Factory Systems

Developer Code Test – Version 1.5 – April 2021

Surface roughness often shortened to roughness, is a component of surface texture. It is quantified by the deviations in the direction of the normal vector of a real surface from its ideal form. If these deviations are large, the surface is rough; if they are small, the surface is smooth.

A database has been constructed that has somewhere between 5 and 10 surface roughness tests that have been collected for a plane. Each test should contain 1,000 height measurements over an XY plane along with the location of the measurement. A test is only considered a valid test if contains 1,000 measurements. All measurements are in mm. This database is attached as *SurfaceRoughnessDB.db3* along with its schema.

Several standard parameters are used to describe surface roughness of engineered surfaces. Average roughness (R_a) is the average of the individual heights (asperities) and depths from the arithmetic mean elevation of the profile.

$$R_a = \frac{1}{mn}\sum_{k=0}^{m-1}\sum_{l=0}^{n-1}|Z(x_k, y_l) - \mu|$$

Where

$$\mu = \frac{1}{mn}\sum_{k=0}^{m-1}\sum_{l=0}^{n-1}Z(x_k, y_l)$$

Root mean square roughness (R_q) is the square root of the sum of the squares of the individual heights and depths from the mean line. In general data analysis this is also knows as the Population Standard Deviation.

$$R_q = \left(\frac{1}{mn}\sum_{k=0}^{m-1}\sum_{l=0}^{n-1}(Z(x_k, y_l) - \mu)^2\right)^{0.5}$$

Your task is to create a console application using C# that takes this database as its input and outputs a summary report CSV file of all the surface roughness tests in the database.

When run, this application should prompt the user for the location of the database and then generate a summary report CSV file for all the tests available in the database. The summary for each test should include the following calculated values as well as any of the included identifying properties of the test.

- Minimum height and its location on the plane
- Maximum height and its location on the plane
- Mean height
- Height range
- Average roughness (R_a)
- Root mean square roughness (R_q)

Create a clean github repository for your solution and submit it to hr.manager@symbrium.com when completed.

Bonus

When run, this application would also prompt the user for the size of a filter used to remove outliers from the calculations. This input will allow the user to indicate how many population standard deviations they would like to use as a filter to eliminate outliers. This value should default to 3 (it is an industry standard that points that fall more than 3 standard deviations from the norm are likely outliers). The filtered summary for each test would then also include the following calculated values.

- Standard deviation of the measurements
- Count of measurements inside the filter input
- Count of measurements outside filter input