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MODERN EXPLANATION OF AGE-OLD PROBLEMS

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▲作者何宝起及夫人生活近照

序　言

宇宙是何等的宏旷浩瀚，千象万物，神奇莫测，奥妙无穷啊！大自然的发展变化都是按照自身规定的法则和规律进行的，是不依人类的意志而改变的。所以，发现、掌握、揭示和利用事物的内在规律性，来为人类服务，是我们所追求的。

人类的一切社会实践活动，各行各业劳动生产、工作学习、军事科研等都有各自内在的规律性，只有掌握利用了这些规律性，一切活动才能得心应手，劳动生产效率才能提高，学习成绩才能突飞猛进，科研活动才能取得显著成果。

本书主要对四个古问题进行讨论分析。首先是被国际数学界称为“世界三大数学难题”之一的“四色猜想”。这个问题是1852年被提出的，之后，有不计其数的数学家给出了“证明”。1976年，美国阿佩尔与哈肯在高速电子计算机上用1200个小时，作了100亿次判断，终于“完成了四色定理证明”。但是，需要指出的是，所谓“100亿次判断”，只是大海一滴的实例实验或验证，绝不是揭示其规律性的彻底证明！其次是1742年被提出的“哥德巴赫猜想”和孪生素数猜想。这两个问题经过了二百七十年的研究，特别是二十世纪国际范围数学家们的研究攻关都未能攻克！其原因，我认为是数学家们撇开了问题所固有的规律性不管，误把猜想问

PREFACE

How vast and great the universe is, and everything is mystical with endless secret! The development and the change of the nature are all carried out along with the rule and the law of itself without any interference of human's will. Therefore, we will explore how to find, master, reveal and apply laws of nature for the service of humanity.

All social practical activities of human being, no matter what fields, industry or manufacture, being employed or pursuing education, even military research, have their internal laws, only by mastering and following the laws, all activities can be done smoothly with proper methods; social production efficiency can be improved; education can be achieved with excellent fruits; and to get a remarkable achievement in scientific field.

The main contents in this book is to analyze the four conundrum in mathematic method. The first conundrum is "Four-colour Conjectures", which is called one of three math conundrums in the world, remained unsolved in mathematic field. It was put forward in 1852, and had aroused innumerable mathematicians enthusiasm to offer the "proof". In 1976, American mathematicians Kenneth Appel and Wolfgang Haken, who have carried out 10 billion times of judgement on high-speed computer, spending 1200 hours and finally "achieved the proof of Four-colour Theorem". However, we have to point out "10 billion times of judgement" is only an experimental sample, which is a drop in the sea, can not be proved to reveal the whole regularity! The second conundrum are Goldbach Conjecture & Twin Primes Conjecture. Goldbach Conjecture was put forward in 1742, remained unsolved after 270 years of research, although mathematicians in the world tried hard in the twentieth century! In my years study, I dare to say with certainty that

题归为分析方法的解析数论来研究，明知该方法是对大偶数有效，对小偶数无效的，其本身就不是完全有效的方法，但在“方法唯高论”的倾向下，还是百折不回地踏上解析数论“这条不解之路”，这正是数论研究者们的最大憾事之所在！最后是早被载入书典的“三大尺规作图不能”问题之一的“三等分一角不能”问题。现在，我有理由断定，这个历经几千年来直到百余年前国际数学家们研究所得“三等分一角不能”的历史结论是完全错误的！原因也是对作图问题规律性的认识有局限性，“不知其规律性就作不出图”，即“不知其然，不能办其事”；而前三个问题都是“知道这回事，而不知道为什么会是这回事”，即“知其然，不知其所以然”。这四个问题的内在规律性各是什么？能够做出和给出证明的标志是什么？本书都将分别给出我的解答和证明。

本书通俗易懂，高中生可看懂全文，初中生也能看懂绝大部分，是大学、中学的师生和数学爱好者的新奇科普读物。

在出版过程中，感谢大连出版社各级领导所给予的大力支持，感谢编辑及相关人员在出版、翻译等项工作中给予的大力帮助。

何宝起

二〇一二年二月

most mathematicians have neglected inherent regularity of it, and wrongly classified "conjecture" into "analytic theory of number" as an analysis method for the research, although they are fully aware that this method is effective to "Big even number", but not effective to "Small even number". So it is not an integrated effective method. However, in the trend of "Method is essential", they still insist on indissoluble way of "analytic theory of number", never withdraw. This is the main reason that researchers of analytic theory of number hold the large matter for regret! The third conundrum is the problem of "impossible to trisect an angle", as the one of "impossible to draw by three rulers and compasses" which was recorded in books before. Now, I am certain with enough proofs that the historical conclusion of "impossible to trisect an angle" drawn by mathematicians in the world, for several thousand years, is wrong completely! It is mainly because that cognition on the regularity of drawings is limited in most people, "What doesn't know about its regularity, it is impossible to draw", namely, "you know the hows, you know how to do it". As for the first three conundrums, "know this matter but don't know why this is so", namely, "know the hows but don't know the whys". What is the "internal regularity" of these four conundrums respectively? What is the symbol to do and how to give the proof? I will present my answers and prove one by one in this book.

This book is easy to understand, and students of senior middle school can understand all, students of junior middle school can understand mostly, so it is even a popular science book for students of university, and math fans.

I'm very thankful to leaders of Dalian Publishing House with their great supports during publishing this book, and especially thankful to the editor and staffs for the helpful supports in publishing and translating.

He Baoqi
February, 2012

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Part I

四色定理
Four-colour Theorem

第一章　四色定理

第一节　问题的提起

据介绍，现在国际上所称谓的“四色定理”，是被公认为已被证明了的。但是起初问题提出时，是被称为“世界三大数学难题”之一的“四色猜想”。英国伦敦大学毕业的弗南西斯·格思里来到一家科研单位进行地图着色时发现，每幅地图都可以用四种颜色着，使得有共同边界的国家着上不同的颜色。1852 年，“四色猜想”正式提出。

我们都知道，自问题提出后，国际上的数学家们有不计其数的所谓对四色定理的“证明”，而最著名的是被传颂的 1976 年美国数学家阿佩尔与哈肯在高速电子计算机上用 1200 个小时，作了 100 亿次判断的所谓终于“完成了四色定理证明”。但是，在我看来，100 亿次只是个“1”字当头的 11 位数，比起 100 个国家的全排列种数，只不过是大海之一滴（当每个国家的大小、形状一定时，全排列种数是“9”字当头的 158 位数；而当每个国家的大小、形状不定，千变万化时，这 100 个国家的全排列种数是 158 位数的无限大次乘方数）。1200 个小时，按单机每天工作 8 小时计算，要用 150 天，而要完成158位数的无限大次乘方次的判断，即使他们子子孙孙代代

Chapter I Four-colour Theorem

§ 1 Statement of the Problem

According to the introduction, "Four-colour Theorem" in the world was acknowledged to be proven. However, it was raised firstly as "Four-colour Conjecture", which was called one of three math mysteries in the world. Francis Guthrie of University of London found that every map can be put with four colours to enable those countries with common borderline painted in different colours, when he was in a technology institute for colouring map. So this problem was put forward formally in 1852.

As we know, after the problem was put forward, innumerable mathematicians in the world gave the "proof". In which the best remarkable and being widely read, is that American mathematicians Kenneth Appel and Wolfgang Haken carried out 10 billion times of judgement on a computer and finally "finished the proof of Four-colour Theorem". However, in my opinion, 10 billion times only just a 11-digit number with the head of 1, comparing with permutation kinds of all 100 countries, just is a drop in the sea (if the size, shape of every country are fixed, permutation kinds of all 100 countries reach 158-digit with the head of 9; but assume the size, shape of every country are changed in various way, permutation kinds of all 100 countries will be ∞ power of 158-digit). As for 1200 hours, a computer will run 150 days as per calculation of 8 hours a day, assume it wants to finish judgement of ∞ power of 158-digit times, it needs all efforts of their generation after generation of descendants, but it may not be finished! Therefore, the

无穷地接力下去，也是永远无法完成的！因而，100 亿次的判断只是个别实例的实验，只是重复地知道是“这么回事”，而不知道“为什么会是这么回事？”这就是“知其然，而不知其所以然！”它绝不是什么“完成了四色定理证明”，因为这根本不是揭示其规律性的、完全彻底的证明！

第二节　四色定理的证明

四色定理——有共同边界的两个邻国，必须着不同颜色，每幅地图各国着色共用四色即可。

证明：

1. 如有 A、B 两国相邻（有共同边界，下同），如图 1.1，这时着色必用二色。

2. 如有 A、B、C 三国同时互为邻国时（任意两国同时为邻国），如图 1.1，这时必用三色。

3. 如在 2 的情况下，又有第四国 D 国出现，要与 A、B、C 国都同时为邻国时，D 国必须包围 A、B、C 其中一国（如图 1.1 中的 C 国）才能实现 A、B、C、D 四国任意两国同时为邻国，这时必用四色。

4. 若在 3 的情况下，又有第五国 E 国出现时，在 A、B、C、D 四国周围至多可达到与其中三国（如图 1.1 与 A、B、D 国）同时两两互为邻国，而与被前国所包围的 C 国不能为邻国，即可与其用同一颜色，所以，这时仍用四色即可，不需用第五色。同样，如第六

judgement of 10 billion times only is an experiment by individual examples, only repeat to know "also folgendes", but don't know why. This is that "know the hows but don't know the whys". So it is not a "finished proof of Four-colour Theorem" at all, because it is not a complete proof to reveal the regularity!

§ 2 Proof of Four-colour Theorem

Four-colour Theorem——Two neighboring countries with common borderline must be coloured with different colours, and the total colours in map are presented no more than four.

Demonstration:

1. Set two neighboring countries A and B (with common borderline, the same below), as shown in Fig. 1.1, here, colouring them in two colours.

2. Set three neighboring countries A, B and C mutually with common borderline (any two countries are neighboring), as shown in Fig. 1.1, here, colouring them in three colours.

3. In the case of 2, assume there is another country D which is neighboring with A, B and C mutually, D must share borderlines with A, B or C (refer to C in Fig. 1.1), colouring four countries mutually in four colours.

4. In the case of 3, assume there is the fifth country E which is neighboring at most with the three countries among A, B, C and D mutually (as shown in Fig. 1.1, with A, B and D), here, for it fails to be neighboring with C which is shared by the former country, so it can use the same colour with C. Therefore in this case, it is also OK with four colours, not necessary to use another colour. Similarly, assume here is the sixth country F which is neighboring at most with the three countries among A, B, C, D and E (as shown in Fig. 1.1, with B, D and E) in the way that the two countries are neighboring mutually, here, for it fails to be neighboring with A and C which are shared by the former countries, so it can use the same colour with them, not necessary to use