There are four tasks for this exam. It is expected that you do all. The four tasks are weighted as indicated in brackets.

**Task 1: Triangular Irregular Network (TIN) (25%)**

a. What is a Triangular Irregular Network (TIN) and how is it created?
b. Describe the role of different feature inputs commonly used to create a TIN.
c. Describe the difference between hard and soft options to feature inputs when creating a TIN.
d. Describe two interpolation methods used to transform a TIN into a raster surface.

**Task 2: Raster encoding (20%)**

Use the geographical features and the grid presented in the figure below to describe four raster encoding principles. Demonstrate them by illustrations. For each principle indicate feature type(s) the principle is useful for.
Task 3: Curvature (25%)

a. Use the illustrations below and explain the concept of curvature.

b. Plan curvature can be used to differentiate between ridges and valleys. How?

c. Describe how curvature can be used to investigate erosion and runoff processes in a drainage basin.
**Task 4: Spatial Interpolation**

The illustration to the right shows the rural area measuring 8 by 8 kilometers. The area is located nearby an airport. The numbers represent the noise level [dB] measured at each sample point location. You are asked to help a landscape planner from the local administration to elaborate a noise map using spatial interpolation.

a. Most of the spatial interpolation methods are based on the spatial autocorrelation concept when generating statistical surfaces. What is spatial autocorrelation?

b. The study area is divided into 4 x 4 grids. What is the spatial resolution of an individual grid cell?

c. The landscape planner requires keeping the exact values measured in the sample point locations in the resulting noise map. You consider the possibility of using two common interpolation methods based on polynomials. What are these two methods and which of those let you keep the exact values of the sample points in the resulting statistical surface? Describe this method and explain how it does so?

d. After considering different options, finally, you decide to use Inverse Distance Weighting (IDW) as an interpolation method. For the highlighted raster cell, demonstrate how the $z$-value for this location is calculated using IDW. As inclusion criteria for sample points, use a fixed search radius. The search radius should be twice the pixel resolution. For the demonstration, include an illustration and a formula populated with numbers.

The formula for the IDW is:

$$z(x) = \frac{\sum w_i z_i}{\sum w_i}$$

$$w_i = \frac{1}{d_i^2}$$

where $z(x)$ is the $z$-value for position $x$, $z_i$ is a known $z$ value at location $x_i$ with weight $w_i$, $d$ is the distance between the known point $x_i$ to the unknown point $x$. 