Amateur mathematician partially solves 60-year-old problem
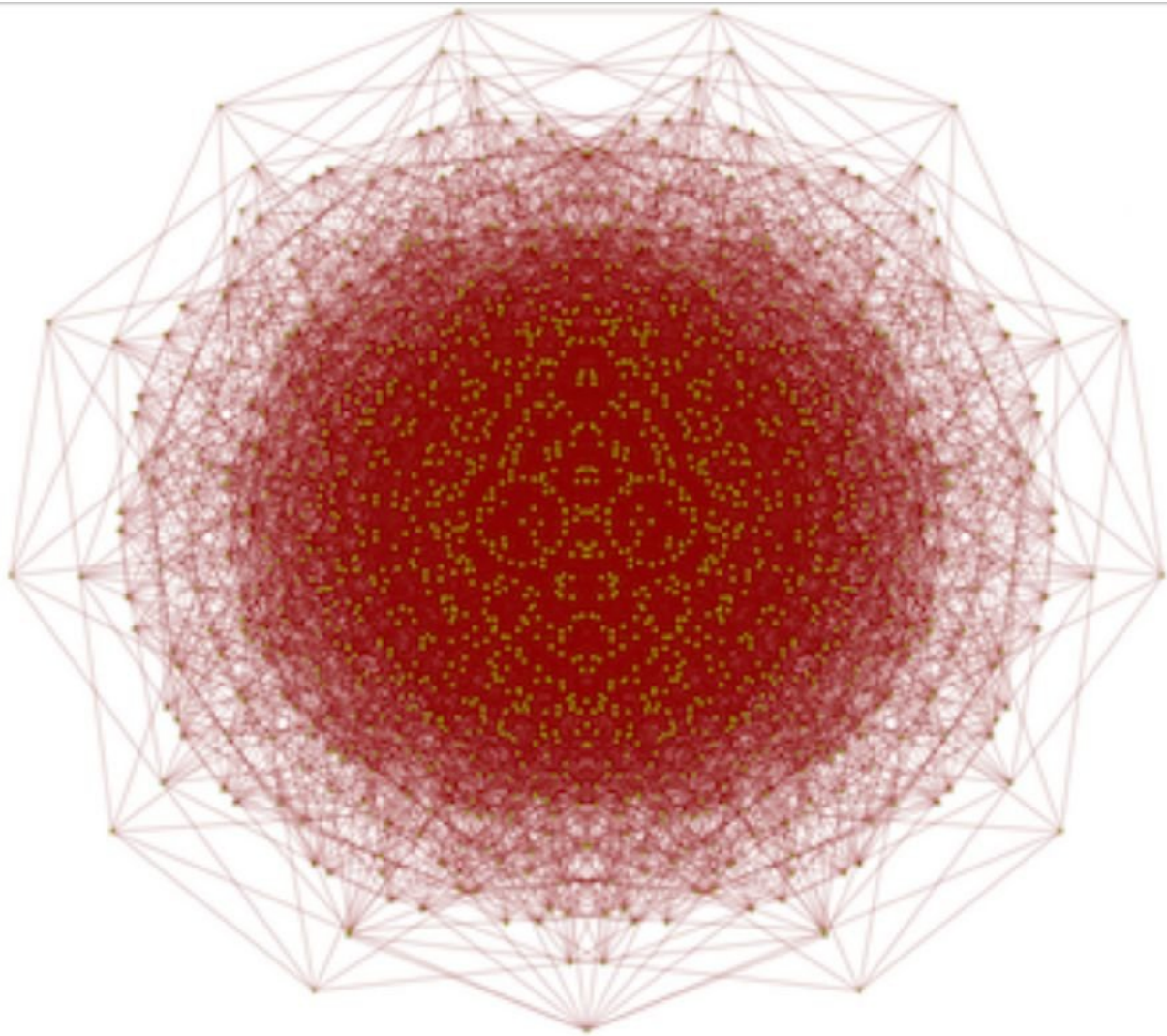
April 24 2018, by Bob Yirka

The 1581-vertex, non-4-colourable unit-distance graph G. Credit:
arXiv:1804.02385 [math.CO]

Professional biologist and amateur mathematician Aubrey de Grey has partially solved the [Hadwiger-Nelson problem](#), which has vexed mathematicians since 1950. He has published a paper describing the solution on the *arXiv* preprint server.

The Hadwiger-Nelson problem came about when Edward Nelson and Hugo Hadwiger wondered about the smallest number of colors necessary to color all of the points on a graph, with no two connected points using the same color. Over the years, mathematicians have attacked the problem, and have narrowed the possibilities down to four, five, six or seven. Now, de Grey has eliminated the possibility of four colors as the [solution](#).

Interestingly, de Grey is well known for his work in his primary field, biology. More specifically, he has made public comments suggesting that some people alive today will live to be a thousand years old due incipient medical breakthroughs. He has established a foundation dedicated to reversing aging and continues working on the problem. His journey to math puzzle solver, he notes, has roots in his love of the game Othello. He used to be a competitive player, through which he befriended a group of mathematicians. They wound up teaching him some math theory, which he began to explore as a means of unwinding after a hard day at work.

Several years later, a group of mathematicians put together the [Polymath Project](#), a collaboration of mathematicians around the world—their online platform allows those interested in working on difficult math puzzles to collaborate with like-minded individuals. It was on that platform that de Grey found the Hadwiger-Nelson problem. He began working on it over his Christmas break, and after some time exploring the problem using the Moser spindle, discovered that one of the

assumptions of prior mathematicians was wrong, and because of that, he was able to rule out four colors as a possible solution.

The amateur [mathematician](#) is not taking himself too seriously though, describing his findings as "extraordinarily lucky."

More information: The chromatic number of the plane is at least 5, arXiv:1804.02385 [math.CO] arxiv.org/abs/1804.02385

Abstract

We present a family of finite unit-distance graphs in the plane that are not 4-colourable, thereby improving the lower bound of the Hadwiger-Nelson problem. The smallest such graph that we have so far discovered has 1581 vertices.

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