NATIONAL INSTITUTE OF TRANSPORT

DEPARTMENT OF COMPUTING AND COMMUNICATION TECHNOLOGY

MODULE NAME: GEOGRAPHICAL INFORMATION SYSTEM

MODULE CODE: ITU 08209

GROUP NO: 14

GROUP ASSIGNMENT

S/N	NAME	REGISTRATION NUMBER
1	DAUDI W SHOMBE	NIT/BIT/2020/1442
2	GLORY D KIMARO	NIT/BIT/2020/1272
3	JUSTIN ANDREW MSENGI	NIT/BIT/2020/1214
4	WILFRED D SILAYO	NIT/BIT/2020/1379
5	INOCENT DANIEL MTITU	NIT/BIT/2020/1477

LECTURER'S NAME : MR. PETER MWAKALINGA

SUBMISSION DATE : 11TH JUNE, 2023

1. Meaning of Geo-database and its components:

A geodatabase is a specialized database designed to store, manage, and analyze spatial data. It is a collection of datasets, rules, and relationships that enable the storage and manipulation of geographic information. The main components of a geodatabase are:

i.Feature classes: Feature classes are the primary data storage units in a geodatabase. They represent spatial features such as points, lines, and polygons.

ii.Relationship classes: Relationship classes define the associations and behavior between different feature classes in a geodatabase. They allow for the establishment of one-to-one, one-to-many, or many-to-many relationships.

iii.Attribute tables: Attribute tables store non-spatial information associated with the features in a geodatabase. They contain attribute fields that define the characteristics and properties of the spatial features.

iv.Domains: Domains define a set of allowable values for a specific attribute field in a geodatabase. They help ensure data integrity and consistency by restricting the range of values that can be entered.

2. Functions of Geo-database:

The main function of a geodatabase is to provide a structured and organized environment for storing, managing, and analyzing spatial data. It allows users to:

I. Efficiently store and retrieve spatial data

ii.Perform spatial analysis and modeling

iii.Maintain data integrity and consistency through enforced relationships and domains

iv.Support data sharing and collaboration

v.Enable data versioning and editing workflows

vi. Create and manage topological relationships between features

vii.Store and manage raster datasets and imagery

viii.Enable data visualization and mapping

3. Meaning of ArcGIS:

ArcGIS is a suite of software products developed by Esri, a leading provider of GIS technology. It encompasses a range of tools and applications for working with geospatial data, including mapping, analysis, data management, and visualization. ArcGIS includes software such as ArcMap, ArcGIS Pro, ArcCatalog, ArcGIS Online, and ArcGIS Server, which provide comprehensive capabilities for geodatabase management, spatial analysis, and GIS workflows.

4.Relationship between Geo-database and Database Management System:

A geodatabase is a type of database specifically designed to store spatial data. It is built upon a database management system (DBMS) that provides the underlying infrastructure for data storage, retrieval, and management. The DBMS manages the core database functionality, including data organization, indexing, query processing, and security. The geodatabase, on the other hand, extends the DBMS by adding spatial capabilities and specialized data structures for storing spatial data and supporting spatial operations.

5. Features of Geo-database:

The features of a geodatabase include:

i.Support for storing and managing various types of spatial data, including points, lines, polygons, and raster datasets.

ii.Data integrity and consistency through enforced relationships, domains, and validation rules.

iii.Topological data model for maintaining and managing spatial relationships between features.

iv.Versioning and editing workflows to support collaborative data editing and revision control.

v. built-in spatial indexing for efficient spatial queries and analysis.

Vi. Support for advanced spatial analysis and modeling operations.

vii.Integration with GIS software and tools for data visualization, mapping, and analysis.

viii.Ability to store and manage metadata for documenting and describing the spatial data.

6. Different types of Geo-database:

There are three main types of geodatabases:

I. File geodatabase: A file geodatabase is a folder-based geodatabase stored as a collection of files on disk. It is designed for single-user workflows and is suitable for organizing and managing spatial data at the project or department level. File geodatabases offer good performance and scalability.

ii.Personal geodatabase: A personal geodatabase is a Microsoft Access database file (.mdb) that can store spatial data. It is suitable for small-scale projects or individual users who require a lightweight geodatabase solution. Personal geodatabases have limitations on file size and concurrent users.

iii.Enterprise geodatabase: An enterprise geodatabase is a geodatabase that is stored and managed within a relational database management system (RDBMS), such as Oracle, SQL Server, or PostgreSQL. It supports multi-user editing, high data volumes, and enterprise-level workflows. Enterprise geodatabases provide scalability, data security, and robust data management capabilities.

7. Geo-database schema with their examples:

A geodatabase schema refers to the structure and organization of the spatial data and related components within a geodatabase. It defines the spatial datasets, feature classes, tables, relationships, domains, and other elements present in the geodatabase.

For example, a simple geodatabase schema for a city's transportation system could include feature classes for roads, railroads, and bridges, along with corresponding attribute tables for each feature class. Relationships can be established between the feature classes, such as connecting the roads feature class with the bridges feature class to represent which bridges cross over which roads.

The schema may also include domains to define allowable values for specific attributes, such as a domain for road types (example., arterial, residential, highway) or bridge conditions (example good, fair, poor). The schema helps organize the spatial data and define the rules and relationships within the geodatabase.

8. Geo-database data modeling:

Geo-database data modeling is the process of designing the structure and relationships of spatial data within a geodatabase. It involves identifying the spatial entities, attributes, relationships, and rules that define the geospatial data and how it is organized and stored. Data modeling helps ensure data integrity, consistency, and efficient data management within the geodatabase.

During data modeling, concepts such as feature classes, tables, relationships, domains, and topologies are defined. Feature classes represent different types of geographic features, such as points, lines, or polygons, and their attributes. Tables store attribute data associated with the features. Relationships define the connections between feature classes, allowing for data integration and analysis. Domains specify valid values for attribute fields, enforcing data consistency. Topologies define spatial relationships and rules, such as connectivity or adjacency between features.

9. Different types of data sets in Geo-database:

In a geodatabase, there are several types of datasets that can be stored and managed:

i.Feature datasets: A feature dataset is a container that organizes related feature classes into a single dataset. It allows for the grouping of spatial data that share common characteristics or are part of the same project or theme. For example, a feature dataset could contain feature classes representing roads, buildings, and parcels.

ii**.Feature classes**: Feature classes are the primary data storage units in a geodatabase. They represent different types of geographic features, such as points, lines, or polygons. Examples of feature classes include roads, rivers, land parcels, and buildings.

iii.Tables: Tables store non-spatial attribute data associated with the features in the geodatabase. They can be linked to feature classes using unique identifiers, allowing for attribute data integration and analysis. Tables can contain information such as population data, land ownership details, or asset inventories.

iv.Raster datasets: Raster datasets store grid-based data, such as satellite imagery, aerial photographs, or elevation data. They are composed of cells or pixels, with each cell representing a value or attribute. Raster datasets are commonly used in applications such as remote sensing, terrain analysis, or land cover mapping.

10. How to edit different Geo-database files:

Editing geodatabase files can be done using GIS software that supports geodatabase functionality, such as Esri's ArcGIS or open-source alternatives like QGIS. The specific steps may vary depending on the software, but the general process includes the following:

i.Open the GIS software and load the geodatabase file or connect to the geodatabase if it is stored in a database management system.

ii.Identify the feature class or table that you want to edit.

iii. Use the editing tools provided by the GIS software to make changes to the geodatabase. This can include adding new features, modifying existing features, or deleting features.

iv. When adding new features, ensure that you enter the appropriate attribute values for the feature.

v. When modifying features, select the feature(s) you want to modify and make the necessary changes to the attribute values or geometry.

vi. Save your edits to the geodatabase file or commit the changes if you are working with a geodatabase stored in a database management system.

vii. Review your edits and verify that they are correctly reflected in the geodatabase.

It is important to exercise caution while editing geodatabase files to avoid unintended changes or data loss. It is recommended to have a backup of the geodatabase before performing any edits and to follow best practices provided by the GIS software documentation.