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From Dirichlet characters to binary sequences with large merit factor

A binary sequence of length n is an n-tuple of elements taking on values $+1$ or -1 and its merit factor is a measure of self-similarity of the sequence. The problem of determining the largest possible merit factor of long binary sequences is related to several classical conjectures due to Littlewood, Erdős, and Turyn. We consider binary sequences of odd square-free length n for which $\phi(n)$ of the n elements are determined by the real nonprincipal Dirichlet character modulo n, while the remaining $n-\phi(n)$ elements can be freely chosen. Subject to mild conditions, we determine the worst-case and best-case behaviour of the merit factor of these sequences, and show that almost all these sequences have the best-case behaviour. We also give explicit examples of such sequences having the best-case behaviour.

This is joint work with Jonathan Jedwab.