

GAL research paper  
15. Ramsey theory - Ramsey theorem

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**Abstract:**

Ramsey theorem can be seen as a generalization of the pigeonhole principle. Given any set of objects it tells us that for sufficiently big number of these objects there is always a subset having a given property (for example, given  $r$ -coloring of positive integers, there is arbitrarily large monochromatic arithmetical progressions). In other words, complete chaos is impossible.

Theorem was proved by Frank Plumpton Ramsey in 1928 in his work on a problem of the formal logic. The theorem was rediscovered by P. Erdos and G. Szekeres in geometry application, proving that for any  $k$ , there is an  $n$  so large that in any set of  $n$  points in the plane with no 3 collinear there is convex  $k$ -gon. They also defined Ramsey numbers.

It is used in many applications concerning number theory, harmonic analysis, metric spaces, convex and computational geometry, information technology, complexity, logic, games etc. In Ramsey theory of graphs we talk about arrowing problem asking if there is a 2-coloring of edges of graph  $G$  such that  $G$  contains subgraph  $R$  or  $B$  having the same color.