrat	ive	
		= 📝	Σ	•

> The Print Layout will appear



 $\blacktriangleright \text{ Add Item} \rightarrow \text{Add Scale Bar}$

Layout	m Properties	Guides							
Item Properties	Item Properties 🗗								
Scalebar	Scalebar								
▼ Main Pro	perties								
Мар 🔲 М	Map Map 1								
St <u>y</u> le Single	e Box								
▼ Units Scalebar unit	ts (Kilome	ters		•					
Label unit mu	ultiplier 3.0000	000		÷					
Label for uni	ts km								
▼ Segment	▼ Segments								
Segments		lef rig	t 1 ht 4						

➢ Add Item → Add Label→Add a Label using HTML rendering

USIT6P4 (1	scipline Specific Elective Practical) Principles of Geographic Information Systems Practical
Lay	ut Item Properties Guides
Item	Properties
Lab	
	1ain Properties h2>© Copy Right Reserved h1>B. Sc. IT Student
► A M	Render as HTML \rightarrow can be saved in Image or PDF using Layout \rightarrow Export as Image / Export as PDF
📿 P	ctical_3A
Lay	t <u>E</u> dit <u>V</u> iew <u>I</u> tems <u>A</u> dd Item Atlas
	ave Project Ctrl+S
	Vew Layout Quplicate Layout Delete Layout

۲

Save the Map to a location appropriate location as PDF or Image.

Layout <u>M</u>anager... Layouts

Add Pages...

-

6

ĥ

Layout Properties... Rename Layout...

Save as Template...

Export as Image ...

Export as SVG...

Export as PDF...

Add Items from Template...

Export Options							
Export resolution	600jdpi	\$					
Page width	6921 px	Φ.					
Page height	4897 px	4					
V Crop to C	intent						
			Top margin	Орк			
Left	0 p	c	4	Right		0 grx	
			Bottom	0 px	4		
Generate world	fle ng						



USIT6P4 (Discipline Specific Elective Practical) Principles of Geographic Information Systems Practical b) Importing Spreadsheets or CSV files Many times the GIS data comes in a table or an Excel spreadsheet or a list lat/long coordinates, therefore it has to be imported in a GIS project. Sample file for Earthquake data will be used in this practical. \geq ▶ Go to Layer \rightarrow Add Layer \rightarrow Add Delimited text Layer eet - QGIS Processing Laver Settings Plugins Vector Raster Database Web MMQGIS Data Source Manager Ctrl+L Create Layer × Add Layer V_n Add Vector Layer... Add Raster Laver Embed Layers and Groups... Add from Layer Definition File... Add Delimited Text Layer.. Add PostGIS Lavers... Data Source Manager | Delimited Text window will appear Select the \GIS_Workshop\Practical_03\C\Sample.csv file from data folder. х Data Source Manager | Delimited Text Browser File name I:\GIS_Workshop\Practicals\Practical_03\C\Sample.csv Layer name Sample Encoding UTF-8 Ŧ Vector File Format * Raster CSV (comma separated values) 🗸 Tab Colon Space Quote " Escape * Oustom delimiters Delimited Text **Record and Fields Options** GeoPackage **Geometry Definition** SpatiaLite

Point coordinates X field LONGITUDE Ŧ Well known text (WKT) Y field LATITUDE PostgreSQL No geometry (attribute only table) DMS coordinates MSSQL EPSG:4326 - WGS 84 Geometry CRS Oracle Layer Settings Sample Data DB2 I_D FLAG_TSUNAMI YEAR MONTH DAY HOUR MINUTE SEC ^ Virtual Layer 1 1 -2150 2 E m VMS/WMTS Ш Add Close Help

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- > Press ADD and close the window.
- > Output:



c) Using Plugins

- > Core plugins are already part of the standard QGIS installation. To use these, just enable them.
- > Open QGIS. Click on Plugins \rightarrow Manage and Install Plugins....

Q Plugins Installed (11)	
촕 All	Q. Search
	Coordinate Capture
Installed	🔽 🚞 DB Manager
	eVis 📰
🇯 Not installed	🔲 🗼 Geometry Checker
1000	C the Georeferencer GDAL
Install from ZIP	📄 🏭 GPS Tools
1947 - T	📄 🙊 GRASS 7
** Settings	🔽 🕵 MetaSearch Catalog Client
A Seconds	📄 🤿 OfflineEditing
	🔽 🌞 Processing

- **To enable a plugin**, check on the checkbox next to Plugin. This will enable the plugin to use it.
- External plugins are available in the QGIS Plugins Repository and need to be installed by the users before using them.

or

- > Click on Not Installed or Install from ZIP.
- > Once the plugin is downloaded and installed, you will see a confirmation dialog.
- ➢ Click on Plugins → <<new Plugin Name>>
- > The Plugin if marked **Experimental plugin** can be installed, from Setting \rightarrow check on

Show also experimental plugins

Show also deprecated plugins

- A Lab will be added to Plugin Manager Window.
- Click on a plugin name and Click Install.

d) Searching and Downloading OpenStreetMap Data

OpenStreetMap (**OSM**) created by Steve Coast in the UK in 2004 is a collaborative project to create a free editable map of the world. Rather than the map itself, the data generated by the project is considered its primary output. The creation and growth of OSM has been motivated by restrictions on use or availability of map information across much of the world, and the advent of inexpensive portable satellite navigation devices.

- Add "Open Layer" and "OSM Search" Plugin from Not Installed option from Plugin Manager Dialog Box.
- ➤ The OSM Place Search plugin will install itself as a Panel in QGIS, if not go to View → Panels → select OSM Place Search.



➢ Go to Web → OpenLayer Plugin and select Open Street Map



No projection (or unknown/non-Earth projection)

OSM place search 🗗 🗙
Name contains University of Mumbai
Limit to extent
University Institute of Chemical Technology, Purar
University Institute of Chemical Technology (UICT)
University Road, Kala Ghoda, A Ward, Zone 1, Mu
T.S. Chanakya Maritime University, Palm Beach Ma
SNDT Women's University, Juhu Road, H/W Ward
SNDT Womens University, U A H Khan Marg, Bori
Dayalbagh University, Chunabhatti Road, Rahul N
Mumbai University - Fort Campus, Mahatma Ganc
Mumbai University, Santa Cruz – Chembur Link Ro
Mumbai University Grounds, Maharshi Karve Roa
P
😢 🛐 👄 Zoom



Dom

- > In OSM Place search Pane \rightarrow Enter Mumbai or any place name to search
- Double click on the desired place in OSM Place search Panel or Click and press
 Output:



PRACTICAL - 4

A. Working with attributes

- ➢ Start a new project.
- ➢ Go to Layer → Add Layer → Add Vector Layer
- Select "\GIS_Workshop\Practicals\Practical_04\A\Data\ne_10m_populated_places_simple.zip"



- ▶ Right click on Layer in Layer Panel \rightarrow Open Attribute Table.
- > Explore various attributes and their values in the Attribute table.
- > To find the Place with maximum population click on "**pop_max**" file

Q n	ne_10m_populated_places_simple :: Features Total: 7322, Filtered: 7322, Selected: 0							
1	/ 🗱 🖶 😂 🖄 🐂 🌄 🍢 🍸 🖺 🌺 🗭 🛍 🛗 🛗 🎕							
	latitude	longitude	changed	namediff	diffnote	pop_max	pop_min	pop_other
1	35.68501690580	139.75140742900	0.00000000000	0		35676000	8336599	1294525
2	40.74997906400	-73.98001692880	0.00000000000	0		19040000	8008278	929260
_	19/11211211200	9913090020170	0.00000000000	•		19020000	10011002	
4	19.01699037570	72.85698929740	0.00000000000	0		18978000	12691836	1242608

> On clicking the Select feature using expression button the following window will appear.

Q Select by Expression - ne_10m_populated_places_sim	ple	
Expression Function Editor		
= + - / * ^ II () \//'	Q. Search	operator OR
pop_max >100 and pop_max < 10000	+ ^	Returns 1 when condition a or b is true.
	<=	Syntax
	< >	Examples
	=	• 4 = 2+2 OP 1 = 1 = 1
	>	• $4 = 2+2$ OR $1 = 1-1$ • $4 = 2+2$ OR $1 = 2 \rightarrow 1$
		 4 = 2 OR 1 = 2 → 0
	ILIKE	
	IN	
	IS	
	LIKE	
	OR	
	Rasters ==	
	Record and Attributes	
	▷ String	
	Variables	
Output provinent 0	V Recent (Selection)	
output preview. 0		
Help		Select features 💌 🖸 Close

Enter pop_max>100 and pop_max<10000 and click button to get all the places with population between 100 and 10000.</p>

> The places matching the criteria will appear in different color.



$\boldsymbol{b})$ Terrain Data and Hill shade analysis

A terrain dataset is a multiresolution, TIN-based surface built from measurements stored as features in a geodatabase. Terrain or elevation data is useful for many GIS Analysis like, to generate various products from elevation data such as contours, hillshade etc.



https://www.google.com/maps/@27.9857765,86.9285378,14.75z/data=!5m1!1e4?hl=en-US
 ➢ Go to Layer → Add Raster Layer → select "10n060e_20101117_gmted_mea300.tif", from Data folder

Layers	ē ×	
🗸 🏨 💿 🕇 8	% - ⊯ 11 ⊡	
▲ 🔽 🐩 <u>10n060</u> ■ 0	<u>De 20101117 q</u>	
8243		and the second sec

- The Lower altitude regions are shown using dark color and higher using light shade as seen on top region containing Himalaya and Mt Everest.
- Mt. Everest is located at the coordinates 27.9881° N, 86.9253° E.
- Enter 86.92, 27.98 in the coordinate field, Scale 900000 and Magnifier 100% at the bottom of QGIS.

Coordinate 86.92,27.98 🗞 Scale 1:1000000	-	Magnifier	100%	* *
--	---	-----------	------	--------

> Press enter the view port will be centered on Himalaya Region.



- > Crop the raster layer only for the region under study.
- > Go to Raster → Extraction → Clip Raster by Extent



- Select the clipping area by selecting the option Use Canvas Extends if the visible part of map is to be selected or manually select an area on canvas by using Select Extent on Canvas.
- > Select the location and file name for storing clipped raster layer.



- Press RUN.
- Deselect the original layer and keep the clipped one.
- > The Clipped raster layer is representing altitude are from 103 Meters.



- Counter lines are the lines on a map joining points of equal height above or below sea level. A contour interval in surveying is the vertical distance or the difference in the elevation between the two contour lines in a topographical map.
- > To derive counter lines from given raster.
- ➢ Go to Raster → Extraction → Contour

USIT6P4 (Discipline Specific Elective Practical) Principles of Geographic Information Systems Practical
Raster Database Web MMQGIS Processing Help Raster Calculator Align Rasters Image: Conversion Image: Conversion Analysis Image: Clip Raster by Extent Miscellaneous Image: Clip Raster by Mask Layer Extraction Image: Clip Raster by Mask Layer Conversion Image: Clip Raster by Mask Layer
The Contour configuration window will appear
Parameters Log Input layer Clipped (extent) [EPSG:4326] Band number Band 1 (Gray) Interval between contour lines 100.00000 Attribute name (if not set, no elevation attribute is attached) [optional] ELEV Offset from zero relative to which to interpret intervals [optional] ELEV Offset from zero relative to which to interpret intervals [optional] 0.00000 Advanced parameters Contours 1/GIS_Workshop/Practicals/Practical_04/Himlaya_Region_Contour!gpkg @ Dpen output file after running algorithm GDAL/OGR console call gdal_contour -b 1 -a ELEV + 100.0 -f "GPKG" 1:/GIS_Workshop/Practicals/Practical_04/Clipped_Himalay_Region.tif 1:/ GIS_Workshop/Practicals/Practical_04/Himlaya_Region_Contour.gpkg
0% Cancel Run as Batch Process Run Close Help
 Select the input raster layer name. Set contour interval 100.00 meters, select the output file name & location and check the option to add output file to project after processing. Press "RUN". The contour layer will appear like this



> Label the layer using "ELEV" field and set appropriate symbols for line.

		Q Layer Propertie	s - Contours Symbology
Q Layer Properties	- Contours Labels	Q	🚍 Single symbol
Q	🐽 Single labels	🧿 Informatio 🔶	 Line — Simple line
🧃 Informatio	Label with 1.2 ELEV	Source	
Source	▼ Text Sample	Symbolog	
Source .	Lorem Ipsum	Diagrams	
🐳 Symbology		🔶 3D View 🗉	Unit Millimeter
(abc Labels	Lorem Ipsum	Source Fields	Color
		Attributes	Width 0.20000

- > In the Layer panel right click on Contour Raster Layer and select "Open Attribute table",
- ➢ Arrange the table in descending order based on the value of "ELEV" column.
- \triangleright



Compare the above counter line raster layer with the previous Google map image or visit https://www.google.com/maps/@27.9857765,86.9285378,14.75z/data=!5m1!1e4?hl=en-US

- > To verify the above contour files using Google Map
- → Make a copy of Contour Layer, Go to Layer \rightarrow Save As
- Select file format as "Keyhole Markup Language", set file name, location and Layer Name.
- Also set CRS to WGS 84 EPSG:4326

USIT6P4 (Discipline Specific Elective Practical) Principles of Geographic Information Systems Practical

 Image: Save Vector Layer as...

 Image: Format
 Keyhole Markup Language [KML]

 File name
 I:\GIS_Workshop\Practicals\Practical_04\Himalayan_Google_Map_File.kml

 Layer name
 Himalayan_Google_Map_File

 CRS
 EPSG:4326 - WGS 84

Go to the stored location on Hard Disk and open the "Himalayan_Google_Map_File.kml" with Google Map.\

A **Hillshade** is a grayscale 3D representation of the surface, showing the topographical shape of hills and mountains using shading (levels of gray) on a map, just to indicate relative slopes, mountain ridges, not absolute height.

- ➢ For Hill Shade surface analysis
- > Go to Plugin → Install Georeferencer GADL.
- → After successful installation of plugin Go to Raster → Analysis → Hill Shade



> Select the input raster layer, select file name and location for storing Hill Shade output file.

Parameters Log Input layer	
Clipped (extent) [EPSG:4326]	▼
and number	
Band 1 (Gray)	•
Z factor (vertical exaggeration)	
1.00000	<u></u>
Scale (ratio of vertical units to horizontal)	
1.000000	
Azimuth of the light	
315.000000	•
Altitude of the light	
45.000000	×
Compute edges	
Use ZevenbergenThorne formula instead of the Horn's one	
Combined shading	
Multidirectional shading	
Advanced parameters	
tillshade	
I:/GIS_Workshop/Practicals/Practical_04/Hill_Shade_Himalya_Region.tif	
Open output file after running algorithm	\sim
GDAL/OGR console call	
gdaldem hillshade I:/GIS_Workshop/Practicals/Practical_04/Clipped_Himal Hill_Shade_Himalya_Region.tif -of GTiff -b 1 -z 1.0 -s 1.0 -az 315.0 -alt 45	ay_Region.tif I:/GIS_Workshop/Practicals/Practical_04/ 5.0
	0% Cance

- > Press "RUN" and Close the Hill Shape Dialog window.
- > After Raster styling the Output will appear like this.



PRACTICAL - 5

Working with Projections and WMS Data

A **Web Map Service** (**WMS**) is a standard protocol developed by the Open Geospatial Consortium in 1999 for serving georeferenced map images over the Internet. These images are typically produced by a map server from data provided by a GIS database

- Start a new Project.
- ▶ Layer → Add Layer → Vector Layer
- Select "ne_10m_admin_0_countries.zip" Layer from data folder.
- ➢ Go to Layer → Save As

Select format as ESRI Shape File

Select folder location and file name

Set CRS North_America_Albers_Equal_Area_Conic EPSG: 102008

G	Save Vector	r Layer as		×
	Format	ESRI Shapefile		•
'	File name	I:\GIS_Workshop	\Practicals\Practical_04\My_Projected_Wold_map.shp	
	Layer name			
	CRS	EPSG: 102008 - N	lorth_America_Albers_Equal_Area_Conic	

- Press "OK".
- Deselect the original Image and keep the projected layer visible.



Select Layer → Add Layer → Add Raster Layer → Select MiniScale_(standard)_R17.tif from Location

 $\label{eq:gb_minisc_gb_minisc_gb_minisc_gb_data\RGB_TIF_compressed\MiniScale_(standard)_R17.tif"$

The Layer appears on a different location than the location where Great Britain is shown on Map.

Q Project Properties CRS		X
Q General Metadata	Project Coordinate Reference System (CRS) No projection (or unknown/non-Earth projection) Filter Q bri Recently used coordinate reference systems	
TRS CRS	Coordinate Reference SystemAuthority IDOSGB 1936 / British National GridEPSG:27700	
Marca Default Styles		

- ▷ Open Layer Properties \rightarrow CRS \rightarrow Search bri \rightarrow select British National Grid EPSG 27700.
- Processing may take some time.
- Locate United Kingdom on Layer; the vector layer exactly coincides by the raster layer covering United Kingdom.



PRACTICAL - 6

> Georeferencing

A. Georeferencing Topo Sheets and Scanned Maps

- Start a new project
- ➢ Go to Layers → Add Layer → Add vector Layer
- Select GIS_Workshop\Manual\Prac06\IND_adm0.shp
- > Zoom in to Mumbai region in the layer.



- ➢ Go to Plugins → Manage and Install Plugins
- Ensure that Georeferencer GDAL is checked, if not install Georeferencer GDAL plugin.
- ▶ Go to Raster \rightarrow Georefrencer

▶ File → Open

Rast	er	Database	Web	M
2	Ras	ster Calculat	or	
	Ali	gn Rasters		
Ħ	Ge	oreferencer.		
	An	alysis		۲

➤ A new Georeferencer window will open

			1		Ψ,	ر هر	P [r q	d 29	0\$ 0	4	2 11	
GCP	table												
									Tr	ansform: I	Vot set	15,-1	EF

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Select file "1870_southern-india_3975_3071_600.jpg" from project data folder



→ Go to Settings → Transformation Settings



In the Transformation Settings window



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Q Transformation Settings
Transformation parameters
Transformation type Thin Plate Spline
Resampling method Nearest neighbour
Target SRS EPSG:4326 - WGS 84
Output settings
Output raster vata/1870_northern-india_3975_3071_600_modified.tif
Compression None
Press "RIIN"
 ➤ In Georeferencing window go to → File → Start Georeferencing
Q Georeferencer - 1870_northern-india_3975_3071_600.jpg
File Edit View Settings
Reset Georeferencer
Ctrl+O Ctrl+O
Start Georeferencing Ctrl+G
Generate GDAL Script Ctrl+C
Progress Indication 33% Cancel
> The canvas area will now have the scanned map of Mumbai referenced with control points.
Select the newly added layer in Layer Panel Right click and go to property.
Layers B × ≪ ① © T E → II T □ © Beographybombay modified V IND_adm0 Export Styles Properties
Set Transparency level of raster layer to appropriate level.








- ▶ Go to Edit \rightarrow Add Point
- > Select control points from map (Indicated in red color).
 - ▶ Go to Setting \rightarrow Transformation Setting

Transformation (param	eters
Transformation	type	Thin Plate Spline
Resampling met	hod	Nearest neighbour
Target SRS		Project CRS: EPSG:3857 - WGS 84 / Pseudo-Merca 🔻
Output settings		
Output raster	actica	s/Practical_06/t/GateWay_Imagery_modified.tif 🖾 [
Compression	None	

- > Go to File \rightarrow Start Georeferencing or Press the \square button in Georegerencing Window.
- > The progress indicator will appear



Observe that the aerial image of the Gateway of India is georeferenced on OSM in the map canvas.



C. Digitizing Map Data

Spatialite is an open database format similar to ESRI's geodatabase format. Spatialite database is contained within a single file on your hard drive and can contain different types of spatial (point, line, polygon) as well as non-spatial layers. This makes is much easier to move it around instead of a bunch of shapefiles.

Digitizing Map Data

➢ Go to Layer → Add Raster→ Select "Christchurch Topo50 map.tif" from project Folder.



- > QGIS offers a simple solution to make raster load much faster by using Image Pyramids.
- ▶ Right-click the Christchurch Topo50 map.tif layer and select Properties.

Layers 🛛 🗗 🕹 😴 通 👁 🝸 원, 🕶 🔃 😭 🗔	:		
📝 🚼 Christchurch Topo50	8	<u>Z</u> oom to Layer Show in Overview Export	
		Styles <u>P</u> roperties	South Hagley Park

Choose the Pyramids tab. Hold the Ctrl key and select all the resolutions offered in the Resolutions panel.

Q Layer Properties - Chris	tchurch Topo50 map Pyramids
Q # Information Source Symbology Transperency Histogram Arendering Metaduta Metaduta Legend QGIS Sever	Description 30 40 452 Level resolution rate layence can be conderably increasing hower resolution coder at the distance of the level of zoom. You must have write access in the directory where the original data is street to build prymatic. 8 81.13 Picase note: that building internal pryamids could corrupt your image - always make a backup of your data first 44 x 57
	Overview format External Resampling method Average 0% Build Pyramids
(Style



USIT6P4 (Discipline Specific Elective Practical) Principles of Geographic Information Systems Practical
New SpatiaLite Layer
Database I:/GIS_Workshop/Practical_06/C/MySpatialDataBasi Layer name Digitize_Road Geometry type Line Include Z dimension Include M values EPSG:4167 - NZGD2000 New Field Name Type abc Text data Fields List Fields List Name Type
Name text Class text
Add "Name" and "Class" fields using "Add to Fields List".
Once the layer is loaded, click the Toggle Editing button to put the layer in editing mode.

Add Line Feature (Ctrl+.)

Click the Add feature button. Click on the map canvas to add a new vertex. Add new vertices along the road feature. Once you have digitized a road segment, right-click to end the feature.

Digitize_F	Road - Feature Attributes		
Actions			
pkuid	Autogenerate		~
Name	MyRoad	×	
Class	Street]

On Layer Panel Right Click on Digitze_Road, Select the Style tab in the Layer Properties dialog.





PRACTICAL - 7

Managing Data Tables and Saptial data Sets:

a) Table joins

- Start a new project
- $\blacktriangleright \quad \text{Go to Layer} \rightarrow \text{Add Layer} \rightarrow \text{Add new Vector Layer}$
 - "I:\GIS_Workshop\Practicals\Practical_07\A\Data\tl_2013_06_tract.zip"
- ➤ We could import this csv file without any further action and it would be imported. But, the default type of each column would be a *String* (text). That is ok except for the *D001* field which contains numbers for the population. Having those imported as text would not allow us to run any mathematical operations on this column. To tell QGIS to import the field as a number, we need to create a *sidecar* file with a *.csvt* extension.



- This file will have only 1 row specifying data types for each column. Save this file as ca_tracts_pop.csvt in the same directory as the original .csv file.
- ➢ Go to Layer → Add Layer → Add Delimited Text Layer

And add I:\GIS_Workshop\Practicals\Practical_07\A\Data\ca_tacts_pop.csv"



▶ In the layer panel, Right click on "tl_2013_06_tract", layer and select Properties



Layer Properties - tl_2	2013_06_tract Symbology	×
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	Column 123 ca tracts pop D001	3
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Attributes Form	29961.60 - 37452.00 29961.6000 - 37452.0000	
Joins	Mode Equal Interval	Classes 5
Auxiliary Storage	Classify (B) Delete All	Advanced 🔻
Actions	V Link class boundaries	
Display	Layer Rendering	

A detailed and accurate population map of California can be seen as the result. Same technique can be used to create maps based on variety of census data.



b) spatial joins

Layers

▶ Go to Layer \rightarrow Add Layer \rightarrow Add Vector Layer \rightarrow Select "I:\GIS_Workshop\Practicals\Practical_07\B\Data\nybb_12c\nybb_13c_av\nybb.shp" and "I:\GIS_Workshop\Practical_07\B\Data\OEM_NursingHomes_001\OEM_NursingHo mes_001.shp", from data folder.



Go to attribute table and observe the data. \geqslant

Table before performing Join \triangleright

Q	OEM_NursingHomes_001 :: Features Total: 177, Filtered: 177, Selected: 0						
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з	2401 LACONIA	BRONX		10469	1245.0000000000	7000338.000000	200
4	3200 BAYCHES	BRONX		10475	1242.0000000000	7000356.000000	236
5	700 WHITE PLA	BRONX		10473	856.0000000000	7000361.000000	240
6	3400 CANNON	BRONX		10463	1234.0000000000	7000374.000000	400
7	612 ALLERTON	BRONX		10467	1218.0000000000	7000308.000000	520
8	666 KAPPOCK S	BRONX		10463	1233.0000000000	7000385.000000	200
9	3518 BAINBRID	BRONX		10467	1227.0000000000	7000319.000000	200
10	801 CO-OP CIT	BRONX		10475	1260.0000000000	7000389.000000	480
11	2266 CROPSEY	BROOKLYN		11214	1364.0000000000	7001303.000000	271
12	2865 BRIGHTO	BROOKLYN		11235	1399.0000000000	7001342.000000	320

Go to Vector \rightarrow Data Management Tools \rightarrow Join Attributes by Location \geq



Parameters Log Input layer Inp	Select Al Clear Selection Toggle Selection Cancel
Joined layer [Create temporary layer] [Open output file after running algorithm Unjoinable features from first layer [Skp output] 0% Cancel	

Attribute table after join

City	Zipcode	PFI	OpCert	Capacity
ASTORIA	11102	6384.00000000000	7003405.000000	280
BROOKLYN	11217	5546.0000000000	7001377.000000	288
BRONX	10472	1251.0000000000	7000381.000000	200
STATEN ISLAND	10304	1755.0000000000	7004310.000000	300
NEW YORK	10003	4807.0000000000	7002351.000000	28

- Use the Identify Feature
- Button to select a region to view join data on map Layer.

Output



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T. Y. B. Sc. (Information Technology) SEMESTER VI Teacher's Reference Manual



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➢ Use the select Feature button to c	heck country wise counting of Earthquakes.
Plugins Vector Raster Database Web MMQGIS Pr	rocessing Help
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Also a new column is added to attribute table "NumPoints" indicating number of earth quake points in each country.

NUMPOINTS
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d) Performing spatial queries

➢ Go to Layer → Add Layer → Add Vector Layer and load "\GIS_Workshop\Practicals\Practical_07\D\Data\ne_10m_populated_places_simple\ne_10m_popul ated_places_simple.shp" and

"I:\GIS_Workshop\Practical_07\D\Data\ne_10m_rivers_lake_centerlines\ne_10m_rivers_lake_centerlines.shp" from project data folder.



➢ Open project Properties → Set CRS "World_Azimuthal_Equidistant EPSG 54032". The map will be re-projected as





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→ Go to Vector → Research Tool → Select By Location
Vector Raster Database Web MMQGIS Processing Help
🕂 Coordinate Capture 🛛 🖓 🌆 🖓 🖉 🔁
Check Geometries
Topology Checker
Geoprocessing Tools
Geometry Tools
Analysis Tools Data Management Tools
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equal or ros
ine_10m_populated_places_simple [EPSG:4326]
Modify current selection by Creating new selection
Run as Batch Process
This will highlight only those rivers containing a populated place within 2 KM
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Damag Silvassa Nasik Aurangabad Chandrapyr
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Krishna Gulbarga Hyderabad Khammam
Kolhapur Sangli Bijapur Krishna Vijayawada
Belgaum Raichur Guntur Machilipatnam
Panaji Hubli Tupo a b b a dra Bellary Hospet Bellary
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PRACTICAL - 8

Advanced GIS Operations 1:

a) Nearest Neighbor Analysis

> Go to Layer → add Layer → add Delimited Text Layer and load "signif.txt" from data file.

Q Data Source Manager Delimit	ied Text
Erowser	File name I:\GIS_Workshop\Practicals\Practical_08\A\DATA\EarthQuakeDatabase.txt 🚳 🛄
V Vector	Layer name EarthQuakeDatabase Encoding UTF-8
Raster Mesh	CSV (comma separated values) Image: Tab Image: Colon Space Regular expression delimiter Semicolon Comma Others Image: Custom delimiters Quote Escape Image: Custom delimiter
GeoPackage	Record and Fields Options Number of header lines to discard 0 Decimal separator is comma First record has field names Trim fields
PostgreSQL	Commetry Definition
MSSQL	 Point coordinates Well known text (WKT) No geometry (attribute only table) X field LATITUDE DMS coordinates
DB2 DB2	Geometry CRS EPSG: 4326 - WGS 84 ▼ →
С wms/wmts Ф wcs	I_D FLAG_TSUNAMI YEAR MONTH DAY HOUR MINUTE SEC 1 9652 Tsu -326 11
WFS	
ArcGIS Map Server	1 badly formatted records discarded from sample data
ArcGIS Feature Server	Close Add Help

➤ Go to Layer → Add Layer → Add vector Layer and from data folder "\GIS_Workshop\Practicals\Practical_08\A\DATA\ne_10m_populated_places_simple.zip" load the layer to the project and remove all rows from attribute table other than India.



- Calculate the Distance matrix and perform Nearest Neighbor Analysis
- Now you will be able to see the content of our results. The InputID field contains the field name from the Earthquake layer. The TargetID field contains the name of the feature from the Populated Places layer that was the closest to the earthquake point. The Distance field is the distance between the 2 points.



7. Here select the earthquake layer signif as the Input point layer and the populated places ne_10m_populated_places_simpleas the target layer. You also need to select a unique field from each of these layers which is how your results will be displayed. In this analysis, we are looking to get only 1 nearest point, so check the Use only the nearest(k) target points, and enter 1. Name your output file matrix.csv, and click OK. Once the processing finishes, click Close.

Input point layer					
signif					
Input unique ID field					
I_D					
Target point layer					
ne_10m_populated_places_simple					
Target unique ID field					
name					
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8. Once the processing finishes, click the Close button in the Distance Matrix dialog. You can now view the matrix.csv file in Notepad or any text editor. QGIS can import CSV files as well, so we will add it to QGIS and view it there. Go to Layer Add Layer Add Delimited Text Layer....

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9. Browse to the newly created matrix.csv file. Since this file is just text columns, select No geometry (attribute only table) as theGeometry definition. Click OK.

.ayer r	name m	atrix			Encoding UTF-8	В
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Record	d options	Number o	f header lines to disc	ard 0 🗢 🗶 First record has field	d names	
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10. You will see the CSV file loaded as a table. Right-click on the table layer and select Open Attribute Table.



11. Now you will be able to see the content of our results. The InputID field contains the field name from the Earthquake layer. The TargetID field contains the name of the feature from the Populated Places layer that was the closest to the earthquake point. The Distance field is the distance between the 2 points.

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5	11	Iraklio	0.408843567409				
6	9712	Al Ladhiqiyah	0.144408036939				
7	12	As Salt	0.230569794451				
8	13	Al Agabah	0.10661139997				
9	14	Al Qunaytirah	0.34713470868				
10	7793	Nabatiye et Tahta	0.256395311798				
11	16	Sparti	0.101878534504				
12	7794	Saida	0.003261678933				
13	9713	Piraiévs	0.206150410754				
14	17	Volos	0.4810609473				
15	18	Sparti	0.101878534504				
16	5878	Lamia	0.265998307404				
17	19	Varamin	0.239101501046			5	
18	20	Patra	0.520403483984				
	21	Trablin	0 350232618378				

12. This is very close to the result we were looking for. For some users, this table would be sufficient. However, we can also integrate this results in our original Earthquake layer using a Table Join. Right-click on the Earthquake layer, and select Properties.



14. We want to join the data from our analysis result to this layer. We need to select a field from each of the layers that has the same values. Select matrix as the Join layer` and InputID as

the Join field. The Target field would be I_D. Leave other options to their default values and click OK.

🌠 Add vector join	S ×
Join layer	matrix
Join field	InputID 🔻
Target field	D
Cache join layer in virtual memory	
Create attribute index on join field	
Choose which fields are joined	
Custom field name prefix	
	OK Cancel

15. You will see the join appear in the Joins tab. Click OK.

🕺 Layer Properties - signif	Joins			2 ×
🤀 General	Join layer	Join field	Target field	Memory cache
😽 Style	matrix	InputID	I_D	v
abc Labels				
Fields				
🧭 Display				
Actions				
Joins				
Diagrams				
🥡 Metadata				
	Style	•		OK Cancel Apoly Help
	otyne			or Ma contest which Lieb

16. Now open the attribute table of the signif layer by right-clicking and selecting Open Attribute Table.



17. You will see that for every Earthquake feature, we now have an attribute which is the nearest neighbor (closest populated place) and the distance to the nearest neighbor.

1	B 🗍 📅 🛛 😜	-, 🏥 🚱	🌺 🎾 📄	1. II. 🗮		
	HOUSES_DESTR(S_DESTROYED_D	AL_HOUSES_DAMA	ES_DAMAGED_[matrix_TargetID	matrix_Distance
5139	NULL	NULL	3100	4	Dulan	2.01739872078
3345	NULL	NULL	2800	4	Yogyakarta	1.76045290364
5721	600	3	55000	4	Lijiang	1.68697672541
5464	331	3	5613	4	Aksu	1.63416691989
3225	326	3	2200	4	Yogyakarta	1.62947269236
5668	NULL	NULL	30000	4	Shihezi	1.58756245594
3924	500	3	1951	4	Hios	1.5457604489
5590	127511	4	273796	4	Sendai	1.35225172867
4877	3600	4	18771	4	Shache	1.23735810418
3897	2000	4	5000	4	Jember	1.18334084967
4647	NULL	3	2000	4	Feyzabad	1.14744856695
4841	100	2	5000	4	Birjand	1.08829070683
5575	NULL	3	1800	4	Bam	1.07386335966
1798	20000	4	15000	4	Tokushima	1.06587936484
4919	NULL	NULL	2800	4	Serang	0.945435509316
5042	650	3	1350	4	Bandar-e Bushehr	0.929327026627
3369	29205	4	46950	4	Tsu	0.924368786383
5454	30	1	5400	4	Namtu	0.902227067915
5455	30	1	5400	4	Namtu	0.902227067915

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18. We will now explore a way to visualize these results. First, we need to make the table join permanent by saving it to a new layer. Right-click the signif layer and select Save As....



19. Click the Browse button next to Save as label and name the output layer as earthquake_with_places.shp. Make sure the Add saved file to map box is checked and click OK.

Format	ESRI Shapefile	
Save as	C:/Users/Ujaval/Downloads/e	earthquakes_with_places.shp Browse
CRS	Selected CRS (EPSG:4326, W	GS 84) 🔻 🌏
Encoding	g	System 🗸
Save	e only selected features	
X Add	attribute creation saved file to map	
Symbolo	ogy export	No symbology 💌
Scale		1:50000
	Extent (current: layer)	
▼ Dat	asource Options	
		OK Cancel Help

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20. Once the new layer is loaded, you can turn off the visibility of the signif layer. As our dataset is quite large, we can run our visualization analysis on a subset of the data. QGIS has a neat feature where you can load a subset of features from a layer without having to export it to a new layer. Right-click the earthquake_with_places layer and select Properties.



21. In the General tab, scroll down to the Feature subset section. Click Query Builder.

	Layer source C:\Users\Ujaval\Downloads\earthquakes_with_places.shp
	Data source encoding System 🔻
🍯 Style	
bc Labels	Coordinate reference system
Fields	Selected CRS (EPSG: 4326, WGS 84)
Display	Create spatial index Update extents
Actions	Scale dependent visibility
🧳 Joins	Minimum (exclusive) (2000,000) (indusive) (
📃 Diagrams	▼ Feature subset
Detadata	
	Query Builder

22. For this tutorial, we will visualize the earthquakes and their nearest populated places for Mexico. Enter the following expression in the Query Builder dialog.

"COUNTRY" = 'MEXICO'

et provider filter on e	earthquakes_with	n_places					
Fields				-Values -]
FOCAL_DEPT							
EQ_PRIMARY							
EQ_MAG_MW							
EQ_MAG_MS							
EQ_MAG_MB							
EQ_MAG_ML							
EQ_MAG_MFA							
EQ_MAG_UNK							
INTENSITY							
COUNTRY							
STATE							
LOCATION_N							
LATITUDE					Sample		All
DECTON COD					Ch		
KEGION_COD				US	e unnittered lay	er	
					/0		
<=	>=	!=	ILIK	E	AND	OR	NOT
Provider specific filts	<pre>expression = 'MEXICO'</pre>						

23. You will see that only the points falling within Mexico will be visible in the canvas. Let's do the same for the populated places layer. Right-click on

the ne_10m_populated_places_simple layer and select Properties.



25. Now we are ready to create our visualization. We will use a plugin named MMQGIS. Find and install the plugin. See Using Pluginsfor more details on how to work with plugins. Once you have the plugin installed, go to MMQGIS [Create [Hub Lines.]]



26. Select ne_10m_populated_places_simple as the Hub Point Layer and name as the Hub ID Attribute. Similarly, selectearthquake_with_places as the Spoke Point Layer and matrix_Tar as the Spoke Hub ID Attribute. The hub lines algorithm will go through each of earthquake points and create a line that will join it to the populated place which matches the attribute we specified. Click Browse and name the Output Shapefile as earthquake_hub_lines.shp. Click OK to start the processing.

Hub Point Layer	Hub ID Attribute	
ne_10m_populated_places_simple	▼ name	
Spoke Point Layer	Spoke Hub ID Attribute	
earthquakes_with_places	▼ matrix_Tar	
Output Shapefile		Brausa
C. I leave I lieure I Devuele e de le sette	quake_hub_lines.shp	browse
C:/Users/Ujavai/Downloads/earth		

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27. The processing may take a few minutes. You can see the progress on the bottom-left corner of the QGIS window.



28. Once the processing is done, you will see the earthquake_hub_lines layer loaded in QGIS. You can see that each earthquake point now has a line that connects it to the nearest populated place.



B)Sampling Raster Data using Points or Polygons

Many scientific and environmental datasets come as gridded rasters. Elevation data (DEM) is also distributed as raster files. In these raster files, the parameter that is being represented is encoded as the pixel values of the raster. Often, one needs to extract the pixel values at certain locations or aggregate them over some area. This functionality is available in QGIS via two plugins - Point SamplingTool and Zonal Statistics plugin.

Procedure

- Go to Layer Add Raster Layer and browse to the downloaded us.tmax_nohads_ll_{YYYYMMDD}_float.tif file and click Open.
- 2. Once the layer is loaded, select the Identify tool and click anywhere on the layer. You will see the temperature value in celsius as the value or Band 1 at that location.



 Now unzip the downloaded 2013_Gaz_ua_national.zip file and extract the 2013_Gaz_ua_national.txt file on your disk. Go to Layer Add Delimited Text Layer.

USIT6P4 (Discipline Specific Elective Practical) Principles of Geographic Information Systems Practical _ 0 **_ x** 💋 QGIS 2.2.0-Valmiera Project Edit View Layer Settings Plugins Vector Raster Database Web Processing Help New P P II P P A A 🕄 » 🕐 👔 🔊 🛃 » Embed Layers and Groups... 🔓 Add Vector Layer... Ctrl+Shift+V Add Raster Layer... Ctrl+Shift+R 🖣 Add PostGIS Layers... Ctrl+Shift+D v 🗄 🕱 📑 😐 🌈 Add SpatiaLite Layer... Ctrl+Shift+L Madd MSSQL Spatial Layer... Ctrl+Shift+M Add Oracle Spatial Layer... Ctrl+Shift+O ሞ Add WMS/WMTS Layer... Ctrl+Shift+W Add WCS Layer... Po Md WFS Layer... 9. Add Delimited Text Lave 6 Copy style **Q** 🔋 Paste style Open Attribute Table // Toggle Editing 🕞 Save Layer Edits // Current Edits V Save As... ?₀ Save Selection as Vector File.. 📕 Remove Layer(s) Ctrl+D *|* • 🔲 Duplicate Layer(s) Set CRS of Layer(s) Ctrl+Shift+C Set Project CRS from Layer Properties... Query... Ctrl+F and Labeling Add to Overview Add All to Overview Remove All from Overview Show All Layers Ctrl+Shift+U Hide All Layers Ctrl+Shift+H Layers Browser Coordinate: -131.5,75.1 Scale 1:30,090,029 - Ў 🕱 Render EPSG:4326 🚳 🔥

4. In the Create a Layer from Delimited Text File dialog, click Browse and open 2013_Gaz_ua_national.txt. Choose Tab under Custom delimiters. The point coordinates are in Latitude and Longitude, so select INTPTLONG as X field and INTPTLAT as Y field. Check the Use spatial index box and click OK.

File Name C:/Users/Ujaval/Downloads/2013_Gaz_ua_national/2013_Gaz_ua_national.txt										
Lav	Laver name 2013 Gaz ua national Encoding UTF-8									
File	format	CSV (comma separat	ed values)	values) Custom delimiters Regular expression					r	
		Comma Other delimiters	Comma Tab			Space Colon Se ote = Escape =			emicolon	
Record options Number of header lines to discard 0 🚔 🗶 First record has field names										
Field options Trim fields Discard empty fields Decimal separator is comma										
Geometry definition Point coordinates Well known text (WKT) No geometry (attribute only table)										
X field INTPTLONG V field INTPTLAT V DMS coordinates										
Layer settings 🕱 Use spatial index 🔹 Use subset index 🔹 Watch file										
	GEOID	NAME	UATYPE	ALAND	AWATER	ALAND_SQMI	AWATER_SQMI	INTPTLAT		
1	00037	Abbeville, LA Urban Cluster	с	29222236	300497	11.283	0.116	29.967224	-	
2	00064	Abbeville, SC Urban Cluster	С	11279155	19786	4.355	0.008	34.179237	-	
3	00091	Abbotsford, WI Urban Cluster	с	5363428	13221	2.071	0.005	44.948612	-	
4	00118	Aberdeen, MS Urban Cluster	С	7416537	52820	2.864	0.020	33.824742		
5	00145	Aberdeen, SD Urban Cluster	С	33124147	120864	12.789	0.047	45.463186	-	
1								[4]		
						ОК	Cancel	Help		

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5. Now we are ready to extract the temperature values from the raster layer. Install the Point Sampling Tool plugin. See *Using Plugins* for details on how to install plugins.



6. Open the plugin dialog from Plugins Analyses Point sampling tool.



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7. In the Point Sampling Tool dialog, select 2013_Gaz_ua_national as the Layer containing sampling points. We must explicitly pick the fields from the input layer that we want in the output layer. Choose GEOID and NAME fields from the2013_Gaz_ua_national layer. We can sample values from multiple raster band at once, but since our raster has only 1 band, choose the us.tmax_nohads_ll_{YYYYMMDD}_float: Band 1. Name the output vector layer as max_temparature_at_urban_locations.shp. Click the OK to start the sampling process. Click Close once the process finishes.

Point Sampling Tool
General Fields About
Laver containing sampling points:
2013_Gaz_ua_national
Layers with fields/bands to get values from:
2013_Gaz_ua_national : GEOID (source point)
2013_Gaz_ua_national : NAME (source point)
2013_Gaz_ua_national : UATYPE (source point)
2013_Gaz_ua_national : ALAND (source point)
2013 Gaz ua national : ALAND SOMI (source point)
2013 Gaz ua national : AWATER SOMI (source point)
2013_Gaz_ua_national : INTPTLAT (source point)
2013_Gaz_ua_national : INTPTLONG (source point)
us.tmax_nohads_ll_20140525_float : Band 1 (raster)
Output point vector layer:
:/Users/Ujaval/Downloads/max_temperature_at_urban_locations.shp Browse
Add created layer to the TOC
Status:
Complete the input fields and press OK OK Close

8. You will see a new layer max_temparature_at_urban_locations loaded in QGIS. Use the Identify tool to click on any point to see the attributes. You will see the us.tmax_no field - which contains the raster pixel value at the location of the point.



9. First part of our analysis is over. Let's remove the unnecessary layers. Hold the Shift key and select max_temparature_at_urban_locations and 2013_Gaz_ua_national layers. Right-click and select Remove to remove them from QGIS TOC.



- 10. Go to Layer Add Vector Layer. Browse to the downloaded tl_2013_us_county.zip file and click Open. Select thetl_2013_us_county.shp as the layer and click OK.
- 11. The tl_2013_us_county will be added to QGIS. This layer is in EPSG:4269 NAD83 projection. This doesn't match the projection of the raster layer. We will re-project this layer to EPSG:4326 WGS84 projection.
- 12. Right-click the tl_2013_us_county layer and select Save As...


13. In the Save Vector layer as.. dialog, click Browse and name the output file as counties.shp. Choose Selected CRS from the CRS dropdown menu. Click Browse and select WGS 84 as the CRS. Check the Add saved file to map and click OK.

Save vector layer as		ि x
Format Save as	ESRI Shapefile	•
C:/Users/Ujaval/Downloads/cou	nties.shp	Browse
Encoding	System	-
CRS	Selected CRS	▼
WGS 84		Browse
Symbology export		No symbology
Scale	1:50000	▲ ▼
Skip attribute creation	More Options >>]
	OK	Cancel Help

14. A new layer named counties will be add to QGIS.



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15. Enable the Zonal Statistics Plugins. This is a core plugin so it is already installed. See *Using Plugins* to know to how enable core plugins.



16. Go to Raster Zonal statistics Zonal statistics.



17. Select us.tmax_nohads_ll_{YYYMMDD}_float as the Raster layer and counties as the Polygon layer containing the zones. Enter ZS_ as the Output column prefix. Click OK.

🕺 Dialog	8 ×
Raster layer:	
us.tmax_nohads_ll_20140525_float	-
Polygon layer containing the zones:	
counties	-
Output column prefix:	
ZS_	
ОК	Cancel

18. The analysis may take some time depending on the size of the dataset.



Once the processing finishes, select the counties layer. Use the Identify tool and click on any county polygon. You will see three new attributes added to the layer: ZS_count, ZS_mean and ZS_sum. These attributes contain the count of raster pixels,

mean of raster pixel values and sum of raster pixel values respectively. Since we are interested in average temperature, the ZS_mean field will be the one to use.





20. Let's style this layer to create a temperature map. Right-click the counties layer and select Properties.



21. Switch to the Style tab. Choose Graduated style and select ZS_mean as the Column. Choose a Color Ramp and Mode of your chose. Click Classify to create the classes. Click OK.

Image: Symbol Change Image: Symbol Value Label 24,7624 Image: Symbol Change Image: Symbol Value Label 24,7624 Image: Symbol Change Image: Symbol Value Image: Symbol Change Image: Symbol Value Image: Symbol Change Image: Symbol Value Image: Symbol Chang	Layer tran	isparency O	Feature blending mode	Normal
Column Zs_mean E Display Display Color ramp OrRd Invert Mode Quantil Symbol Value Joins 0.0000 0.0000 - 24.7624 Z4.7624 24.7624 - 25.5927 Z6.502 22.6595 Z9.6595 29.6595 - 37.0034	Labels	ted		
Display Color ramp OrRd Invert Mode Quantil Actions Symbol Value Label Display Display Display Display Mode Quantil Display Display Display Display Display Mode Quantil Display Display	Rendering Symbol	ZS_mean	▼ E	Classes 5
Symbol Value Label Outoro 0.0000 - 2 0.0000 - 24.7624 24.7624 24.7624 - 26.5927 24.76350 Diagrams 26.5927 26.5927 - 27.6350 27.6350 29.6595 29.6595 - 37.0034	Color ramp	OrRd	Invert	Mode Quantile (Equal Co
Image: Cologianity 27.6350 27.6350 - 29.6595 Image: Cologianity 27.6350 29.6595 29.6595 Image: Cologianity 29.6595 29.6595 29.6595	Joins Diagrams	Value Label 0.0000 0.0000 - 24.7624 24.7624 24.7624 - 26.5927 26.5927 26.5927 - 27.6350		
	i Metadata	27.6350 27.6350 - 29.6595 29.6595 29.6595 - 37.0034		
Classify Add dass Delete Delete all	Classify	Add class Delete Delete a	a	Adv

22. You will see the county polygons styled using average maximum temperature extracted from the raster grid.



c) Interpolating Point Data

Procedure

- 1. Open QGIS. Go to Layer Add Layer Add Vector Layer..
- 2. Browse to the downloaded Shapefiles.zip file and select it. Click Open.
- In the Select layers to add... dialog, hold the Shift key and select Arlington_Soundings_2007_stpl83.shp andBoundary2004_550_stpl83.shp layers. Click OK.

🕺 Select	ayers to add 2 X
Layer ID	Layer name
0	Arlington_Soundings_2007_stpl83.shp
1	Arlington2007_SS_Points_stpl83.shp
2	Boundary2004 550 stpl83.shp
- 3	Islands_2004_550_stpl83.shp
···· 4	tnrs07Ar 1_5ftcont.shp
	OK Select All Cancel

4. You will see the 2 layers loaded in QGIS. The Boundary2004_550_stpl83 layer represents the boundary of the lake. Un-check the box next to it in the Table of Contents.



5. This will reveal the data from the second layer Arlington_Soundings_2007_stpl83. Though the data looks like lines, it is a series of points that are very close.



6. Click the Zoom icon and select a small area on the screen. As you zoom closer, you will see the points. Each point represents a reading taken by a *Depth Sounder* at the location recorded by a *DGPS* equipment.



7. Select the Identify tool and click on a point. You will see the Identify Results panel show up on the left with the attribute value of the point. In this case, the ELEVATION attribute contains the

depth of the lake at the location. As our task is to create a depth profile and elevation contours, we will use this values as input for the interpolation.



- 8. Make sure you have the Interpolation plugin enabled. See *Using Plugins* for how to enable plugins. Once enabled, go toRaster Interpolation Interpolation.
- 9. In the Interpolation dialog, select Arlington_Soundings_2007_stpl83 as the Vector layers in the Input panel. Select ELEVATION as the Interpolation attribute. Click Add. Change the Cellsize X and Cellsize Y values to 5. This value is the size of each pixel in the output grid. Since our source data is in a projected CRS with **Feet-US** as units, based on our selection, the grid size will be **5 feet**. Click on the ... button next to Output file and name the output file as elevation_tin.tif. CLick OK.

Vector layers	Arlington_Soun	dings_2007_stpl83 💌	Interp Numbe	olation method er of columns	Triangular interpolatio	n (TIN)	•	Number of rows	4096	<i>u</i>
Use z-Coordinate	for interpolation	Demous	Cellsiz	e X	5.00000		-	Cellsize Y	5.00000	
	Add	Remove	X min	2.3581e+06		X max	2.3706	1e+06		
Vector layer	Attribute	Туре	Y min	6.92883e+06		Y max	6.9493	1e+06		
····· Arlington_So	ELEVATION	Points						Set to current ext	ent	
			Outpu	t file C:/Users	/Uiaval/Downloads/ele	vation tir	.tif			[
			X Ac	id result to proje	ct					

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- 10. You will see the new later elevation_tin loaded in QGIS. Right-click the layer and select Zoom to layer.
- 11. Now you will see the full extent of the created surface. Interpolation does not give accurate results outside the collection area. Let's clip the resulting surface with the lake boundary. Go
 - to Raster Extraction Clipper.



12. Name the Output file as elevation_tin_clipped.tif. Select the Cliiped mode as Mask layer. Select Boundary2004_550_stpl83 as the Mask layer`. Click OK.

Input file (raster)	elevation_tin		▼ Sel
Output file	:/Users/Ujaval/E	Downloads/elevation_tin_clippe	d.tif Sel
No data value	0		
Clipping mode —			
 Extent 		Mask layer	
Mask layer		Boundary2004_550_stpl83	▼ Select
Create an ou	tput alpha band		
Create an ou	tput alpha band		
Create an ou	tput alpha band		
Create an ou	tput alpha band when finished		
Create an ou	tput alpha band when finished /vsizip/C:		
Create an ou Create an ou Control Con	tput alpha band when finished /vsizip/C: loads\Shapefiles STiff C:/Users/Uja	zip/Boundary2004_550_stpl83. aval/Downloads/elevation_tin.ti	shp - if
Create an ou Crea	tput alpha band when finished /vsizip/C: loads \Shapefiles.: JTiff C:/Users/Uja vnloads/elevation	zip/Boundary2004_550_stpl83. aval/Downloads/elevation_tin.ti _tin_dipped.tif	shp - f
Create an ou Load into canvas gdalwarp -q -cutline Users/Ujaval\Down crop_to_cutline -of C:/Users/Ujaval/Dow	tput alpha band when finished /vsizip/C: loads\Shapefiles Shiff C:/Users/Uje vnloads/elevation	zip/Boundary2004_550_stpl83. aval/Downloads/elevation_tin.ti u_tin_dipped.tif	shp - f

13. A new raster elevation_tin_clipped will be loaded in QGIS. We will now style this layer to show the difference in elevations. Note the min and max elevation values from the elevation_tin layer. Right-click the elevation_tin_clipped layer and select Properties.



14. Go to the Style tab. Select Render type as Singleband pseudocolor. In the Generate new color map panel, select Spectralcolor ramp. As we want to create a depth-map as opposed to a height-map, check the Invert box. This will assign blues to deep areas and reds to shallow areas. Click Classify.

General	Band rendering			
😻 Style	Render type Singleband p	oseudocolor 🔻		
Transparency	Band	Band 1 (Gray)	Generate new color map	
🚔 Pyramids	Color interpolation	Linear 👻	Spectral -	• 🗙 Invert
Histogram		 	Mode Continuous 💌 Classe	s 5 🚖
	Value Color	Label	Min 507.296 Max	542.347
	507.296000 516.058750	507.296000 516.058750	d	assify
	524.821500	524.821500 533.584250	Min / max origin:	
	···· 542.347000	542.347000	User defined	
			Load min/max values	
			Cumulative 2.0 + 9	8.0 🔹 %
			O Min / max	
			Mean +/ 2.00	•
			- Extent	
			Eul	Estimate (faster)
			O Current	Actual (slower)
	Clip			Load
	▼ Color rendering			
	Blending mode Normal		-	🦘 R
	Brightness		Contrast	0
	Saturation		Grayscale Off	
	Hue Colorize	Strengt	h	
	Restore Default Style	Save As Default	Load Style	Save Style
			ок 📐	Cancel Apply
			65	

15. Switch to the Tranparency tab. We want to remove the black-pixels from our output. Enter 0 as the Additional no data value. Click OK.

🔏 Layer Properties - elevatio	on_tin_clipped Transpare	ncy			? ×
K General	 Global transparency 		▼ No data value	2	
Stale	0		No data val	ue: -9999	
Style	None	0%	Full Additional no da	ata value 0	
Transparency		options			
Pyramids	Transparency band	59 8015			•
Histogram	Transparent pixel list				
Metadata	From To		Percent Transparent		•
					P
	Restore Default Style	Save As Defaul	t Load Styl	e Save S	style
			ок	Cancel Apply	Help

16. Now you have a elevation relief map for the lake generated from the individual depth readings. Let's generate contours now. Go to Raster Extraction Contours.

💋 QGIS	2.6.0-Brig	hton											
P <u>r</u> oject	<u>E</u> dit <u>V</u> i	w <u>L</u> ayer <u>S</u> ettings	<u>Plugins</u>	Vect <u>o</u> r	<u>R</u> aster <u>D</u> atabase	<u>W</u> eb	Processing	<u>H</u> elp					
8 🖻	<u> </u>	1 - - - -	1 8 4	(dh	Raster Calculator	·		n	\bigcirc	\bigcirc	» 🕜 » 🔽		N CSW
ŝ 🗖			<u>ه ا</u>		Georeferencer	•	/ M 🎢	Þ	∕∕ ≤	∕∕⊠	" (**)" (*	" (<mark> </mark>	. 9 🗖 . 9 📼
100000000		Provide Layers (Provide)	nanan 🗗		Interpolation	+					_		
V	j 🐧 🧃	E 💎 🖪 🖬			Projections	+							
				_	Conversion	•							
•		Boundary2004_5	50_stpl83		Extraction		Contour.			- /			
(T)		507.296000	ppea		Analysis	+	Clipper	3		1			
0		516.058750			Miscellaneous	•			1				
Pa		524.821500			GdalTools Setting	IS			-	1.1		r	
PU		533.584250											
		542.347000							1.0			r	
		elevation_tin											
		507.296							P				

17. In the Contour dialog, enter contours as the Output file for contour lines. We will generate contour lines at 5ft intervals, so enter 5.00 as the Interval between contour lines. Check the Attribute name box. Click OK.

🚀 Contour		8 23
Input file (raster)	elevation_tin_clipped 💌	Select
Output file for contour lines (vector)	aval/Downloads/contours	Select
Interval between contour lines	5.000	-
Attribute name If not provided, no elevation attribute is attached.	ELEV	
X Load into canvas when finished		
gdal_contour -a ELEV -i 5.0 C:/Users/Ujaval/Downloads C:/Users/Ujaval/Downloads/contours	/elevation_tin_clipped.tif	

- 18. The contour lines will be loaded as contours layer once the processing is finished. Right-click the layer and select Properties.
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19. Go to the Labels tab. Check the Label this layer with box and select ELEV as the field. Select Curved as the Placement type and click OK.

🔏 Layer Properties - contours	Labels		? ×
🔀 General	X Label this layer with	ELEV E	
Style	▼ Text/Buffer sample ⁻ Lorem Ipsum		
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20. You will see that each contour line will be appropriately labeled with the elevation along the line.



Practical 9

Advance GIS Operations 2:

- a) Batch Processing using Processing Framework
- b) Automating Complex Workflows using Processing Modeler
- c) Automating Map Creation withPrint Composer Atlas

(a) Batch Processing using Processing Framework **Procedure**

- 1. Go to Layer ► Add Vector Layer.
- 2. Browse to the downloaded Admin 0 Countries shapefile ne_10m_admin_0_countries.shp and click Open.
- 3. As our task is to clip the global layers to the boundary of Africa, we need to first prepare a layer containg a polygon for the entire continent. The countries layer has an attribute called **CONTINENT**. We can use a geoprocessing concept called *Dissolve* to merge all countries that have the same continent value and merge them to a single polygon.



4. Open the Dissolve tool from Vector • Geoprocessing Tools • Dissolve.

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5. Select ne_10m_admin_0_countries as the Input vector layer. The Dissolve field would be CONTINENT. Name the output file as continents.shp and check the box next to Add result to convas.

Note

If you want to merge **ALL** polygons regardless of their attributes, you can select – Dissolve All – as the Dissolve field. This will combine all polygons in the layer and give you a single aggregate polygon.

🔏 Dissolve	? ×
Input vector layer	
ne_10m_admin_0_countries	-
Use only selected features	
Dissolve field	
CONTINENT	-
Output shapefile	
C:/Users/Ujaval/Downloads/continents.shp	Browse
X Add result to canvas	
0% ОК	Close

6. The dissolve processing may take a while. Once the process finishes, you will see the new continent layer added to QGIS. Use the Select Single Feature tool from the toolbar and click on Africa to select the polygon representing the continent.



Format	ESRI Shapefile			-
Save as				
C:/Users/Ujaval/Downloads/afr	ica.shp		Browse	
Encoding	System			-
CRS	Layer CRS			-
WGS 84			Browse	
Symbology export		No	symbology	-
Scale	1:50000			▲ ▼
X Skip attribute creation				
✗ Add saved file to map				
	More Options	s >>		

9. Now you will have the africa layer loaded in QGIS containing a single polygon for the entire continent. Now, it's time to start our batch clip process. Open Processing - Toolbox.

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🔏 QGIS 2.2.0-Valmiera				
Project Edit View Layer Settings Plugins V	ect <u>o</u> r <u>R</u> aster <u>D</u> atabase Pr	rocessing <u>H</u> elp		
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		✓ Options and configuration		
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Continents				
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Layers Browser				
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10. Browse all available algorithms and find the Clip tool from QGIS geoalgorithms • Vector overlay tools • Clip. You may also use the Search box to easily find the algorithm as well.



11. Right-click the Clip algorithm and select Execure as batch process.



12. In the Batch Processing dialog, the first tab is Parameters where we define out inputs. Click the ... next to the first row in the Input layer column.

			×
Parameters Log Help	 01 J	 or	
Input layer	 Clip layer	Clipped	
	 		🔻

13. Browse to the directory containing the global transportation layers that you had downloaded.Hold the Ctrl key and select all the layers that you want to clip. You may also use Shift or Ctrl-A to make multiple selection. Click Open.

🚀 Open file							x
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Organize 🔻 New fo	older						(?)
☆ Favorites	^ Na	me		Date modified	Туре	Size	
Nesktop		ne_10m_admin_0_coun	tries.shp	30-03-2014 04:02	SHP File	8,603 KB	
🗼 Downloads		ne_10m_airports.shp		30-03-2014 04:03	SHP File	25 KB	
🚹 Google Drive		ne_10m_ports.shp		30-03-2014 04:02	SHP File	30 KB	
E Recent Places		ne_10m_railroads.shp		30-03-2014 04:03	SHP File	23,212 KB	
 Libraries Documents Music Pictures Videos 							
🖳 Computer 🚢 Local Disk (C:)	Ŧ						
File	e name:	"ne_10m_railroads.shp"	"ne_10m_airports.shp	" "ne_10m_ports.shp"	 SHP files(*.s Open 	hp)	•

14. You will notice that the Input layer columns will be auto-populated with all layers you had selected. You may use Add row button to add more rows and define more inputs. Next, we need to select the layer containing the boundary to clip our input layers. Click the ... button for the first row and add the africa.shp Clip layer. Since the clip layer is the same for all our inputs, you can double-click the column header Clip layer and the same layer will be auto-filled for all the rows. Next, we need to define our outputs. Click the ... button next to the first row in the Clipped column.

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🔏 Batch Processing - Clip						×))
Parameters Log Help							
Input layer		Clip layer		Clipped		lint	
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15. Browse the directory where you want your output layers. Type the filename as clipped_ and click Save.

Save file				Σ
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Organize 🔻 Nev	/ folder			== •
🔆 Favorites	▲ Name	Date modified	Туре	Size
🧮 Desktop	africa.shp	30-03-2014 17:24	SHP File	518 KB
鷆 Downloads	continents.shp	30-03-2014 04:12	SHP File	7,175 KB
🝌 Google Drive	🐌 naturalearth	30-03-2014 17:28	File folder	
 Libraries Documents Music Pictures Videos 	-			
File name:	clipped_			
Save as type:	SHP files(*.shp)			
Hide Folders			Save	Cancel

16. You will see a new Autofill settings dialog pop up. Select Fill with parameter values as the Autofill mode. Select Parameter to useas Input layer. This setting will add the input file name to the output along with the specified output_filename. This is important to ensure all the output files have unique names and they do not overwrite each other.

🕺 Autofil	settings	2 ×	
Autofill mo	de Fill with parameter value	•	
		OK Cancel]
7. Now we are ready to s	tart the batch procesing.	Click Run.	
Parameters Log Help			
Input layer	Clip layer	Clipped	Load in QGIS

rs\Ujaval\Downloads\africa.shp

rs\Ujaval\Downloads\africa.shp

-

naturalearth\ne_10m_ports.shp

alearth\ne_10m_railroads.shp

18. The clip algorithm will run for each of the inputs and create output files are we have specified. Once the batch process finishes, you will see the layers added to QGIS canvas. As you will notice, all the global layers are properly clipped to the continent boundary that we had specified.

Run

0%

bads/clipped_ne_10m_ports.shp

s/clipped_ne_10m_railroads.shp

Add row Delete row

Yes

Yes

Cancel

Close

-

.



(B)

Automating Complex Workflows using Processing Modeler

Procedure

Our workflow for this exercise will have the following steps.

- Apply a Majority Filter algorithm to the input landcover raster. This will reduce noise in our output by eliminating isolated pixels.
- Convert the resulting raster to a polygon layer.
- Query for a class value from the attribute table of the polygon layer and create a vector layer for that class.

The following steps outline the process to code the above process into a model and run it on the downloaded datasets.

1. Launch QGIS and go to Processing - Graphical Modeler....



2. The Processing modeler dialog contains a left-hand panel and a main canvas. Select the Inputs tab in the left-hand panel and drag the + Raster layer to the canvas.

🌠 Processing modeler			
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🖻 Parameters	[Enter model name here]	[Enter group name here]	
🕂 🕂 Boolean			
🕂 🕂 Extent			
🕂 🕂 File			
🕂 🕂 Number			
🕂 🕂 Raster layer			
🕂 🕂 String			
🕂 🕂 Table		+ Raster laver	
🕂 🕂 Table field			
🕂 🕂 Vector layer		<u>+</u>	

3. A Parameter definition dialog will pop-up. Enter Input as the Parameter name and mark Yes to Required. Click OK.

🕺 Parameter defin	ition ? X
Parameter name	Input
Required	Yes 🔻
ОК	Cancel

4. You will see a box with the name Input appear in the canvas. This represents the landcover raster that we will use as input. Next step is to apply a Majority filter algorithm. Switch to the Algorithm tab from the bottom-left corner. Search for the algorithm and you will find it listed under SAGA provider. Drag it to the canvas.

Note

If you do not see this algorithm or any of the subsequent algorithms mentioned in thi tutorial, you may be using the Simplified Interface of the Processing Toolbox. Switch to the Advanced Interface by using the dropdown at the bottom of the Processing Toolbox in the main QGIS window.

not processing modeler		
major 🛛	[Enter model name here] [Enter group name here]	
 Orfeo Toolbox (Image analysis) Learning Great FusionOfClassifications (majorityvoti SAGA (2.1.2) Grid – Filter Majority filter 	문 Input	

5. A configuration dialog for Majority Filter will be presented. Leave the values to their default and click OK.

🕻 Majority filter
Parameters Help
Description Majority filter
Grid
Input 🗸
Search Mode
[0] Square
Radius
1
Threshold [Percent]
0
Filtered Grid <outputraster></outputraster>
[Enter name if this is a final result]
Parent algorithms
0 elements selected
OK Cancel

6. You will note that there is now a new box named Majority Filter in the canvas and it is connected to the Input box. This is because the Majority Filter algorithm uses the Input raster as its input. The next step in our workflow is to convert the output of majority filter to vector. Find the Polygonize (raster to vector) algorithm and drag it to the canvas.

Note

The boxes can be moved and arranged by clicking on it and dragging it while holding the left mouse button. You can also use the scroll-wheel to zoom in and out in the model canvas.



7. Select 'Filtered Grid' from algorithm 'Majority Filter' as the value for Input layer. Click OK.

USIT6P4 (Discipline SI	Specific Elective Practical) Principles of Geographic Informati	ion Systems Practical
Poly Param Des Inp Fil Out	lygonize (raster to vector) meters Help escription Polygonize (raster to vector) put layer iltered Grid' from algorithm 'Majority filter' utput field name	
DN Veci [Er	N ctorized <outputvector> Enter name if this is a final result] arent algorithms</outputvector>	
	elements selected	
	ок	Cancel

8. The final step in the workflow is to query for a class value and create a new layer from the matching features. Search for the Extract by attribute algorithm and drag it the canvas.

extra	[Enter model name here]	[Enter group name here]
GDAL/OGR GDAL/OGR GDAL/OGR GDAL/Projections Extract projection GRASS commands Faster (r.") Creation - Common -	in param twork extr ects from ects from sets	In the second s

9. Select 'Vectorized' from algorithm 'Polygonize (raster to vector) as the Input Layer. We want to extract the pixels that represent Croplands. The corresponding pixel value for this class will be 12. (see <u>Code Values</u>). Enter DN as the Selection attribute and 12 as the value. As the output

of this operation will be the final result, we need to name the output. Enter vectorized class as the Output.

Description Extract by attribute	
Input Layer	
'Vectorized' from algorithm 'Polygonize (raster to vector)'	
Selection attribute	
DN	
Operator	
=	
Value	
12	
Output <outputvector></outputvector>	
vectorized_dass	
Parent algorithms	
0 elements selected	

10. Enter the Model name as vectorize and Group name as raster. Click the Save button.

🚀 Processing modeler		x
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	vectorize	
Image: Constraint of the second se	Input In Majority filter Out In Polygonize (raster to vect) Out In Extract by attribute Out Vectorized_class	
Inputs Algorithms		

11. Name the model vectorize and click Save.

SIT6P4 (Discipline Specific Elective Practical) <i>Principles of</i>	of Geographic 1	nformat	ion Systen	ıs Practic
🕺 Save Model			23	1
	√ 4 ₇	Search models	٩	
Organize 🔻 New folder			ii • 🕡	
Favorites Favorites	Date modified No items match your search.	Туре	Size	
File name: vectorize	III		•	
Save as type: Processing models (*.model)				
Hide Folders		Save	Cancel	

12. Now it is time to test our model. Close the modeler and switch to the main QGIS window. Go to Layer • Add Layer • Add Raster Layer....

🔏 QGIS	2.8.1-V	Vien																		• ×	
Project	Edit	View	Layer	Settings	Plugins	Vector	Raster	Da	tabase	Web	MMQ	GIS Pro	cessing	Help							
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Po			Sav	e Layer Ed	lits				A	d WCS	Layer										
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				9				-													

- 13. Browse to the downloaded LC_hd_global_2001.tif.gz file and click Open. Once the raster is loaded, go to Processing Toolbox.
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14. Find the newly created model under Models ► raster ► vectorize. Double-click to launch the model.



15. Select LC_hd_global_2001 as the Input and click Run.

vectorize	8 23
Parameters Log Help	
Input	
LC_hd_global_2001.tif [EPSG:4326]	▼
vectorized_class	
[Save to temporary file]	
Open output file after running algorithm	
Open output file after running algorithm	

16. You will see all the steps being executed without any user input. Once the processing finishes, a new layer vectorized_class will be added to QGIS. Let's improve the model a little bit. Right-click on the vectorize model and select Edit model.



17. In Step 12, we hard-coded the value 12 as the class value. Instead, we can specify it as a input parameter which the user can change. To add this, switch to the Inputs tab and drag the + String to the model.

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► ■ ■ □ □ □ ► Φ Boolean □ ↓ Extent □ ↓ File □ ↓ Number □ ↓ Table □ ↓ ↓ Table □ ↓ ↓ Table □ ↓ ↓ Table □ ↓ <th>vectorize raster</th>	vectorize raster
Inputs Algorithms	

18. Enter the Parameter Name as Class. Enter 12 as the Default value.

🕺 Parameter definition 🛛 🔋 🗙
Parameter name Class
Default value 12
OK Cancel

19. We will now change the Extract by attribute algorithm to use this input instead of the hardcoded value. Click the Edit button next to the Extract by attribute box.

	vectorize raster	
→ # Boolean → # Extent → # File → # Number → # String → # String → # Table → # Table → # Vector layer	Vectorized_class	355

20. Click the dropdown arrow for Value and select Class. Click OK.

💋 Extract by attribute	? ×
Parameters Help	
Description Extract by attribute	
Input Layer	
'Vectorized' from algorithm 'Polygonize (raster to vector)'	▼
Selection attribute	
DN	-
Operator	
=	-
Value	\frown
Class	(,)
Class	
vectorized_dass	
Parent algorithms	
0 elements selected	
	OK Cancel

21. You will see from the model diagram that the Extract by attribute algorithm now uses 2 inputs. The modeler has a shortcut to launch the model and test it. Click the Run button from the toolbar.

22. Notice that the model dialog has a new editable field called Class. Enter 16 as the Class value and click Run.

IT6P4 (Di	iscipline Specific Elective Practical) Principles of Geographic Information Systems Practic
~	
4	🖉 vectorize
	Parameters Log Help
	Input
	LC_hd_global_2001.tif [EPSG:4326]
	Class
	16
	vectorized_class
	[Save to temporary file]
	Copen output file after running algorithm
	Run Close

23. Once the processing finishes, you will see that with just a click of a button we were able to run a complex workflow and extract the area for class 16.



24. Now that our model is ready, we can run it just as easily on a new raster layer. Load the LC_hd_global_2012.tif.gz file by going to Layer ► Add Layer ► Add Raster Layer.... Click the vectorize` model from the Processing Toolbox panel.



26. Once the new output is loaded, you can compare the changes in the Croplands from 2001 to 2012.



27. It is always a good idea to add documentation to your model. The modeler has a built-in Help editor that allows you to embed help directly in the model. Right-click the vectorize model and select Edit model.

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(V)																			Scripts (0 g		Edit model	2

28. Click the Edit model help button from the toolbar.

Parameters Parame	5P4 (Discipline Specific Elective Practical)	Principles of Geographic Information Systems Practi
	Parameters Boolean	vectorize raster

29. In the Help editor dialog, select any item from the Select element to edit panel and enter the help text in Element description. Click OK. This help will be available in the Help tab when you launch the model to run.

Algorithm applies a majority filter t given class as polygons.	o the given raster, converts it to vector and extracts the
Input parameters	
Input Classified landuse raster	4
Select element to edit	Element description
 Algorithm description Input parameters Input Class Outputs Algorithm created by Algorithm help written by Algorithm version 	Classified landuse raster

(c) Automating Map Creation with Print Composer Atlas

Procedure

- 1. Launch QGIS and go to Layer Add Layer Add Vector Layer.
- 2. owse to the HI_Wetlands.shp.zip file and click Open.

🔏 Add vect	or layer			? X
Source typ	e			
• File		 Database 	O Protocol	
Encoding	System			•
Source				
Dataset	C:\Users\Ujaval\Do	wnloads\HI_Wetlands.shp.zip		Browse
		Open	Cancel	Help

3. Select the HI_Wetlands_Poly layer and click OK.

4	🞸 Select v	ector layers to add			8 ×
	Layer ID 0 1 2 3	Layer name HI_Wetlands_Historic_Map_Info HI_Wetlands_Linear HI_Wetlands_Metadata HI_Wetlands_Poly	Number of features 1 1408 118 9145	Geometry type Polygon LineString Polygon Polygon	
			0	Select All	Cancel

You will see the polygons representing the wetlands in the entire state of Hawaii. Since we want to make separate wetlands map for each county in the state, we will need the county boundaries layer. Go to Layer ► Add Layer ► Add Vector Layer and browse to the county10.shp.zip file. Click Open.


USIT6P4 (Discipline Specific Elective Practical) Principles of Geographic Information Systems Practical 6. Leave the composer title field empty and click OK. 2 X 🔏 Composer title Create unique print composer title (title generated if left empty) Ŧ OK Cancel his 7. Go to Layout • Add Map. 🔏 Composer 1 Composer Edit View Layout Atlas Settings ㅎ 🕈 🎵 🕫 🕀 🔁 » Add Label Add Scalebar (In Ea Add Legend X 💿 🔒 Item 🚉 Add Image \mathcal{O} <u>8</u>-/ Add Arrow Add Attribute Table \sim Add HTML Ę, Move <u>I</u>tem v -Move Content С L. Composition Item properties Atlas generation Group Ctrl+G 2 × 💭 Ungroup Ctrl+Shift+G Item properties 📙 <u>R</u>aise Ctrl+] T. S. Lower Ctrl+[-Eo Bring to Front Ctrl+Shift+1 🚽 Send to <u>B</u>ack Ctrl+Shift+[🔒 Lock Selected Items Ctrl+L <u>8</u>: 🔒 Unl<u>o</u>ck All Ctrl+Shift+I Δ 150 -</> 1.20 220 y: 170.041 mm x: -16.4177 mm page: 1 45.1% • 8. Drag a rectangle while holding the left mouse button where you would like to insert the map. đ <u>به</u> 💿 🔒 Item 1 Г. -Composition Item properties Atlas generation **.** Map 0 <u>क</u> Main properties Eo Cache Update preview -----) 🗣 2281015 8: A, ation 0.00 ° ÷ 🖶 1 X Draw map canvas item Lock layers for map item . <u>8</u>: Lock layer styles for map iter <u></>></u> Extents X min 356879.415 æ 145 T. Y. B. Sc. (Information Technology) SEMESTER VI **Teacher's Reference Manual**

9. Scroll down in the Item Properties tab and check the Controlled by atlas box. This will indicate the composer that the extent of the map displayed in this item will be determined by the Atlas tool.



10. Switch to the Atlas generation tab. Check the Generate an atlas box. Select the county10 as the Coverage layer. This will indicate that we want to create 1 map each for every polygon feature in the county10 layer. You can also check the Hidden coverage layer so that the features themselves will not appear on the map.



11. You will notice that the map image does not change after configuring the Atlas settings. Go to Atlas • Preview Atlas.



12. Now you will see the map refresh and show how individual map will look like. Notice that it shows the current feature number from the coverage layer at the bottom right.



13. You can preview how the map will look for each of the county polygons. Go to Atlas • Next Feature.



14. Atlas will render the map to the extent of the next feature in the coverage layer.



15. Let's add a label to the map. Go to Layout • Add Label.



17. The label of the map can use the attributes from the coverage layer.he concat function is used to join multiple text items into a single text item. In this case we will join the value of

the NAME10 attribute of the county10 layer with the text County of. Add an expression like below and click OK.

concat('County of ', "NAME10")



19. Add another label and enter Wetlands Map under the Main properties. Since there is no expression here, this text will remain the same on all maps.



20. Go to Atlas • Last Feature and verify that the map labels do work as intended. You will notice that the wetland map has polygons extending out in the ocean that looks ugly. We can change the style to that areas outside the county boundaries are hidden.



21. Switch to the main QGIS window. Right-click the county10 layer and select Properties.



22. In the Style tab, select the Inverted polygons renderer. This renderer styles the *outside* of the polygon - not inside. Select white as the fill color and click OK.

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23. Switch to the Print Composer window. If we want the effect of the inverted polygons to show, we need to uncheck the Hidden coverage layer box under Atlas generation. You will now see that the rendered image is clean and areas outside the coverage polygon is not visible.



24. There is one problem though. You can see areas of the map that are outside the coverage layer boundary but still visible. This is because Atlas doesn't automatically hide other features. This

can be useful in some cases, but for our purpose, we only want to show wetlands of the county whose map is being generated. To fix this, switch back to the main QGIS window and right-click the county10 layer and select Properties.



25. In the Style tab, select Rule-based renderer as the Sub renderer. Double-click the area under Rule.

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26. Click the ... button next to Filter.

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The **\$atlasfeatureid** function will return the currently selected feature. We will construct an expression that will select only the currently selected Atlas feature. Enter the expression as : \$id=\$atlasfeatureid



28. Back in the Print Composer window, click the Update preview button under Item properties tab to see the changes. Notice that now only the area covering the county boundary is shown.



29. We will now add another dynamic label to show the current date. Go to Layout • Add Label and select the area on the map. ClickInsert an expression button.



30. Expand the Date and Time functions group and you will find the **\$now** function. This holds the current system time. The function todate() will convert this to a date string. Enter the expression as below:

concat('Created on: ', todate(\$now))



31. Add another label citing the data source. You may also add other map elements such as a north arrow, scalebar etc. as described in *Making a Map* tutorial.



32. Once you are satisfied with the map layout, go to Atlas • Export Atlas as Images.



- 33. Select a directory on your computer and click Choose.
- 34. The Atlas tool will now iterate through each feature in the coverage layer and create a separate map image based on the template we created. You can see the images in the directory once the process completes.

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35. Here are the map images for refeence.







PRACTICAL - 10

A. Validating map data.

AIM: To validate Map data using Excel and QGIS.

Software Used: QGIS Desktop 3.4.2 and Microsoft Excel 2013.

Datasets Used: The following datasets are used

- 1. Kenya_epidemiological_data.xls
- 2. Kenya_epidemiological_dict.xls

Shape Files used: Kenya admin.

Theory

The aim of this practical is to focus on the validation steps that should be performed during data cleaning. These include three types of checks:

- 1. Structural checks: e.g. unique ID, duplicates, format
- 2. Validation of plausibility possible range of values e.g. min/max expected age
- 3. Logical checks inconsistencies in answers e.g. occupation/age

The practical will be conducted using Microsoft Excel and QGIS software. The practical will be performed in the following stages

- 1. Developing a data cleaning plan
- 2. Performing Structural data checks
- 3. Verifying the plausibility of data
- 4. Performing Logical data checks
- 5. Verifying coordinates of mapping data
- 6. Preparing data for mapping.

Procedure

The following steps we need to perform in the Stage I of developing a data cleaning plan

- 1. Open the "Kenya_epidemiological_data.xls" in Microsoft Excel. Additionally open the corresponding dictionary "Kenya_epidemiological_dict.xls", which contains a description of all variables and information about their coding.
- 2. You should make note of the number of entries in your database, as you will need to keep track of any changes e.g. when you remove duplicates at a later stage.

The following steps we need to perform in the Stage II of performing Structural Data checks

- A. Format of the Database
- B. Removing Duplicates
- C. Coding of variables

2A Format of the database

Open Kenya_epidemiological_data.xls in excel. Go to the View tab, click Freeze Panes and choose Freeze Top Row.

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select the entire "child_id" column(first column), Under Home Tab, click on Conditional formatting >Highlight Cell Rules> Select Duplicate values

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Now select the first combo box and select **Duplicate** and select **Light red fill with Dark red text** in the next combo box as shown in figure

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2B Removing Duplicates

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2C Coding of variables

In the current worksheet, select the sex column.

Now type Ctrl+F and use Replace Function and Replace as follows

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Please keep track of how many values are getting replace.

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Step 3 Verifying the plausibility of data

In this step, we perform two basic operations

- A. Coding of variables
- B. Using a filter to detect outliners

3A Coding of variables

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Now go to Insert tab and select Scatter. You will set chart as shown below

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3B Using a filter to detect outliners

First go to the Home Tab>Sort and Filter>Filter. Click and apply the filter to all the columns of the worksheet.

Now click on age filter and click on Number Filter> Greater Than option and type the value 20 in greater than field.

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Step 4: Logical Data checks

In this step, we perform two basic operations

- A. Cross Tabulations
- B. Formulas

4A. Cross Tabulations

Open the existing worksheet. Now go to Insert Tab and select Pivot table function.

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Select New Worksheet and click OK

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An empty table is inserted in a new sheet and a window will open on the right hand side named PIVOT TABLE FIELD LIST.



From the PivotTable Field List, drag the "stool" item and drop it into the "Row Label" field as show above.

Similarly, Click on *anysth_inf* and draw it into the "Column labels" and " Σ Values" field.

To include the count of observations in the table you might need to change the value field settings to count.

Click on the combo box Sum of stools and Click on Value Field Settings.

Change the value in Summarize value filed by to Count and click OK. Table is updated with count values as shown below

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4B Formulas

Open the existing worksheet

Create a new column with the variable called check

Type the following formula in S2 column of worksheet =IF(AND(H2=0, NOT(P2="")),1,0)



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Now copy the formula to all other cells (ensure that the formula is copied to all rows in your dataset) Now use the filter to show only entries with a check value of 1.

Step 5: Verifying the coordinates of mapping data

Create a New Project in QGIS Desktop 3.4.2.

Let's add the files!

Navigate to Add Vector Layer and add file: Kenya_admin.shp

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Here we have to add file: **Kenya_school_location.csv**. In **the Geometry Definition section**, there is a field called **Geometry CRS**, in that we have to select **WGS84** as coordinate system.

As you can see 2 points are not on the map.

To examine this, we need to save these layers as a Shapefile, to do that select both the layers **Kenya_school_location** and **Kenya admin**, then right click on them and choose **Save Features As...**

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In the menu that comes up, set **Format** as **ESRI Shapefile** and put **File Name** as **Kenya_schools.shp After this is done you can uncheck the Kenya_school_location in the layers section.**

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Let's try and get the details of these 2 points that are not on the map, select the **Kenya_schools** layer, click on the **Identify Features Tool** button and then click on the points outside of Kenya to get their details.



Now we want to add the district information to the map. Therefore, we will join information based on the geographical localization.

In the menu click on Vector, then Data Management Tools, then select Join attributes by location.



Then select Kenya_schools as Input layer and Kenya_admin as Join layer.

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We also need to save the output so in **Joined Layer**, click "…" button to Browse location.

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Save as Kenya_school_district.csv

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And then click run.

After it is done...

Navigate to the location of saved file **Kenya_school_district.csv** and open it, you should now be able to compare both **district** and **Name** for discrepancies.

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We need to change the co-ordinate of those 2 points which were not on the map. So, open the file **Kenya_school_location.csv** and make the following changes, set:

IBWALI: Longitude 34.6459198

SIWOT: Longitude 35.35437012

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Save the file as: Kenya_school_location2.csv.

Step 6: Preparing data for mapping

Open Kenya_epidemiological_data_2.xls, select the entire sheet, go to Insert tab to create new Pivot Table.

Tick New Worksheet to tell Excel that you want to place the table in a new sheet.

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Now click on school_idtodragand drop it in the "Row labels" field at the bottom. Add district_id to" Σ Values" and click on it, a drop down list will open, click on Value Field Settings. Choose Average as type of calculation, because all children in the same school will have same district_id.

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Now drag and dropchild_id into the " Σ Values" field, click on Value Field Settings and choose Count to summarize the results. So, we come to know how many children per school are infected. Similarly, Drag and dropanysth_inf into the field, click on Value Field Settings and choose Sum. As, infected is 1 and not affected is 0, the sum will give us the total number of infected children.

Now **copy the table**, open a new Excel file and paste the values into the new spreadsheet. Therefore, click Paste in the Home tab, then choose **Paste special** and paste only the **values**. **Remove the last row which has Grand Total and other values**.

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Save this new data table as Kenya_school_STH_surveys.xlsx

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Now we need to know the total count of infected children, that is, the prevalence of STH. So, w ecreate a new column:sth_previn which we are going to be dividing the number of infected children by the number of children and multiplying by hundred to obtain a value in percent (%). In the first cell under the heading type =F2/C2*100 (this assumes that your number of children is in row C and the number of infected children in row F; you will need to <u>adjust the column label</u> <u>accordingly</u>); then copy the formula to the other cells in the column.

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Additionally, you could calculate the 95% confidence interval (CI) of your prevalence.

You will have to create a new column called "Cllow" (lower confidence limit) and "Clup" (upper confidence limit)

You can calculate the limits by typing the formulas as follows and then copying to the other cells: For CIlow: =I2 - (1.96*(SQRT((I2*(100-I2)/C2))))

For CIup: =I2 + (1.96*(SQRT((I2*(100-I2)/C2))))

Assuming I2 as sth_prev and C2 as Count of child_id, adjust accordingly.

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Save this file as Kenya_epidemiological_school.csv

Now that all the datasets are ready, let's add them.

Open a new QGIS project.

First, add **Kenya_school_location2.csv** to the project. Click on **Add Delimited text** layer in the menu, and browse to select the file.



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Similarly, Add Vector Layer and add Kenya_ epidemiological_school.csv





Now we'll join the data.

Right click on Kenya _school_location2 layer and click on Properties



Go to the **Joins** section and click on the plus(+) button at the bottom



For "Join layer" choose **Kenya_epidemiological_school** and for "Join field" and "Target field" choose **school_id.** Then click on OK.



Right click on Kenya_school_location2 layer and select Open Attribute Table.



You will see that the epidemiological variables are included.

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6	1231	719	95	0	0	0	0	MAKUTANO	3.535870075	35.2449913	TURKANA
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USIT6P4 (Discipline Specific Elective Practical) Principles of Geographic Information Systems Practical We are finally done, now we just have to save the files!! Select all the layers, right-click on them and in Export select Save Features As. 🔇 *Untitled Project - QGIS Ē × Brows Identify Results 8 × 🗔 😂 🍸 📅 🕖 🖂 | 🐺 😭 👯 | 🔩 | 🗇 🛞 🕶 👯 🗸 Zoom to Selecti 숨 Favorites Feature Value Show in Overview > 🙆 Home Show Feature Count 0 C:\ 0 Copy Layer GeoPackage GeoPackag SpatiaLite PostGIS MSSQL Rename Layer 0 🕞 Duplicate Layer Oracle 0 DB2 Move to Top 0 C WMS/WMTS Group Selected 3 XYZ Tiles Open Attribute Table wcs WES WFS Filter... Set Layer Scale Visibility... 0 Set CRS . Layers ò 0 🗸 🥼 👁 🝸 🖏 = 💷 🟦 🗔 Save Features As Export • Kenya_epidemiological_school Save Selected Features As Properties... Kenya_school_location Kenya_school_location2 Save as Layer Definition File... Save as QGIS Layer Style File... 0 0 0 0 0 Mode Current layer ~ Auto open form C View Tree 🗸 Help Coordinate 31.82,-0.93 🛞 Scale 1:5191366 🗸 🔒 Magnifier 100% 🖨 Rotation 0.0 ° Render 💮 EPSG:4326 🚇 Q. Type to locate (Ctrl+K 10:38 PM へ (1) に 10:38 PM (10:38 Type here to search x∄ G 4

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USIT6P4 (Discipline Specific Elective Practical) Principles of Geographic Information Systems Practical

Links for Datasets:

- 1. For Multiple data sets : <u>https://www.gadm.org/download_country_v3.html</u>
- 2. For Multiple data sets : <u>https://urs.earthdata.nasa.gov</u>
- 3. Geological survey data : <u>https://ers.cr.usgs.gov/register</u>
- 4. Raster Mosaic: https://lance-modis.eosdis.nasa.gov/imagery/subsets/?project=fas
- 5. https://www.gadm.org/download_world.html
- 6. <u>https://github.com/datameet/maps/tree/master/Survey-of-India-Index-Maps</u>
- 7. <u>https://bhuvan.nrsc.gov.in</u>
- 8. For DEM : http://viewfinderpanoramas_org3.htm

Dear Teacher, please send your valuable feedback and contribution to make this manual more effective.

Please send on <u>dandhiren@yahoo.co.in</u> and/or <u>shaikh.aa@rediffmail.com</u>