

Tutorial Instructions

Lectures 6

1 Lists of integers

The files `num1.dat` and `num2.dat` contain lists of integers. We want to know which numbers are present in `num1.dat` but not in `num2.dat` and vice versa. Write a program that performs this task, then compile and run it (you should know how by now). Of course, we will want to compare other files in the future, so the names `num1.dat` and `num2.dat` should not be hard-coded. Let the user provide them from the command line.

Answer: The numbers unique to `num1.dat` are 90721, 2080770 and 2436800 while the numbers unique to `num2.dat` are 154321, 518479 and 2469334.

2 Significant points

We have built a detector to monitor suspicious alien activity. The detector, which is pointed at space, counts the number of detected subspace transmissions during a certain period of time and writes this data to a file called `detReadout.dat`. Each row of the file has three numbers. The format is `<time> <counts> <flag>`. Table 1 explains the meaning of each field.

Table 1: The meaning of each field in `detReadout.dat`. The data in this file could be represented by a set of points in a graph with time on the x-axis and counts on the y-axis.

<code><time></code>	The time in hours at which the detector was read out
<code><counts></code>	The number of counts detected since the last readout
<code><flag></code>	This flag is 1 if the data is OK, 0 otherwise

The data is probably all background noise, but we want to be sure. Write a program that checks if, at any point, a significant number of subspace transmissions were detected. A point is considered significant if it is at least five standard deviations away from the mean. In case you forgot, the standard deviation of a data sample is given by

$$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (y_i - \mu)^2} = \sqrt{\frac{1}{N} \sum_{i=1}^N (y_i^2) - \mu^2} \quad (1)$$

where N is the number of data points, x_i is the number of counts in the i :th point and μ is the average number of counts in the sample. Remember to check the data quality flag. If a point is not OK, it should not be included in the calculation. What values did you obtain for μ and σ ?

Answer: The mean is $\mu = 24.96$, the standard deviation is $\sigma = 10.48$ and there is alien activity at 149h (130 counts), 486.4h (219 counts) and 653.8h (84 counts).