The Erdős–Gallai conditions are necessary and sufficient conditions for the existence of a simple graph with a given degree sequence. Much work has been done characterizing the polytope of degree sequences of simple graphs. The corresponding conditions for 3-hypergraphs are still unknown.

A simple 3-hypergraph $G$ consists of a set $V$ of vertices and $E$ of edges, such that each edge is a triple $u, v, w$ of distinct vertices. Repeated triples are not allowed in $G$. The degree of a vertex $v$ is $\text{deg}(v)$, the number of triples containing $v$. The degree sequence of $G$ is the sequence of degrees $D(G) = (d_1, d_2, \ldots, d_n)$, such that $d_1 \geq d_2 \geq \cdots \geq d_n$. We ask when a given sequence $D$ is the degree sequence of a simple 3-hypergraph?

It is still unknown whether this problem has a polynomial-time algorithmic solution, or whether it is NP-complete. Recently Kocay and Li showed that any two 3-hypergraphs with the same degree sequence can be transformed into each other by a sequence of operations known as trades. The proof is based on null-hypergraphs. We describe the structure of null-hypergraphs, and a closely related NP-complete problem for 3-hypergraph degree sequences.