Answer to **three** questions. Each question is worth a maximum of 10 points.

Your submission to each question should be an essay. In each essay remember to explicitly describe all relevant aspects of the topic or topics related to the question. Focus on aspects mentioned in the grading outline for the question and remember to write **an essay** for each answer. Other types of answers, such as bullet point lists, will be given **significantly** reduced points.

All publicly available sources are acceptable. Please remember that plagiarism is, however, **not** acceptable. Short direct quotes (e.g. for definitions) are permitted and should be clearly marked as such in the text. If you use sources other than lecture slides or literature mentioned in the slides, please include a list of references. You do **not** need to include citations in the text, but the list of references is required.

This is individual work. Plagiarism includes cooperation with other students.

You can write your answers in Finnish, Swedish, or English.

1.

Define the DE-9IM model. What is it used for? If you are given a shapefile containing Finnish postal areas (postinumeroalue), what DE9-IM topological relationships would indicate problems in the data and why?

Definition of DE-9IM (2p)
Explanation of what DE-9IM is used for (3p)
Naming topological relationships that indicate problems (2p)
Explanation why those particular relationships are relevant (3p)

2.

Describe what it means for an element in an Object model to be *identifiable, relevant, and describable*. Explain how elements in a vector data model representing buildings are *identifiable*, *relevant*, and *describable*.

Description of what it means that a data element is *identifiable* (2p)
Description of what it means that a data element is *relevant* (2p)
Description of what it means that a data element is *describable* (2p)
Proper explanation on how to apply this in the example (4p)

3.

Why geodata requires specialized data types in databases? What kinds of data types are used to store geodata? Give an example of a geodata feature that for each different data type. Use features that need that type of data.

Explanation why specialized data types are required (3p)
Description of data types used to store geodata (3p)
Examples of geodata features for the different data types (4p)

4.

Compare the point range search and line/polygon windowing query problems, as well as the data structures used for solving these problems

Description of point range search and the appropriate data structure(s) (3p)
Description of windowing query and the appropriate data structure(s) (3p)
Comparison of the two problems (4p)

5.

Explain how finding the shortest path in a raster dataset works. What sort of different approaches are there to modeling raster neighborhood for shortest path algorithms? How does the size of the pixel neighborhood affect the situation?

General explanation of the problem (2p)
Explanation of the different approaches there are (6p)
Explanation of the effect of the neighborhood size on the problem (2p)