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Type-II matrices and the Hamming Scheme

An $v \times v$ matrix W is type-II if

$$\sum_{h=1}^{v} \frac{W_{i,h}}{W_{j,h}} = \begin{cases} v & \text{if } i = j, \\ 0 & \text{otherwise,} \end{cases}$$

for all $i, j = 1, \ldots, v$.

Each type-II matrix W gives the Bose–Mesner algebra of an association scheme, called the Nomura algebra of W. Jaeger, Matsumoto and Nomura showed that W belongs to its Nomura algebra if and only if cW is a spin model for some non-zero scalar c. Note that spin models give link invariants. Jaeger, Matsumoto and Nomura's result motivates us to determine the Bose–Mesner algebras that are the Nomura algebra of type-II matrices.

In this talk, we show that the Bose–Mesner algebra of the Hamming scheme $H(n, q)$ cannot be the Nomura algebra of a type-II matrix when $q \geq 3$.