Vacanze Romane

Many weather stations were placed around the region of Lazio, Italy, to record the minimum and maximum temperatures over the months. The data was provided to the public by the region: http://dati.lazio.it/catalog/en/dataset/serie-storica-dato-termometrico (zip file: *temperature_data*):

> 1. *We would like to see an Exploratory Data Analysis on these recordings to get an idea of the quality of the data and the general distribution of the variables*

A second dataset contains the latitude, longitude and altitude of a large number of stations around central Italy (zip file: *coordinates_data*):

> 2. (a) *A client of ours is a weather forecast enthusiast, he would like to have a map of Lazio divided in climatic sub-regions -* **use our data to create such a map**
>
> (b) *Apparently, we forgot to log one of the stations, placed in Sant'Angelo Romano,* **we'll need you to estimate the temperatures it recorded**

We are planning to build some heat exchange generators to produce green energy out of the temperature differences during the day. Our engineers estimated that we can get the equivalent of 1 euro of energy for every degree of difference between the minimum and maximum of the day!

However, for these pumps to work, the internal fluid cannot freeze, as this will break the pumps. This happens at a temperature of $T0(-3°C)$ and causes damage to the running engine for 30 euros which promptly shuts down and produces no energy for the day.

> 3. *Find the optimal spot in the Lazio region to install this pump, to maximize the economical gain*

A bright engineer of our team had an idea: if we can predict if the temperature of the next day is going to be equal or less of T0, we can remotely shut down the pump and avoid costly damage at the price of no energy production for the whole day:

> 4. (a) *Given spatial coordinates and past days temperatures, build a model that predicts the minimum temperature of the next day*
>
> (b) *Recalculate the estimated gain of the pump, based on the fact that we would turn it off if the chance of going under T0 is above 10%*

- BONUS 1: determine if the arbitrary 10% of risk can be optimized further to maximize energy production
- BONUS 2: find the new optimal spot for the pump given the engineer's idea (consider the optimal risk, if the previous bonus task was completed)