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by jasperE3

Problem 1 Let $\mathfrak{F} = \{A_1, A_2, \dots, A_n\}$ be a collection of subsets of the set $S = \{1, 2, \dots, n\}$ satisfying the following conditions:

(a) Any two distinct sets from $\mathfrak{F}$ have exactly one element in common;
(b) each element of S is contained in exactly k of the sets in $\mathfrak{F}$.

Can n be equal to 1996?

Problem 2 Let there be given a set of 1996 equal circles in the plane, no two of them having common interior points. Prove that there exists a circle touching at most three other circles.

Problem 3 The sequence $\{x_n\}$ is given by

$$x_n = \frac{1}{4}\left(\left(2+\sqrt{3}\right)^{2n-1} + \left(2-\sqrt{3}\right)^{2n-1}\right), \qquad n \in \mathbb{N}.$$

Prove that each x_n is equal to the sum of squares of two consecutive integers.
