# SOFTWARE 2 PRACTICAL

ARRAYS & STATIC METHODS

Week 2 – Additional Exercises

For this week practical, you should create a Java project (see last week introduction to VS Code).

Problem:

The aim of this problem is to resample a set of data points store in an array. Write a class `LinearInterpolation` which will contain a set of static methods to resample data point using linear interpolation. The class should be in the package `sof2week02softwarelab` if you want to test your code in GradeScope. To start with we will look at the simple case where we want to (almost) double the number of sample point using linear interpolation. For example, given an array of 4 known values (shown below), we want to resample the array in order to have 7 values. A simple approach is to use linear interpolation (see [linear interpolation on Wikipedia](#)). To compute the values in the grey boxes, you just have to take the two neighbouring boxes, add them together and then divide by 2.
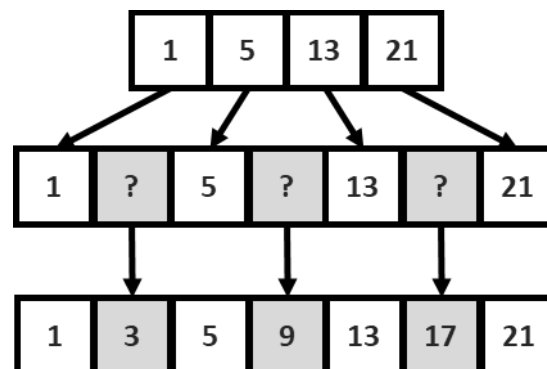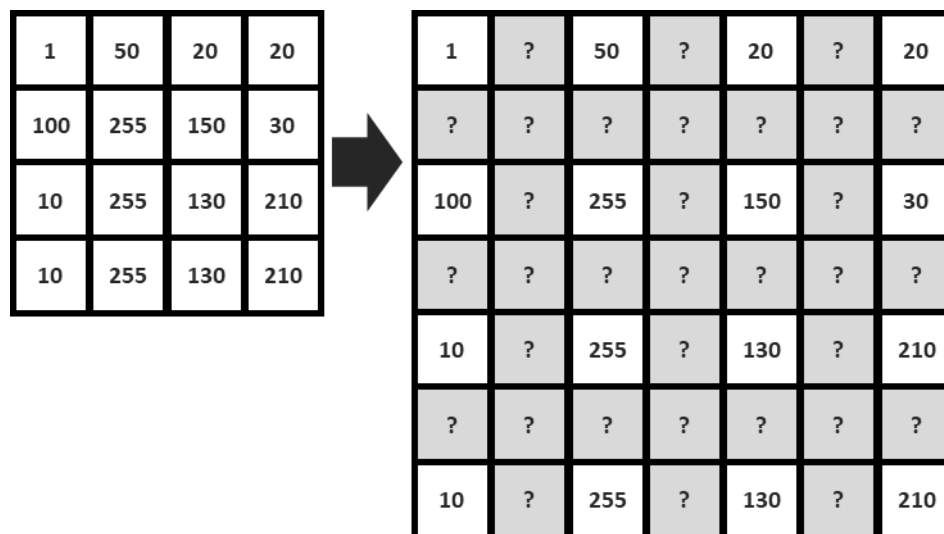

1. Implement a static method `int[] resample(int[] datapoints)` that does just that.

Something more challenging is to be able to resample the data for any factor (`int`). Below is an example of a factor of three.
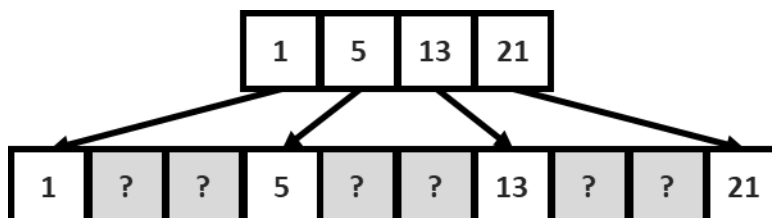
2. Implement the method `int[] resample(int[] datapoints, int scale)` that does just that. You will need to understand the formulae given in the section "Linear interpolation between two known points" on the Wikipedia page. In our case the x are the index of the element in the array, and the y are the value stored in the array.

Bilinear interpolation can be used in image processing to resample an image (scaling up the resolution of an image). In this case, the image can be seen as a 2D array of pixel values. Considering a black & white image (a.k.a. greyscale image), the "colours" range from 0 (black) to 255 (white). For example, to double the size of the 4×4 image below, we first build a 7×7 array with missing values. To compute the missing values, we first deal with the even rows (0, 2, 4, 6). When considering the row $r=0$, we can use the linear interpolation seen in 1 to complete that row. Then we proceed to the row $r=r+2$ and so on. Once the rows 0, 2, 4 and 6 have been interpolated, we tackle the columns 0, 1, …, 7. We interpolate one column at a time using the method seen in 1.

1	50	20	20
100	255	150	30
10	255	130	210
10	255	130	210

1	?	50	?	20	?	20
?	?	?	?	?	?	?
100	?	255	?	150	?	30
?	?	?	?	?	?	?
10	?	255	?	130	?	210
?	?	?	?	?	?	?
10	?	255	?	130	?	210

3. Implement `int[][] resample(int[][] image)` which double the size of a greyscale image.

4. Implement `int[][] resample(int[][] image, int scale)` which resample a greyscale image given a scale factor.