

Name: \_\_\_\_\_

Student ID: \_\_\_\_\_

This midterm exam is worth 15% of the final mark for the course.

There is 70 points to earn: 7 questions [10 points each].

For the answers that require drawing:

1. print the exam and scan the page, or
2. draw directly in your computer, Word allows you to do this
3. redraw on a piece of paper the starting elements, and take a picture of your answer.

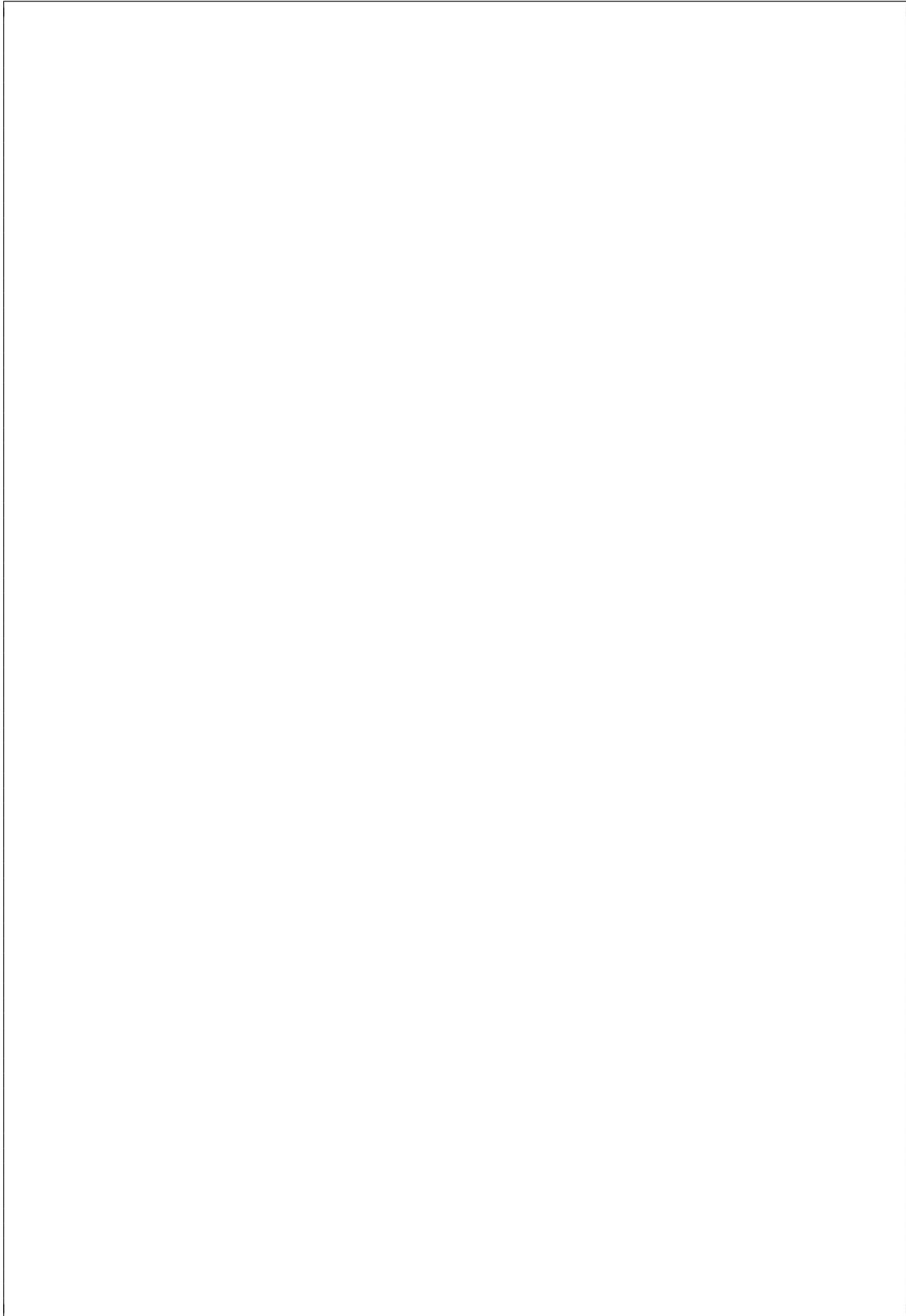
The name of the PDF is your my\_student\_number . pdf, eg 5144666 . pdf

You need to submit a PDF to this Dropbox upload page

You have 1h15min to do this exam, upload at 12:00 maximum.

The total number of pages of this exam is 9 pages.

1. (10 points) With lidar acquisition, multiple returns (also called echoes) can be registered for each emitted laser pulse. Explain how this works and why this is a benefit compared to photogrammetry.

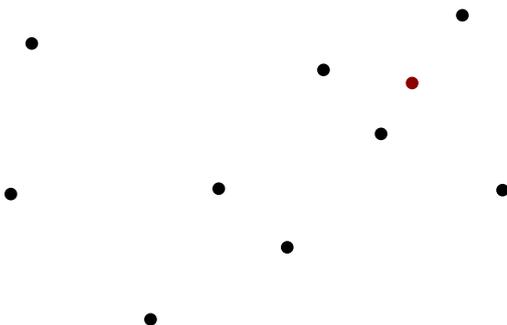


2. (10 points) Draw the isolines  $z = 10$  for the  $3 \times 3$  grid below, the value represent the value at the centre of the cell.

8	12	13
8	9	7
15	12	10

3. (10 points) Given the set  $S$  of 10 points in the plane below:

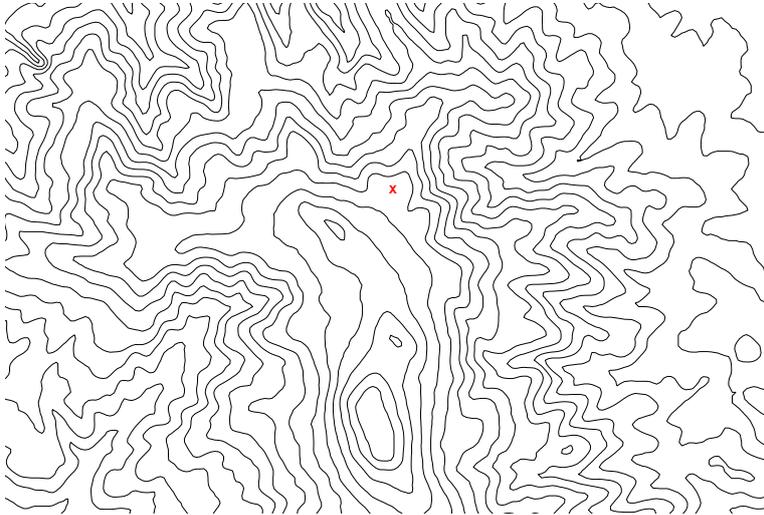
1. Draw the Delaunay triangulation (DT);
2. Draw the Voronoi diagram (in another colour);
3. How many Voronoi cells are unbounded?
4. In the DT, what is the degree of the dark red vertex?



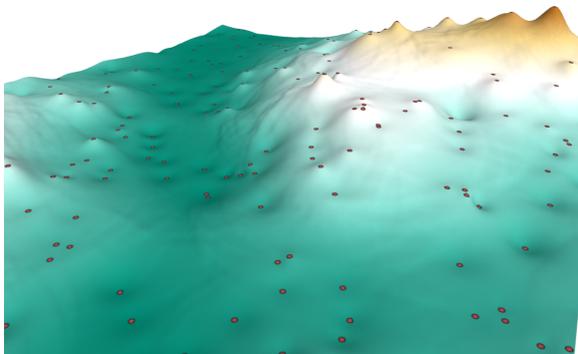
4. (10 points) Say you have a grid like the one below, where the values represent the values at the centre of each cell. Describe the steps necessary to interpolate with *natural neighbour interpolation* at the location  $x$  (in red), and calculate the answer (or an approximation if you cannot calculate the exact value).

•8	•12	•13
•8	•9	•7
•15	•12	•10

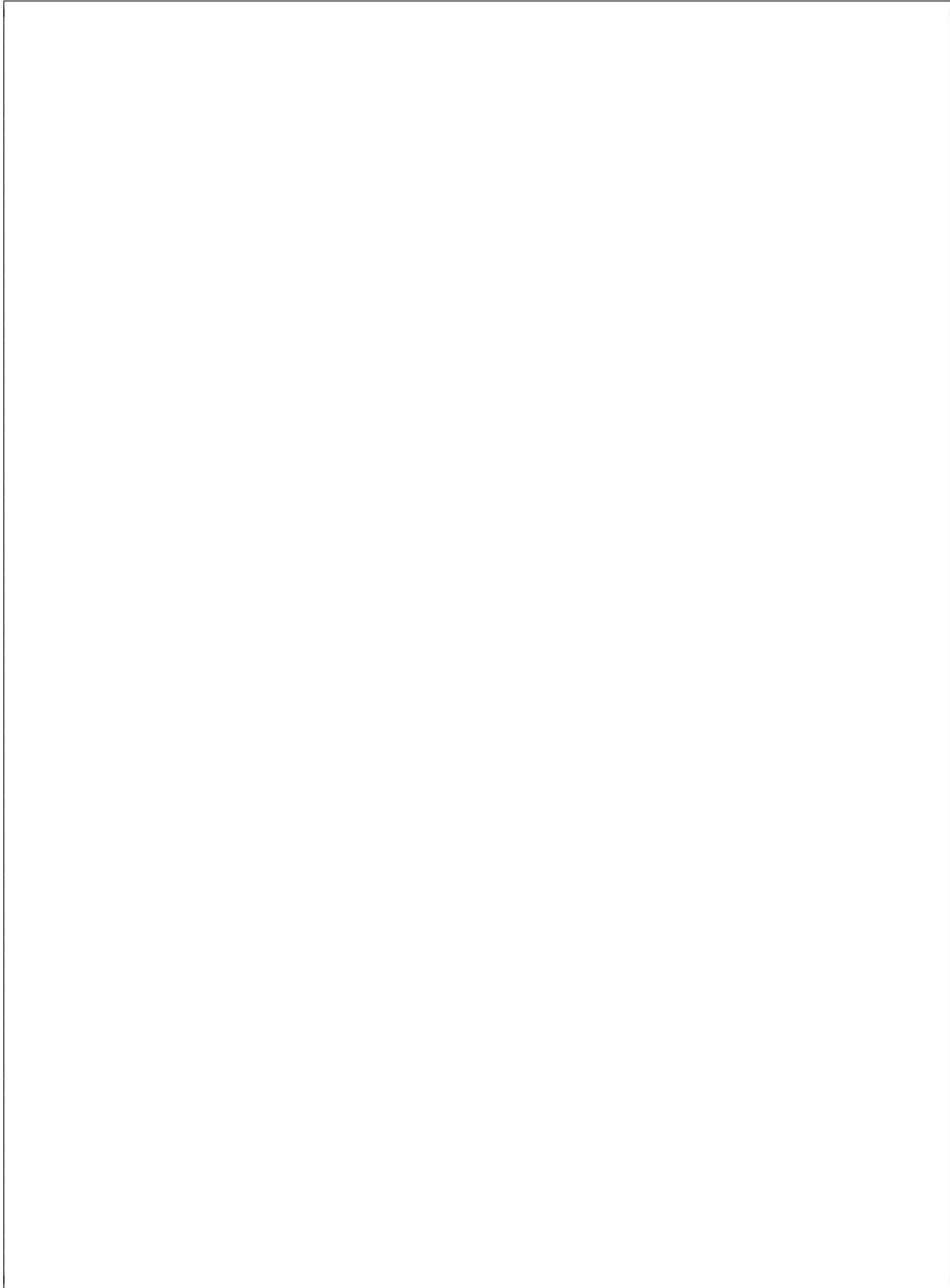
5. (10 points) You obtain the elevation for a given region in a GIS vectorial dataset as shown below, where for each line you know its elevation (it's an attribute). Describe how you would implement a software program that returns the slope at a given  $(x, y)$  location, for instance for the red "x". Describe the main pitfalls.



6. (10 points) You interpolated with IDW and you obtain the terrain shown here, you used a search radius of 25m and a power of 2. If you modified the power to 1.5 and enlarge the radius to 50m, how would the resulting terrain be modified? Discuss.



7. (10 points) When performing an interpolation with kriging, what does the value of the variogram range mean? Think of what a small or large range means in terms of the characteristics of a dataset.



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