TOPICS FOR FINAL EXAM

Geoinformatics MSc.

1. Introduce the GIS-specific programming (concepts, general error types, classification of programming languages). Detailed introduction to the Python language (variables, data types, geospatial applications). Describe a specific technology for visualizing maps on the web.
2. Photogrammetry as a data collection method. Introduce the workflow of photogrammetric processing (interior/exterior orientation, distortion correction, outputs). Describe the background of creating the orthophotos. What is the principle and significance of block adjustment and aerial triangulation?
3. Introduce terrestrial and aerial laser scanning as data collection methods and their role in Earth science analysis. Explain the principle of their data collection, data types and formats of point clouds. What is the importance of using point clouds, filtering, and classification procedures.
4. Role of modeling in Earth Science. Describe the possible applications and main elements of modeling in general, highlighting the importance of model calibration and validation. Introduce specific modeling tools from the topic of hydrological modeling (including their possible input data and model parameters).
5. Introduce the relational database model in detail. Describe how these types of database management systems handle and store the entities, attributes, and relationships between them. What is the role of keys and constraints? Propose the problem of redundancy and describe the procedures used against it.
6. Describe the OSI layer model of networks in general. Describe the main functions and protocols of each layer with a special focus on their geospatial/remote sensing approaches and technologies and data security procedures (RAID, NAS, cloud, etc.). What are the main advantages and applications of microcomputers in modern earth sciences?
7. Databases for environmental informatics. Availability and usability of satellite imagery (temporal availability, nadir/off-nadir) and types with main features (MODIS, Landsat, Sentinel 1-2-3-5P, SPOT, WorldView/Pleiades, Gaofen, Jilin, PlanetScope, SkySat, Satellogic, IceEye, ICESat).
8. Tabular and spatial databases on topography, air, climate, hydrology, soil science (DTM: SRTM, EU-DEM, NASA-DEM, ALOS, MERITDEM; air/climate: S5P, Copernicus Atmosphere Monitoring Service (CAMS), ERA5, PRISM, WorldClim, EOBS, CARPATCLIM; Hydrology: HydroBASINS; Soil: EU-SoilHydroGrids, SOILGRIDS; Land cover: Copernicus High Resolution Layers, Corine, Urban Atlas, GEDI)
9. The conceptual background of object-based image analysis (OBIA), comparison with pixel-based image classification methods, image segmentation methods, steps of object-based image processing. Comparison of object-oriented data, highlighting the role of vector-based GIS and CAD systems.
10. Introduce the physical principles of remote sensing and the resolutions of remotely sensed images (spatial, spectral, temporal, and radiometric). Describe the differences, advantages, and disadvantages between multispectral and hyperspectral images (number of bands, bandwidth, classifiability, information content). Discuss the significance of the infrared range in vegetation mapping and present a selected spectral index.