Module: Sudoku

This module is covered in supplementary material gathered from Wikipedia ("http://en.wikipedia.org/wiki/Sudoku") and OpenSky ("http://www.opensky.ca/~jdhildeb/software/sudokugen/"): The goals are to

- Learn how to play Sudoku
- Learn about marking
- Learn about scanning

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It is inconceivable that one would solve Sudoku with a pen; you will need to use a pencil and an eraser.

The best Sudoku on the web is at the Washington Post site:
http://www.uclick.com/client/wpc/wpdoc/

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Sudoku

From Wikipedia, the free encyclopedia

A Sudoku puzzle...

Sudoku is a logic-based combinatorial number-placement puzzle. The objective is to fill a 9×9 grid so that each column, each row, and each of the nine 3×3 boxes (also called blocks or regions) contains the digits from 1 to 9 only one time each. The puzzle setter provides a partially completed grid.

Completed puzzles are usually a type of Latin square with an additional constraint on the contents of individual regions. Leonhard Euler is sometimes incorrectly cited as the source of the puzzle, based on his related work with Latin squares.

The modern puzzle was invented by an American architect, Howard Garns, in 1979 and published by Dell Magazines under the name "Numbers in Place."[5] It was popularized in 1986
by the Japanese puzzle company Nikoli, under the name Sudoku, meaning single number.\[6\] It became an international hit in 2005.\[7\]

**History**

Number puzzles first appeared in newspapers in the late 19th century, when French puzzle setters began experimenting with removing numbers from magic squares. Le Siècle, a Paris-based daily, published a partially completed 9×9 magic square with 3×3 sub-squares on November 19, 1892.\[8\] It was not a Sudoku because it contained double-digit numbers and required arithmetic rather than logic to solve, but it shared key characteristics: each row, column and sub-square added up to the same number.

On July 6, 1895, Le Siècle's rival, La France, refined the puzzle so that it was almost a modern Sudoku. It simplified the 9×9 magic square puzzle so that each row, column and broken diagonals contained only the numbers 1–9, but did not mark the sub-squares. Although they are unmarked, each 3×3 sub-square does indeed comprise the numbers 1–9 and the additional constraint on the broken diagonals leads to only one solution.\[9\]

These weekly puzzles were a feature of newspaper titles including L'Echo de Paris for about a decade but disappeared about the time of the First World War.\[10\]

According to Will Shortz, the modern Sudoku was most likely designed anonymously by Howard Garns, a 74-year-old retired architect and freelance puzzle constructor from Indiana, and first published in 1979 by Dell Magazines as Number Place (the earliest known examples of modern Sudoku). Garns's name was always present on the list of contributors in issues of Dell Pencil Puzzles and Word Games that included Number Place, and was always absent from issues that did not.\[11\] He died in 1989 before getting a chance to see his creation as a worldwide phenomenon.\[11\] It is unclear if Garns was familiar with any of the French newspapers listed above.

The puzzle was introduced in Japan by Nikoli in the paper Monthly Nikolist in April 1984\[11\] as Suuji (or suji) wa dokushin ni kagiru, which can be translated as "the digits must be single" or "the digits are limited to one occurrence." At a later date, the name was abbreviated to Sudoku
by Maki Kaji, taking only the first kanji of compound words to form a shorter version.[11] In 1986, Nikoli introduced two innovations: the number of givens was restricted to no more than 32, and puzzles became "symmetrical" (meaning the givens were distributed in rotationally symmetric cells). It is now published in mainstream Japanese periodicals, such as the Asahi Shimbun.

Mathematics of Sudoku

A completed Sudoku grid is a special type of Latin square with the additional property of no repeated values in any of the 9 blocks of contiguous 3×3 cells. The relationship between the two theories is now completely known, after Denis Berthier proved in his book, "The Hidden Logic of Sudoku" (May 2007), that a first order formula that does not mention blocks (also called boxes or regions) is valid for Sudoku if and only if it is valid for Latin Squares (this property is trivially true for the axioms and it can be extended to any formula). (Citation taken from p. 76 of the first edition: "any block-free resolution rule is already valid in the theory of Latin Squares extended to candidates" - which is restated more explicitly in the second edition, p. 86, as: "a block-free formula is valid for Sudoku if and only if it is valid for Latin Squares").

The first known calculation of the number of classic 9×9 Sudoku solution grids was posted on the USENET newsgroup rec.puzzles in September 2003[12] and is 6,670,903,752,021,072,936,960 (sequence A107739 in OEIS). A detailed calculation of this figure was provided by Bertram Felgenhauer and Frazer Jarvis in 2005.[13] Various other grid sizes have also been enumerated—see the main article for details. The number of essentially different solutions, when symmetries such as rotation, reflection, permutation and relabelling are taken into account, was shown by Ed Russell and Frazer Jarvis to be just 5,472,730,538[14] (sequence A109741 in OEIS).

The maximum number of givens provided while still not rendering a unique solution is four short of a full grid; if two instances of two numbers each are missing and the cells they are to occupy form the corners of an orthogonal rectangle, and exactly two of these cells are within one region, there are two ways the numbers can be assigned. Since this applies to Latin squares in general, most variants of Sudoku have the same maximum. The inverse problem—the fewest givens that render a solution unique—is unsolved, although the lowest number yet found for the standard variation without a symmetry constraint is 17, a number of which have been found by Japanese puzzle enthusiasts,[15][16] and 18 with the givens in rotationally symmetric cells. Over 48,000 examples of Sudokus with 17 givens resulting in a unique solution are known.

[edit]Recent popularity

In 1997, retired Hong Kong judge Wayne Gould, 59, a New Zealander, saw a partly completed puzzle in a Japanese bookshop. Over six years he developed a computer program to produce puzzles quickly. Knowing that British newspapers have a long history of publishing crosswords and other puzzles, he promoted Sudoku to The Times in Britain, which launched it on 12 November 2004 (calling it Su Doku). The first letter to The Times regarding Su Doku was published the following day on 13 November from Ian Payn of Brentford, complaining that the puzzle had caused him to miss his stop on the tube.

The rapid rise of Sudoku in Britain from relative obscurity to a front-page feature in national newspapers attracted commentary in the media and parody (such as when The Guardian's G2 section advertised itself as the first newspaper supplement with a Sudoku grid on every
Recognizing the different psychological appeals of easy and difficult puzzles, The Times introduced both side by side on 20 June 2005. From July 2005, Channel 4 included a daily Sudoku game in their Teletext service. On 2 August, the BBC's programme guide Radio Times featured a weekly Super Sudoku which features a 16x16 grid.

Even the Greeks owe the publication of their first Sudoku magazine to British influence. It was at Heathrow airport in the middle of 2005 that Greek computer magazine publisher Compupress first laid eyes on a British Sudoku magazine and – realizing the opportunity – proceeded to purchase the necessary software and quickly launch the first local Sudoku magazine, which became an instant success.[citation needed]

In the United States, the first newspaper to publish a Sudoku puzzle by Wayne Gould was The Conway Daily Sun (New Hampshire), in 2004.[18]

The world's first live TV Sudoku show, 1 July 2005, Sky One.

The world's first live TV Sudoku show, Sudoku Live, was a puzzle contest first broadcast on 1 July 2005 on Sky One. It was presented by Carol Vorderman. Nine teams of nine players (with one celebrity in each team) representing geographical regions competed to solve a puzzle. Each player had a hand-held device for entering numbers corresponding to answers for four cells. Phil Kollin of Winchelsea, England was the series grand prize winner taking home over £23,000 over a series of games. The audience at home was in a separate interactive competition, which was won by Hannah Withey of Cheshire.

Later in 2005, the BBC launched SUDO-Q, a game show that combines Sudoku with general knowledge. However, it uses only 4x4 and 6x6 puzzles.

In 2006, a Sudoku website published songwriter Peter Levy's Sudoku tribute song,[19] but quickly had to take down the mp3 due to heavy traffic. British and Australian radio picked up the song, which is to feature in a British-made Sudoku documentary. The Japanese Embassy also nominated the song for an award, with Levy doing talks with Sony in Japan to release the song as a single.[20]

Sudoku software is very popular on PCs, websites, and mobile phones. It comes with many distributions of Linux. Software has also been released on video game consoles, such as the Nintendo DS, PlayStation Portable, the Game Boy Advance, Xbox Live Arcade, several iPod models, and the iPhone. In fact, just two weeks after Apple, Inc. debuted the online App Store within its iTunes store on July 11, 2008, there were already nearly 30 different Sudoku games, created by various software developers, specifically for the iPhone and iPod Touch. One of the most popular video games featuring Sudoku is Brain Age: Train Your Brain in Minutes a Day!. Critically and commercially well received, it generated particular praise for its Sudoku
implementation[1][2][3] and sold more than 8 million copies worldwide.[4] Due to its popularity, Nintendo made a second Brain Age game titled Brain Age 2, which has over 100 new sudoku puzzles and other activities.

In June 2008 an Australian drugs-related jury trial costing over AU$1 000 000 was aborted when it was discovered that five of the twelve jurors had been playing Sudoku instead of listening to evidence.[21]

**Competitions**

- The first World Sudoku Championship was held in Lucca, Italy, from March 10-12, 2006. The winner was Jana Tylová of the Czech Republic.[22] The competition included numerous variants.[23]
- The second World Sudoku Championship was held in Prague from March 28 to April 1, 2007.[24] The individual champion was Thomas Snyder of the USA. The team champion was Japan.[25]
- Hosted by renowned puzzle master Will Shortz, The Philadelphia Inquirer Sudoku National Championship was the first U.S. Sudoku Championship. Thomas Snyder was the winner of the expert division, receiving $10,000 and a spot on the U.S. National Sudoku Team at the 2008 World Sudoku Championship in India.[26]
- The third World Sudoku Championship was held in Goa, India, from April 14-16, 2008. Thomas Snyder repeated as the individual overall champion, and also won the first ever Classic Trophy (a subset of the competition counting only classic Sudoku). The Czech Republic won the team competition.[27]
- United Kingdom newspapers have run several national Sudoku competitions, the most prominent is run by The Times. Nina Pell won the first contest, in 2005, followed by Rachel Roth, in 2006, and Tom Collyer, in 2007. Nina regained her title on September 13, 2008, at the Institute of Education, part of the University of London. In finishing order, the eight grand finalists were: Nina Pell, Howard Granville, Maxwell Rock, George Danker, David Collison, Pippa Wassall, Jason Shannon and Ross Pope.
- The 4th World Sudoku Championship was held in Žilina, Slovakia, from April 24-27, 2009. After past champion Thomas Snyder of USA won the general qualification, Jan Mrozowski of Poland emerged from a 36-competitor playoff to become the new World Sudoku Champion. Host nation Slovakia emerged as the top team in a separate competition of three-membered squads.[28]