Foreword to the Second Edition

The first edition of this book (May 2007) introduced a conceptual framework for Sudoku solving, where "resolution rules" played a central role. All the concepts were formalised in Predicate Logic (FOL), which (surprisingly) was a new idea: all the books and Web forums had always considered Propositional Logic was enough. The concepts were also straightforwardly grounded in the notions every player uses when solving a puzzle. This framework (unchanged in this second edition) was thus totally player oriented from the start; it can be considered as a mere formalisation of what has always been looked for when it is said a "pure logic solution" is wanted.

On the practical side, the book also introduced new resolution rules, based on natural generalisations of the famous xy-chains, such as xyt-, xyz- and zyzt- chains; contrary to those proposed in the current literature, these were not based on subsets. The systematic clarification and exploitation of all the generalised symmetries of the game also led to a new source of generalisation and provided the "hidden" counterparts of the previous chains. After the first edition was published, I devised a further generalisation, pushing the idea of super-symmetry to its maximal extent and allowing to solve almost any puzzle with short chain patterns. Giving a systematic presentation of these new rules (which I had introduced less formally on Web forums) was the main reason for this second edition; and this provided the occasion for local improvements of the parts already present in the first.

What has been changed in the second edition

Let us state the main modifications that have been made in Parts One to Three:
– the graphics have been improved, especially for the grids with candidates;
– the extended Sudoku board defined in chapter II, the way to build and use it in practice, which were previously only available on my Web pages, have been fully

integrated into the book; moreover, they are now explicitly used in several examples, making the whole book more obviously player oriented;

– a new notation, the "nrc notation", is now used for displaying the solution paths of all the examples; being more compact, it allowed the introduction of Part Four without significantly increasing the total number of pages.

What has been added

Part Four of this second edition is completely new:

– the newest topic is "3D" chains (chapters XXII and XXIII); these are the fully super-symmetric extensions, or the 3D counterparts, of all the 2D chains introduced in the first edition (which could be spotted as sequences of cells in either of the rc-, rn-, cn-, and bn- spaces); as 3D chains are more general but also more complex and more difficult to spot on a real grid than the 2D chains of the same length, they take place above them in a complexity hierarchy; they do not replace them; this is why Parts One to Three have been kept unchanged, apart from the presentation details mentioned above; the new 3D chains, even limited to short lengths, allow to solve almost all the puzzles (99% of the random minimal puzzles with chains of length no more than five and 99.9% with chains of length no more than seven);

– chapter XXIV comments some features of the general conceptual framework of this book: the purely factual basic predicates; the concepts of a knowledge state and of a resolution rule; the misleading notion of a chain of inferences, as it appears too often on Web forums; the difference between proving a rule and finding its occurrences; the way our approach allows to unify two apparently conflicting views of chains (chains of cells versus chains of candidates); it also introduces a few factual properties of chains that may have an impact on their practical usefulness;

– resolution rules say what is legitimate and what patterns should be looked for; but they don't always say very explicitly where or how to find these patterns; chapter XXIV introduces the idea that one or more resolution technique(s) can be the implementation of a resolution rule and can thus help find the occurrences of its underlying pattern on a real grid; it gives precise examples for chains, building on classical ideas of colouring and tagging (for fans of such techniques);

– Trial and Error (T&E) is anathemised by purists who want only "pure logic solutions"; it was so obvious for me that its full version, recursive Trial and Error (rT&E), which is guaranteed to produce a solution if there is any, cannot be defined by a resolution rule that I didn't even think of elaborating on this idea in the first edition; a theorem and some comments on this can now be found in chapter XXIV, where the concept of a resolution rule appears to allow a clear theoretical separation between a "pure logic solution" and rT&E.