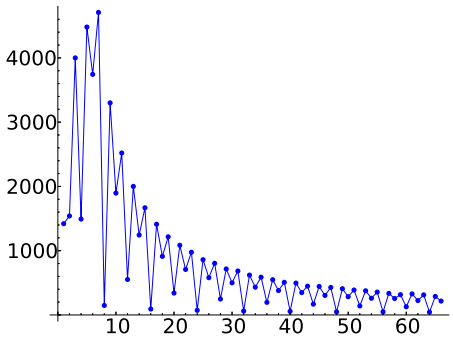
Experimental challenge*: **Checkerboard oddity**

Introduction to digital signals — Deadline: End of the course

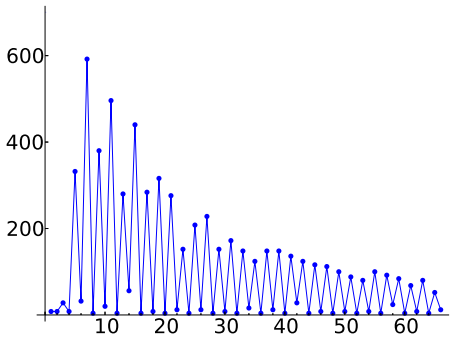
Experimental part

Create a very large image with a checkerboard pattern i.e., alternating black and white squares. If you want to save time and to have more extensive data I recommend to use a little Octave or Matlab code.

The experiment consists in exporting the image to JPEG format and plot the size of the file in kilobytes in terms of the side in pixels of each square, say N. With $1 \leq N \leq 66$ and and image 2520×2520 I got the first figure. Try your own experiments. The results and scales may vary with the software but the general aspect should be similar.



Main experiment



For the optional part

The second plot shows what I got applying to the resulting JPEG files a standard data compression program, in this case `gzip`. Usually this is not a good idea because JPEG already involves compression and we take the risk of getting a bigger file but in this case the ratio is impressive.

Mathematical part

Find formulas matching your data that allow to predict approximately the size of the JPEG file. Try to find a theoretical foundation to these formulas. This foundation cannot be perfect because we have not seen in detail the compression part of JPEG but you have to be able to explain the global aspect of the graph.

Optional: Although we have not studied how `gzip` works, does any idea come to your mind to explain the difference between both figures?

*Some experiments are classical, some are my idea and others come from specific sources. In the latter case I have omitted the reference here on purpose to force the students to work on their own. If you are the author, please do not get angry. I intend to incorporate the references to the final version of the notes.