Meeting: 1001, Evanston, Illinois, SS 2A, Special Session on Extremal Combinatorics

1001-05-343 **Richard M Wilson*** (rmw@caltech.edu). *Incidence matrices and a zero-sum Ramsey-type problem.*

Given t and k with $0 \leq t \leq k$ and a prime p so that $\binom{k}{t}$ is divisible by p, let $R(t, k; p)$ denote the least integer n so that if the t-subsets of an n-set X are colored with integers modulo p, there exists a k-subset A of X so that the *sum* of the colors of all the t-subsets of A is 0 modulo p. More generally, for a t-uniform hypergraph H, $R(H; p)$ denotes the least integer n so that for any coloring of the t-subsets of X with integers, there exists a subhypergraph isomorphic to H so that the sum of the colors on its edges is 0 modulo p.

It is known that $R(G; 2) \leq k + 2$ for any graph G with an even number of edges on k vertices (Alon, Caro), and that $R(t, k, 2) \leq k + t$ whenever $\binom{k}{t}$ is even (Caro). We prove the following.

(1) For any t-uniform hypergraph H on k vertices with an even number of edges,

$$R(H; 2) \leq k + t.$$

(2) When $\binom{k}{t}$ is even, $R(t, k; 2)$ is equal to $k + 2^e$ where 2^e is the least power of 2 that appears in the base 2 representation of t but *not* in that of k. (Received August 31, 2004)