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Zero-sum subsequences in bounded-sum $\{-1,1\}$-sequences

In this talk, we consider problems and results that go in the opposite direction of the classical theorems in the discrepancy theory. The following statement gives a flavor of our approach. Let t, k and q be integers such that $q \geq 0$, $0 \leq t < k$, and $t \equiv k \pmod 2$, and take $s \in [0, t+1]$ as the unique integer satisfying $s \equiv q + \frac{k-t-2}{2} \pmod{(t+2)}$. Then, for any integer

$$n \geq \frac{1}{2(t+2)}k^2 + \frac{q-s}{t+2}k - \frac{t}{2} + s$$

and any function $f : [n] \to \{-1,1\}$ with $|\sum_{i=1}^{n} f(i)| \leq q$, there is a block of k consecutive terms (k-block) $B \subset [n]$ with $|\sum_{x \in B}^{n} f(x)| \leq t$. Moreover, this bound is sharp for all the parameters involved and a characterization of the extremal sequences is given. This is a joint work with Yair Caro and Adriana Hansberg.