The 4-color problem

Math 40210, Fall 2012

September 30, 2012
A brief history of the four color problem (I)

- 1852: Francis Guthrie, while idly colorings a map of counties of England, conjectured that any map can be 4-colored so that no two adjacent regions get the same color.

- October 23, 1852: Augustus De Morgan wrote to William Rowan Hamilton, telling him about the problem, and suggesting a proof, which really just turned out to be a proof that $K_5$ is not planar.

- June 10, 1854: “F.G.” published the conjecture in *The Athenaeum*.
A brief history of the four color problem (II)

- 1878: Arthur Cayley asked members of the London Mathematical Society “hasn’t anyone solved this yet?”
- 1879: Alfred Kempe proved the 4-color conjecture
- 1880: Independently, Peter Guthrie Tait gave another proof
- 1890: Percy Heawood discovered that Kempe’s proof was flawed, and proved the “5-color conjecture”
- 1891: Julius Petersen found a flaw in Tait’s proof
- 1891-1975: The 4-color conjecture was the most actively worked-on problem in graph theory
A brief history of the four color problem (III)

- 1976: Kenneth Appel and Wolfgang Haken published a 139-page, computer assisted proof, that was, to put it mildly, controversial.

- 1997: Neil Robertson, Daniel Sanders, Paul Seymour and Robin Thomas published a 42-page, computer assisted proof, that is now widely accepted.
Some references

There are many great books on the 4-color problem. Here are three of the best, ordered from most accessible to most mathematical:

- Robin Wilson, Four Colors Suffice, Princeton University Press
- Rudolf Fritsch & Gerda Fritsch, The Four-Color Theorem, Springer
- Robert Wilson, Graphs, Colourlings and the Four-colour Theorem, Oxford Science Publications