

Introduction to Cartography and GIS

Introduction to Cartography and GIS Technology

Study guide – key concepts, terminology, and workflow

1. What Is Cartography?

Aspect	Description
Definition	The art and science of designing, producing, and interpreting maps.
Core Goals	• Communicate spatial information clearly. • Support decision-making, navigation, education, and research.
Traditional Tools	Drafting tables, compasses, protractors, ink, and paper.
Modern Tools	Computer-aided design (CAD), Geographic Information Systems (GIS), remote sensing imagery, and web-mapping platforms.
Key Disciplines	– Symbolization (how features are drawn). – Generalization (simplifying detail at smaller scales). – Projection & Scale (transforming Earth's 3D surface onto a 2D plane).

2. Fundamentals of Map Design

1. Purpose & Audience

- Identify the map's primary question (e.g., "Where are the flood-prone zones?").
- Tailor symbology, language, and level of detail to the intended users.

2. Data Selection

- Choose appropriate layers (e.g., topography, land use, transportation).
- Ensure data are current, accurate, and legally usable.

3. Projection & Coordinate System

- **Projection**: mathematical method to flatten the globe (e.g., Mercator, Albers Equal Area).

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- **Coordinate System:** defines units and origin (e.g., WGS'84 lat/long, NAD'83 UTM zone'15N).

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- Consistency across layers prevents misalignment.

4. Scale & Extent

- **Scale** = Map distance ÷ Ground distance (e.g., 1:50,000).
- Determines level of detail, symbol size, and generalization needed.

5. Symbolization & Visual Hierarchy

- Use color, line weight, pattern, and opacity to differentiate features.
- Follow cartographic conventions (blue = water, green = vegetation) unless a specific legend is provided.

6. Typography & Layout

- Choose legible fonts (sans-serif for labels, serif for titles).
- Maintain margins, north arrow, scale bar, and legend in a balanced composition.

7. Map Production Formats

- Print (PDF, TIFF, high-resolution raster).
- Interactive/web (HTML/JavaScript, Web Map Service – WMS, Tile Service).

3. Geographic Information Systems (GIS) – Overview

Component	Role
Data Model	Stores spatial data as vectors (points, lines, polygons) or rasters (grids, images).
Database	Relational (e.g., PostgreSQL/PostGIS) or file-based (e.g., shapefile, GeoPackage).
Analysis Engine	Executes spatial operations: overlay, buffer, network analysis, interpolation, etc.
Visualization	Generates maps, 3D scenes, dashboards, and web apps.
Tools	Desktop (ArcGIS Pro, QGIS), Server (ArcGIS Server, GeoServer), Cloud (Google Earth Engine, ArcGIS Online).

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3.1 GIS Data Types

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Type

Geometry

Typical Use

Vector Point, line, polygon Addresses, roads, land parcels, political