



FACULTY	AGRICULTURE, ENGINEERING AND NATURAL SCIENCE		
DEPARTMENT	ENVIRONMENTAL SCIENCES		
SUBJECT	ADVANCED SPATIAL ANALYSIS & APPLICATIONS		
SUBJECT CODE	GIS 3772		
DATE	November 2022		
DURATION	3 Hours	MARKS	100

Special - Supplementary Examination

Examiner: Alice-Ally Indongo

Internal Moderator: M Hipondoka, PhD

External Moderator: Prof T. Dube, University of the Western Cape

INSTRUCTIONS

- 1.** Answer **all** the questions.
- 2.** While most of the marks will be awarded for content, candidates must bear in mind the importance of presentation, i.e. insight and critical thinking
- 3.** This paper consists of 3 pages; excluding the cover page.

Question 1:

[20]

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- 1.1 Name a five topological rules you would set for a Geodatabase for polyline features (5)
- 1.2 Explain one strategy to remove false pits (i.e., sudden sinks in the terrain that do not exist in the real-world) in digital elevation models (DEMs). (3)
- 1.4 Explain the importance of having a “filled” DEM. (4)
- 1.5 Data redundancy is considered a disadvantage to raster data. Give an example of a raster data set with large amounts of data redundancy. (3)
- 1.6 Would you employ 3D geovisualization when you are working on a public participation GIS (i.e. community projects)? Provide at least two motivations for your answer. (3)
- 1.7 Using a case study, describe how modern geovisualization has led to new insights or efficiencies. (2)
- [20]

Question 2:

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1. You are the GIS Specialist for a group which is entrusted to conduct an Economic and Environmental Impact Assessment (EEIA) of an envisioned tourism lodge establishment. The envisioned area is known for its habitat of very sensitive ecological species, of which the environmentalists are lobbying for optimum protection, at the same time, the lodge establishments wishes for the property development to be established with high scenic amenities. It is clear that a multi-decision analysis ought to be recruited due to the many factors to consider, possibility of long-term impacts on environment and many affected groups. Indicate how to solve using spatial analysis, and by taking into considerations the following:
- 2.1 The main objectives to consider (3)
- 2.2 Criteria to consider per objective (5)
- 2.3 Transformation of criteria to Suitability (5)
- 2.4 Outputs and how they will help resolve the problem (7)
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Question 3:**[20]**

Environmental justice practitioners are interested in equal access to resources. They believe that a healthy neighbourhood should have plenty of green spaces for people to rest, socialise and exercise. As a Spatial Data Analyst, you have been recruited by a local lobby group. Your employer's interest is to find where the urban green spaces are located in connection to population groups of different income and race. The main question is: are urban green spaces equally distributed in the City of Windhoek? In your quest to provide a solution, answer the following questions:

3.1 Which spatial analysis method of approach would you use to solve the problem? (motivate your answer by defining this method) (3)

3.3 There are two most common technical approaches used to solve environmental injustice, one of which is known to come with shortcomings. Based on the mentioned shortcomings, which method would you use for your analysis and why is it considered as a superior method to the other? (5)

3.4 Indicate the list of data required and their sources (5)

3.5 Discuss the outputs of your preferred data analysis method and translate them to answering your employer's question and solving the environmental injustice problem for the city of Windhoek. (7)

Question 4:**[20]**

4.1 A hydrologic project you are involved with is interested in locating an outlet pour point for a dam. Immediately you computed a surface curvature to determine if the surface at the pour point cell locations is upwardly convex or concave. Your curvature surface analysis gave you values between -0.5 to -4. What does that mean for your pour point cells? (5)

4.2 For the same project in Question 4.1, you are interested in generating an area-wide watershed to acquire units areas for the management and planning of the basin water. In delineating your watershed, you used cell threshold with a flow accumulation of more than 500 cells and another one with cell threshold flow accumulation of more than 1000 cells. What would be the density

difference of your generated area-wide watersheds from the two cell flow accumulation values thresholds? (8)

4.3 A watershed may be generated as an area-wide watershed or as point-based watershed. When generating point-based watershed, you realised that you forgot to snap your pour point so that it is located over the cell that is part of the stream link. Describe the differences between the point-based watersheds with pour-point snapped to a cell on the stream link and the one created with a pour point un-snapped to the cell on the stream link. (7)

Question 5:

[20]

The Cuvelai Floodplains Committee is planning a project on flood management and drainage system management of the Cuvelai flood plains. They have the resources to collect the required datasets of the drainage system covering the southern part of Angola where the Cuvelai system originates, up to the northern part of Namibia. However, they have no clue on what sort of spatial analysis to perform in order to produce dataset outputs to inform decision making and better management of aquatic resources and ensure water quality within the drainage system. As a GIS Analyst within the Ministry of Water Affairs, Agriculture and Forestry, you have been nominated as a focal person to assist the committee in this regard. Indicate the type of advice you would provide in terms of the spatial analysis required to address this problem. In your discussion, include the 7 steps required for the analysis to be complete, type of datasets and how you think the analysis outputs will inform a better management of the Cuvelai Drainage system.

(20)

END OF EXAMINATION
