1. What is GIS?

GIS stands for “Geographic Information System”. It is a set of computer tools that allows to work with data that are tied to a particular location on the earth. GIS is **more than just** a mapping system because it does some sophisticated spatial analysis, network analysis, geocoding and geo-referencing, and many more.

A GIS is a database system that uses both spatial and attribute data to answer questions about where things are and how they are related. It has many functions, including creating data, making maps, and analyzing relationships.

2. What can GIS do?

GIS works with different applications: land use planning, environmental management, sociological analysis, business marketing, weather prediction, city planning, waste-water panning, urban planning, navigation tools, and many more.

3. What are Map data types?

This is little bit tricky because most people confuse themselves with map data types and data **formats.** There are **two types of map data: Discrete and Continuous.**

Discrete: objects in real world with specific locations or boundaries, such as cities, roads, or soil units

Continuous: quantity that is measured and recorded everywhere over a surface, such as temp or elevation

4. What are Data formats?

There are two data formats that GIS is handy with: **Vector and Raster data formats.** Both data systems store spatial and attribute data, but in different ways. Both are georeferenced, meaning that the information is

tied to a specific location on the earth's surface using x-y coordinates defined in a standard way: a coordinate system.

Vector model: stores discrete data—eg, points (no dimension), lines (1D), and polygons (2D).

- Benefits of vector models:
  - Can store individual feature classes, such as roads and parcels, with high degree of precision
  - Linked attribute table provides great flexibility in the number and type of attributes that can be stored about each feature.
  - Ideally suited for mapmaking because of high precision and detail—it is a compact way of storing data
  - Ideally situated to certain types of analysis problems, such as determining perimeters and areas, detecting whether features overlap, and modeling flow through networks.
- Drawbacks
  - Poorly adapted to storing continuous surfaces, such as elevation or precipitation.
  - Contours lines can be used to represent surfaces, but calculating derived information from contours such as slope, flow direction, and aspects, is difficult.
  - Some analysis is more time consuming

Raster Model: stores continuous data—set of spatial data represented as series of small squares called cells or pixels. Each pixel contains a numeric code indicating a single attribute, and the raster is stored as an array of numbers. Eg, DEM.

- Benefits of Rater model:
  - Ideally suited to store continuous information because each cell can have a value completely different from its neighbors.
  - Simple and rapid analyses.
  - Extensive set of analyses tools for raster available.

- Drawbacks of raster:
  - Suffer from trade-offs between precision and storage space to a greater extent than vectors do.
  - Can store only one numeric attribute per raster, whereas vector can store hundreds of attribute values for each spatial feature and can handle text data more efficiently.

5. What are feature classes?

In GIS, like features are grouped into data sets called **feature classes.** A feature class can contain only one kind of geometry—point, line, or polygon. Feature classes can be stored in several different formats. Some formats contain only one feature class, whereas some store multiple feature classes and are called feature datasets.

6. What are attributes?

Objects in feature class have information stored about them, such as their name and populations. This information is called attributes and is stored in table.

7. What is map scale?

Map scale is a measure of the size at which features in a map are represented. The scale is represented as a fraction, or ration, of the size of objects in the page to the size of the objects on the ground. Large-scale maps (with smaller denominator) show a relatively small area, such as quadrangle, whereas small-scale maps (with large denominator) show a relatively larger areas, such as states or countries.

8. What is Resolution?

Resolution refers to the sampling interval at which data are acquired. Resolution may be spatial, thematic, or temporal.

- Spatial resolution indicates at what distance interval measurements are taken or recorded.

- Temporal resolution indicates how frequently measurements are taken. Eg, census, temperature, precipitation etc.

9. What is precision?

Precision refers to either number of significant digits used to record a measurement or the statistical variation of a repeated single measurement.

10. What is metadata?

Metadata is a data of the data which stores information about the dataset, such as where it came from, how it was developed, who assembled it, how precise it is, and whether it can be given to another person.

11. What are shapefiles?

Shapefiles are spaghetti data models containing a features class composed of points, lines, or polygons, but never a mixture. The attributes are stored in dBase file. Shapefiles can store multipart features, in which a single feature includes multiple objects.

- .shp file stores coordinate data
- .dbf file stores attribute data
- .shx file stores a spatial index that speeds drawing and analysis
- .prj file stores projection information
- .avl file is a stored legend
- .xml file contains metadata

12. What are geodatabases?

A geodatabase can contain many different objects, including feature classes, networks, tables, raster, and topology. There are 3 types of geodatabases:

1. *Personal geodatabases:* designed by use by individuals or small workgroups and are stored in a single Microsoft Access file. –limited to 2GB.
2. *File geodatabases*: stored in system folder, and each file can be up to 1TB. –can be accessed by multiple operating systems, including Linux or Unix.
3. *Enterprise (SDE) geodatabase*: stores GIS data within a commercial relational database management systems (RDBMS), such as Oracle or SQL Server. —designed to meet security and management needs for large data sets accessed by multiple users.

13. What is geographic coordinate system (GCS)?

It is a measurement of angles from the center of the earth and has units of degrees. Longitudes—measure horizontal angles east or west of the Prime Meridian (-180 to +180), and Latitudes are vertical angles above or below the equator (0 to -90, 0 to +90).

14. What is Map Projection?

A GCS is a three-dimensional coordinate system, but maps need to be flat. The conversion of 3D map into 2D map is called Map Projection. Projection is mainly done to avoid distortions: Area, Distance, Shape, and Direction. There are 3 types of projections:

1. Cylindrical: uses cylindrical surfaces
   a. cylindrical surface tangent to the earth at equator
   b. Transverse: rotate the cylinder sideways making it tangent along a line of longitude
   c. Oblique: tangent at an angle
2. Conic: uses cone on the sphere
   a. Tangent: cone is tangent to the globe along the line of latitude
   b. Secant: cone is places through the sphere touching two places

15. What are the differences between Project Tool and Define Projection?

Project Tools

-acts on x-y coordinate of a layer and converts them to a different coordinate system, producing a new feature class and leaving the original feature class unchanged.

-convert a layer in one coordinate system to another

-should be used only on layers that already work properly and appear in the right location.

Define Projection

– changes the projection system label of the feature class without affecting the coordinates inside.

-just labels the projection system

-should be used only on a dataset that has an Unknown coordinate system or a data set that was previously mislabeled, does not appear in the right location, and needs to be fixed.

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16. What are the differences between Geocoding and Geo-referencing?

Geocoding	**Geo-referencing**
– Geocoding allows you to transform any description of location into an actual location on earth's surface.	– Georeferencing, on the other hand, will align different types of geographic information to a known geographic coordinate system.
– These descriptions of locations could take form of lists of coordinates addresses, names of places or lists of named objects/services/buildings without address (only names).	– This allows a view of the respective information together with another already georeferenced layers of information.

– The result of this operation is a geographic feature (layer) with all additional information as an attribute table in this layer

– The process includes data shifting, scaling, rotating, rectifying, etc.

– When you type an address or a place name in the search box and in return the map shows a marker at the place. The process of associating an address or a place name with coordinates on the map is called **Geocoding**.
– In a spatial database this is done as a point layer with name of the place as an attribute to the point location. This is one way of geocoding. For addresses, the associated coordinates are not saved in a database directly but computed using a method called linear referencing. (Thus, the confusion between the terms *geo-referencing* and *linear-referencing*) The start and end addresses along a line segment are saved and intermediate addresses are interpolated and the coordinates are calculated.

– In some online mapping service, you may have seen satellite imagery. When these images are captured from a satellite or an airplane, they are just plain images, like photographs. But to display these images on a map, they need to be associated with map coordinates. This process is called **GeoReferencing**. Once the image is associated with the map coordinates it can be overlaid on top of street maps. For georeferencing, you can use a GIS software such as ArcGIS or QGIS to georeference an otherwise un-referenced image or scanned maps and load them into Oracle Spatial.
– **Georeferencing** is the process of taking a raster image or vector coverage, assigning it a coordinate system and coordinates, and translating, transforming, and warping/rubbersheeting it into position relative to some other spatial data, such as survey locations, street intersections, etc.

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16. What is a table?

A table is a data structure for storing multiple attributes about a location or an object. It is composed of rows, called **records**, and columns, called **fields** or **attribute fields**. An attribute table consists of information about features in a geographic data set.

- In a shapefile, the row is linked to the spatial feature in a separate file using a unique ID number called feature ID, or FID.
- In geodatabase, the file stores both the attributes and the x-y coordinates in the same data file, although the coordinates are not visible in the tables, and it uses an Object ID, or OID.

17. What is a Database Management System?

The system that are designed to store, manipulate, analyze, and protect tabular data of all kinds are **Database Management Systems.** There are various systems used to store data, such as INFO database (used for coverage), the dBase table (used for shapefiles), the Microsoft Access engine (used for personal geodatabases), and large-scale relational database management system (RDBMS), such as SQL Server (used for enterprise geodatabases). Three types of databases have traditionally been used:

1. **Flat file database:** stores rows of into in a text or binary file; simple but not efficient.
2. **Hierarchical database:** has multiple files, each of which contains different records and fields; parent tables can be linked to child hence defining the relationships.
3. **Relational database:** also has multiple tables stores as files, however, the relationships are not defined ahead of time; user defines can temporarily associate two tables if they share a common field. This association is called a **join.**

18. What is a Join?

In an RDBMS and in GIS, the tables are combined using a common field called a **key,** and this combining of two tables is called **Join.** The key field must be of the same data types in both tables. When a join is performed, the two tables become one. The join can be removed when it is no longer needed.

19. What is a Spatial Join?

A **spatial join** is similar to an attribute join, except that, instead of using a common field to decide which rows in the table match, the *locations* of the spatial features are used. The spatial join uses either a containment criterion (one feature inside the other) or a proximity criterion (one feature close to another).

20. What is a Map Overlay?

Map overlay combines two feature classes to create a new feature class containing information from both inputs. Both features and attributes may be combined.

21. What is a buffer?

A **buffer** is constructed to delineate areas that fall within a certain set of features. Buffers can be created for points, lines, and polygons.

22. What is a Boolean Overlay?

Boolean overlay is similar to vector overlay, but it is uses map algebra with Boolean rasters and operators.

23. What is Euclidean Distance?

The **Euclidean Distance** is a distance function that produces a raster in which each cell represents the shortest distance from a set of specified objects.

24. What is Interpolation?

Interpolation is a method to estimate the values in between the measurements. It takes measured values at points and distributes them across a raster.

25. What is a Reclassify function?

The **Reclassify** function changes the values of a raster according to a scheme designed by the user, such as classifying a slope map into three regions of low, medium, or high slope.

26. What are the components of GIS?

1. Hardware: fast processing computer with high storage
2. GIS Software: produced and distributed by ESRI
3. Data Storage: data are voluminous so requires high storage devices. Can be online too.
4. Information output hardware: Digitizer, scanner, printer etc. Fast processing internet connection
5. GIS Data: Gathering data, assessing their accuracy, and maintaining them
6. GIS personnel: trained person

27. What are the functionalities of GIS?

Varies widely. But providing the means to collect, manage, and analyze data to produce information for better decision is common goal and the strength of GIS.

1. Data entry: digitizing, scanning, text files, and the most common spatial data formats
    a. Data management tools: building data sets, editing spatial feature and their attributes, managing coordinate systems and projections
    b. Thematic Mapping: symbolizing map features in different ways and combining layers for display
    c. Data Analysis: exploring spatial relationships in and between map layers.
    d. May layout: creating soft and hard copy maps with tiles, scale bars, north arrows, and other maps elements

28. What are the new trends and directions in GIS?

ArcGIS online, Web GIS, ArcGIS Pro, ESRI Story Maps, ArcGIS Story Maps, ArcGIS Map Journals.

29. What do GIS Professionals do?

1. Primary Data Providers: create base data. Surveyors, land-use panning professionals, photogrammetrists, remote sensing professionals, GPS experts
2. Application GIS: Geographers, hydrologists, land-use planner, business analyst, utilities experts, statistician, etc. who use GIS tools and skills to make their work efficient, productive, and valuable.
3. GIS Developer: skilled software and hardware engineers—build and maintain GIS software
4. GIS Database Distributor: experts in computer science and networking, Internet protocols, and/or database management systems—set up and maintain the complex server and network systems that allows data services, Server GIS, and Enterprise to operate.

1. Why did you choose Geography/GIS as a career?
2. Describe your technical expertise in GIS?

3. How would you locate addresses?
4. What is the difference between the project tool and the define projection tool?
5. Differentiate Between GIS Commands And Tools?
6. If you were to give someone directions from point A to point B, how would you go about doing it?
7. If you are driving down a road what are the things you make note of? How would you solve this problem?
8. Someone wants to go from Point A to B. How could you create a map to help him?
9. Which Applications of the ArcGIS Desktop are you familiar with?