Shuliang Bai* (sbai@math.sc.edu) and Linyuan Lu. On the spectral radius of hypergraph with e edges and \(\{0,1\}\)-tensor with e ones. Preliminary report.

Let \(r \geq 2\), let \(f_r : [0, \infty) \to [1, \infty)\) be the unique analytic function such that \(f_r(\binom{k}{r}) = \binom{k-1}{r-1}\) for any \(k \geq r - 1\). We prove that the spectral radius of an \(r\)-uniform hypergraph \(H\) with \(e\) edges is at most \(f_r(e)\). The equality holds if and only if \(e = \binom{k}{r}\) for some positive integer \(k\) and \(H\) is the union of a complete \(r\)-uniform hypergraph \(K_r^k\) and some possible isolated vertices. This result generalizes the classical Stanley’s theorem on graphs. We extend the problem to general \(\{0,1\}\)-tensors and prove that the spectral radius of an \(r\)-th order \(\{0,1\}\)-tensor \(A\) with \(e\) ones is at most \(e^{\frac{r-1}{r}}\) with the equality holds if and only if \(e = k^r\) for some integer \(k\) and all ones lies in a principle sub-tensor \(1_{k \times \cdots \times k}\). We also prove a stabilistic result for general \(A\) with \(e\) ones where \(e = k^r + l\) with relatively small \(l\). Using the stabilistic result, we completely characterize the maximum tensors among all \(r\)-th order \(\{0,1\}\)-tensor \(A\) with \(k^r + l\) ones, with \(-r - 1 \leq l \leq r\), for sufficiently large \(k\). (Received September 19, 2017)