

Behind the secrets of Hadamard matrices and their applications

Short description: Have you ever asked yourself how the pictures from spacecrafts are send back to earth and how the scientists can recover the original image free of any errors? The answer lies in the [error correcting codes](#), which are one technique for building in the appropriate redundancy. In 1990, NASA used a matrix of the augmented [Hadamard code](#), called the [Reed – Muller code](#), for the [Mariner 9](#) mission.

Speaking of [Hadamard matrices](#), there is still an open question, known as the Hadamard conjecture. Until now, no one was able to prove that Hadamard matrix of order $4n$ exists for every positive integer n . For example, recently studies, showed that Hadamard matrices of order 764 exist¹.

Your goal is to familiarize and play with Hadamard matrices (by trying to solve the conjecture) and at the end write a program to correct errors in a transmission using the Hadamard error correction code.

Difficulty level: EML2, EML3, EML4, EML5.

Requirements & Tools: Linear algebra, Programming skills (any computer language).

Languages: English, French, German (and Luxembourgish).

Schedule: to be determined.

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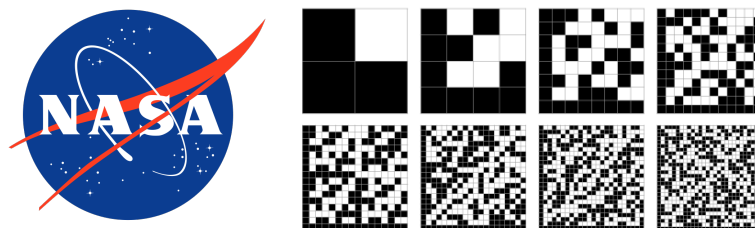


Figure 1: Nasa logo and Hadamard matrices (source: Wikipedia & Wolfram Mathworld).

¹Dokovic, Dragomir Z. (2008). "Hadamard matrices of order 764 exist". *Combinatorica*. 28 (4): 487 – 489.