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Magic Labeling of 2-regular graphs

A total labeling of a graph is a bijective map from the vertices union edges of the graph onto the consecutive integers $\{1, 2, 3, \ldots, v + e\}$, where v is the number of vertices and e is the number of edges. The total labeling is said to be vertex-magic if, at each vertex, the sum of the vertex label and all incident edge labels is a constant. Graphs which have a vertex-magic total labeling are called vertex-magic graphs. Most work on vertex-magic total labelings has been done this century, although Kotzig and Rosa [1] were the first to show that every cycle is vertex-magic. They asked for a classification of vertex-magic 2-regular graphs, and the answer is still far from known.

We will describe some of the progress on this problem. MacDougall has conjectured that all regular graphs of degree at least two are vertex-magic, other than two disjoint copies of a 3-cycle (which is not vertex-magic). We prove that any other disjoint union of 3-cycles is vertex-magic.

References

[1] A. Kotzig and A. Rosa, *Magic Valuations of Finite Graphs.* Canad. Math. Bull. **13**(1970), 451–461.