TD 609
Tutorial 2

1. Consider the maps given at the links below and the points on map. Outline the watershed for each of these points.

http://www.cse.iitb.ac.in/~sohoni/TD603/TutMap1.jpg
http://www.cse.iitb.ac.in/~sohoni/TD603/TutMap2.jpg

2. Consider the map of Karjat Taluka with the locations of the rain-gauges marked in bluw. Also note the marking of the North Karjat tribal block. Use the Voronoi region constructions and estimate the areas for the region allocated to each rain-gauge. If you did not know the existence of rain-gauges outside North Karjat, what would be your decomposition just for North Karjat?

http://www.cse.iitb.ac.in/~sohoni/TD603/northkarjat.png

Use https://www.cse.iitb.ac.in/~sohoni/TD603/grid.pdf as a practice map.

3. Write two programs which take in two tables [x_1 ,... , x_n ] and [r_1 ,...,r_n] and a real number x. The output r is either (i) the r_i , where i is the index so that x_i is closest to x, (ii) is a linear interpolation between r_i and r_(i+1) where i is such that x_i < x < x_(i+1).

4. Consider the drain which runs from H2 to H5, which is 2 meters wide. The elevation difference between the two points is roughly 1.5m and the length is roughly 600m. If the height of the water flowing is 0.5m, estimate the flow in cum/sec. If it is raining at roughly 20mm in an hour, how much area is in the catchement area of the drain?

5. Sangamner taluka receives an average rainfall of 500mm of which about 30% infiltrates into the ground. There are soil layers in the taluka: Soil layer A which is at depths 0m-7m and layer B, from 7m to 40m. There is hard rock under this. The specific yields of layer A is 5% and that of B is 2%. The depth of the water table before the monsoons was 10m below ground level. At what height will be the water table after the monsoon?

6. For the taluka above, roughly 50% of the land is hilly and un-cultivable. Traditionally, crops are sown in two seasons, the *kharif*, i.e., the monsoon season and the *rabbi*, the winter season. Irrigation is from groundwater. For any crop in the kharif season, the net water requirement (above monsoons) is 200mm while for rabbi it is 300mm. The summer crop requires 500m and is not sown. A cash crop may be sown only in the rabbi. Suppose that the taluka plants 100% of its cultivale area in both kharif and rabbi, what will be the annual change in groundwater? Work out a sustainable cropping plan.

7. Let ax+by+cz+d=0 be a plane P and let p=(x0,y0,z0) be a point on the plane. It is required to find the direction vector v of steepest descent. Step I: Express z as a function of x and y, i.e., z=f(x,y). Step II. For a small motion dx and dy, find dz, the change in the z-value. Step III. Now find (dx,dy) such that (i) dx^2 +dy^2=1, and (ii) dz is maximized.

8. The topsoil in an area is of thickness 1m and has porosity 10%. If at anytime, its moisture is x%, then it loses half of it to groundwater. Moreover, it evaporates 4mm every day. Suppose the soil-moisture is 3% on a certain day and it receives the following sequence of rainfall (in mm) for 7 days: [30,50,50,0,0,0,5]. What is the soil-moisture at the end of every day and what is the ground-water recharge?