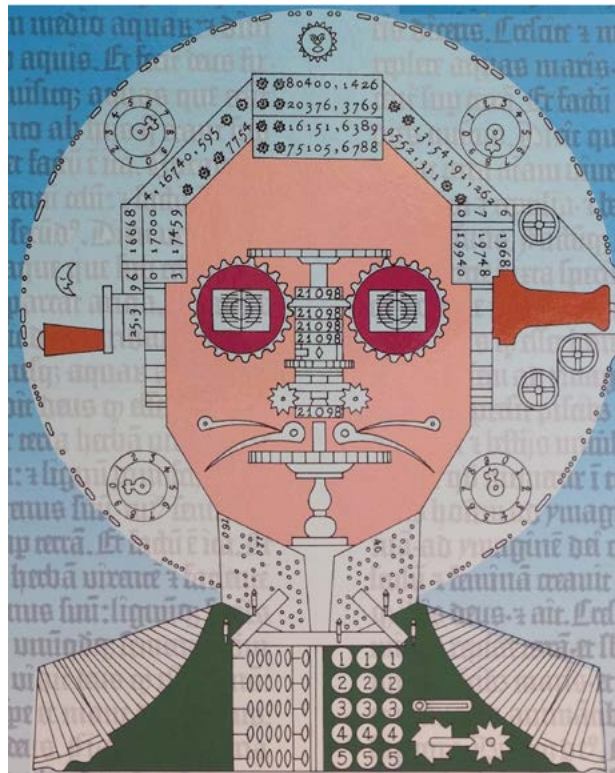


*Catalogue 82:
Classics of Artificial Intelligence &
Mathematical Logic*



HistoryofScience.com

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Query: What is the relationship between artificial intelligence and mathematical logic?

ChatGPT: The relationship between artificial intelligence (AI) and mathematical logic is significant, as mathematical logic forms the foundation for many aspects of AI. Here are some key points regarding their relationship:

Logical Reasoning in AI: Mathematical logic, especially classical logic, is employed in AI for logical reasoning. It provides a formal framework for representing and manipulating knowledge, making it a crucial component in various AI applications.

Knowledge Representation: AI systems need to represent knowledge in a structured and formal manner. Mathematical logic, such as predicate logic, is commonly used for this purpose. It allows the expression of relationships and rules in a way that can be processed by AI algorithms.

Inference and Deduction: Inference and deduction play a vital role in AI systems, helping them derive new information from existing knowledge. Logical systems, including propositional and first-order logic, are used to model and perform deductive reasoning in AI.

Automated Reasoning: Mathematical logic is fundamental to automated reasoning, which involves creating algorithms and systems that can make logical inferences. AI systems often use automated reasoning to draw conclusions, solve problems, and make decisions based on logical rules.

Formal Methods: Formal methods, which involve mathematically rigorous techniques for system specification, verification, and validation, are employed in AI development. Mathematical logic provides a foundation for these formal methods, ensuring the correctness and reliability of AI systems.

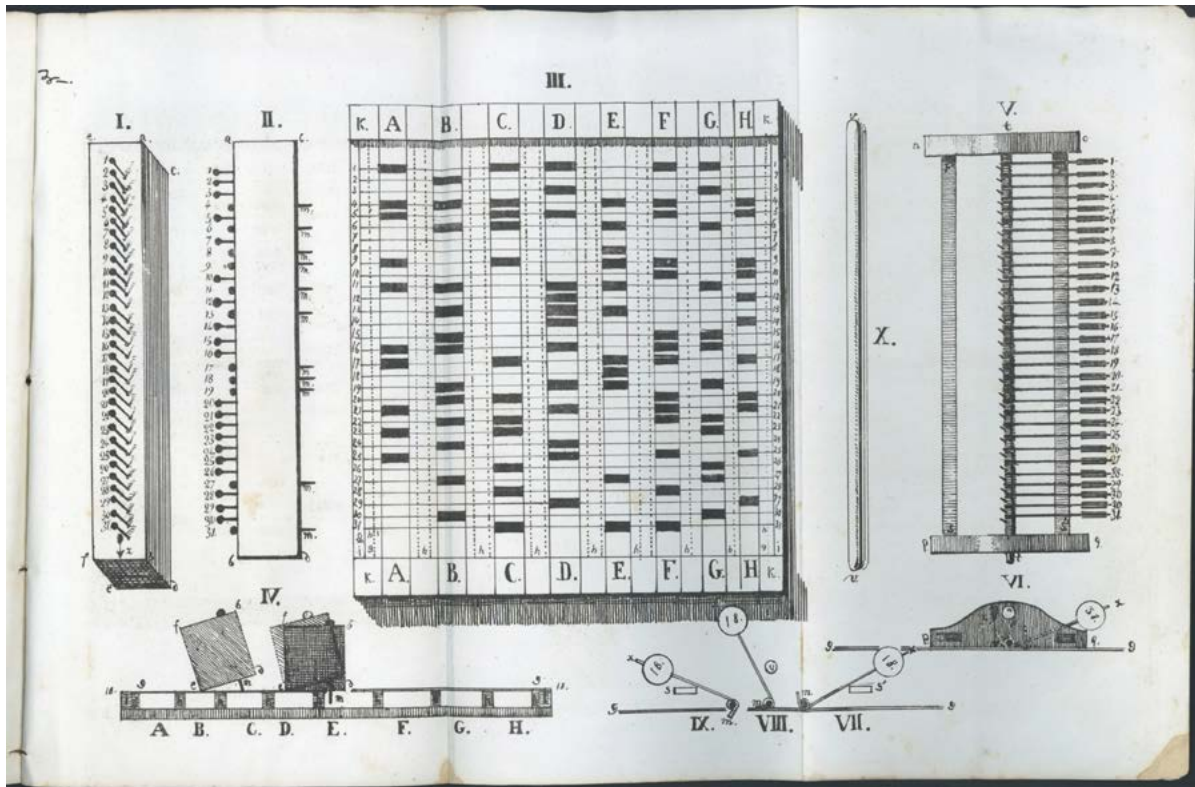
Constraint Logic Programming: Constraint logic programming is a paradigm used in AI for solving complex problems by specifying constraints on variables. It combines aspects of mathematical logic and programming, allowing for efficient problem-solving in various domains.

Machine Learning and Logic: While machine learning (a subset of AI) often relies on statistical methods, there is an increasing interest in combining machine learning with logical reasoning. Integrating logic into machine learning models can enhance their interpretability and enable more transparent decision-making processes.

Modal Logic in AI: Modal logic, a branch of mathematical logic, is used in AI to handle notions of necessity and possibility. It finds applications in representing and reasoning about knowledge and beliefs in multi-agent systems.

In summary, mathematical logic provides a formal and rigorous framework for representing, reasoning, and solving problems in artificial intelligence. It underlies various AI techniques and methodologies, contributing to the development of intelligent systems that can perform logical reasoning, inference, and decision-making.

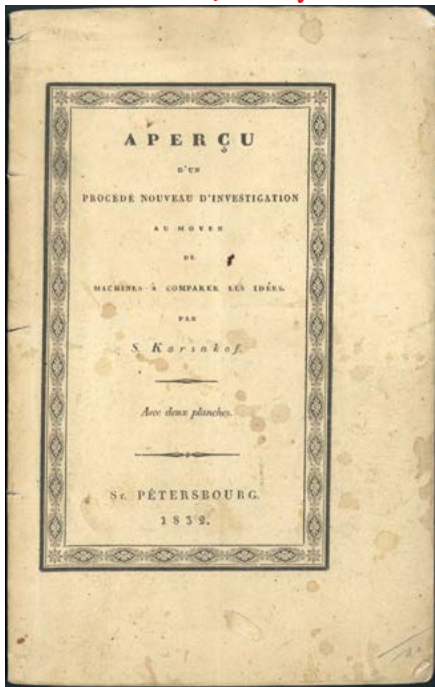
The catalogue is arranged in chronological order



1832

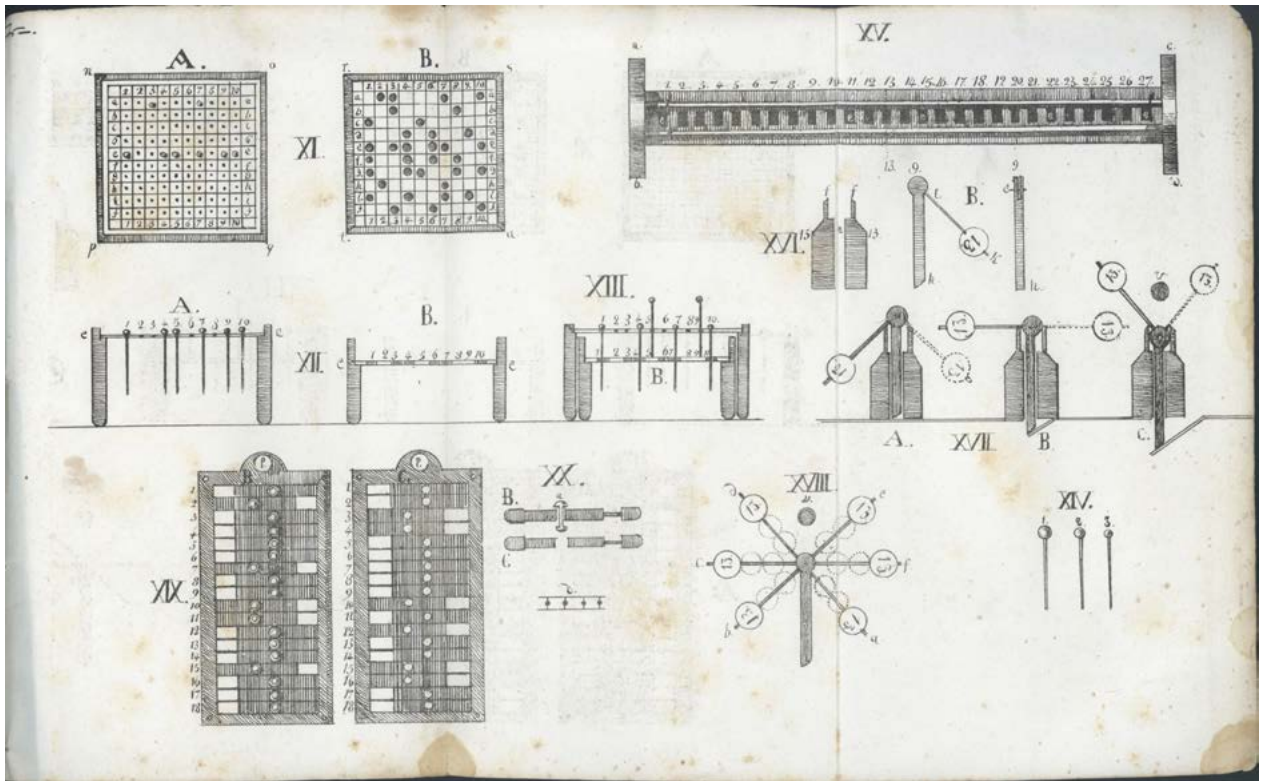
First Step Toward Artificial Intelligence; First Use of Punched-Card Technology to Store Information

1. **Korsakov, Semyon Nikolaievich** (1787-1853). Aperçu d'un procédé nouveau d'investigation au moyen de machines à comparer les idées. [2], 22pp. 2 folding plates. St. Petersburg: De l'imprimerie de la III-me section de la chancellerie privée de Sa Majesté Impériale, 1832. 213 x 135 mm. Original printed wrappers, vertically creased, some spotting. Minor foxing and dampstaining, but very good. \$35,000



First Edition, Extremely Rare, with no copies cited in North American or European libraries in OCLC and no auction records in Rare Book Hub. Korsakov, a statistician with the Russian Police Ministry in St. Petersburg, was a pioneer in the concept of “mechanized thought,” or artificial intelligence. His “machines for comparing ideas,” described and illustrated in the present pamphlet, can “be considered as the very first attempt to design a mechanical device capable to perform such intellectual operations as data analysis, comparison, and selection” (Shilov and Silantiev, p. 71).

While working in the statistics department of the Police Ministry, Korsakov became intrigued with the possibility of using machinery to ‘enhance natural intelligence.’ To this end, he devised several devices which he called ‘machines for the comparison of ideas.’ These included the ‘linear homeoscope with movable parts,’ the ‘linear homeoscope without movable



parts,' the 'flat homeoscope,' the 'ideoscope,' and the 'simple comparator.' The purpose of the devices was primarily to facilitate the search for information, stored in the form of punched cards or similar media (for example, wooden boards with perforations). Korsakov announced his new method in September 1832, and rather than seeking patents offered the machines for public use.

The punch card had been introduced in 1805, but until that time had been used solely in the textile industry to control looms. Korsakov was reputedly the first to use the cards for information storage ("Semyon Korsakov." Revolv, www.revolv.com/page/Semyon-Korsakov [accessed 1/2/19]).

Korsakov's work in this area has remained largely unstudied until fairly recently. Shilov and Silantiev, "Machines à comparer les idées' of Semen Korsakov: First step towards AI," in Tatnall and Leslie, eds., *International Communities of Invention and Innovation* (Cham: Springer-Verlag, 2016), pp. 71-86). 44771

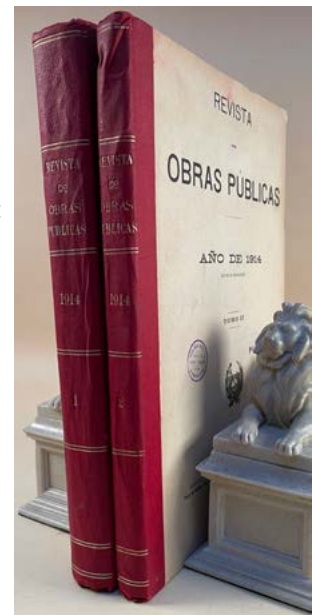
1914

Torres Quevedo's Most Important Paper on Automation Theory

2. Torres Quevedo, Leonardo (1852-1936). Automática: Complemento de la teoría de la máquinas. In *Revista de obras públicas* 62, part 1 (1914): 575-583. Whole volume. Text illustrations. 346 x 257 mm. Original quarter cloth, printed boards, corners worn, light spotting. Very good to fine.

\$750

Second edition. In the early twentieth century, as the first mass production lines were being set up in factories, the Spanish inventor Leonardo Torres Quevedo "was demonstrating a theory of automata that looked beyond assembly lines to the industrial use of programmed machines. To prove that machines could do jobs that seemed to require mental ability, he combined electromechanical calculating techniques with his principles of automata, and showed how a machine could be assembled to perform any desired sequence of arithmetic operations" (Eames and Eames, *A Computer Perspective: Background to the Computer Age*, p. 66).



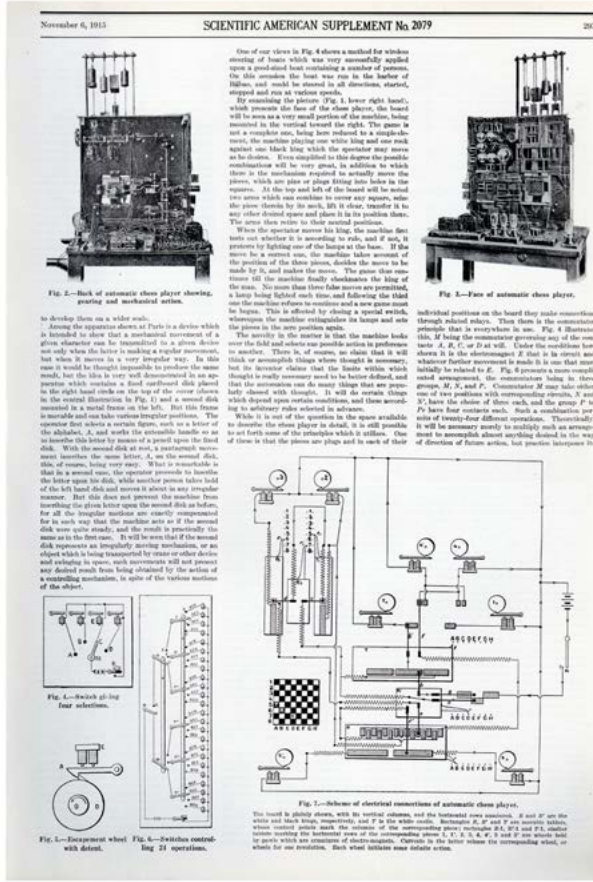


In 1913 Torres Quevedo published his most important paper on automation theory, “Ensayos sobre automática” (*Revista de la Real Academia de ciencias exactas, físicas y naturales* 12: 391-418), the second edition of which we are offering here (the 1914 version was given a different title, but the text is the same as the 1913 version). In it he described his design for a special-purpose electromechanical calculator based on Babbage’s Analytical Engine, and introduced “almost casually” (Randell, p. 335) the idea of floating-point arithmetic, a method of computing that uses integers of fixed precision (for example, 5 digits) scaled by an integer exponent of a fixed base (for example, base 2). Floating-point arithmetic, an essential part of a computer system, allows the rapid calculation of very small or very large numbers—for example, the number of distance units between galaxies or between protons in an atom.

A French translation of Torres Quevedo’s paper was published in 1914, and an English translation is included in Randell’s *The Origins of Digital Computers* (1973). Randell, “From Analytical Engine to electronic digital computer: The contributions of Ludgate, Torres, and Bush,” *Annals of the History of Computing* 4 (1982): 327-341. 51692

3. [Torres Quevedo, Leonardo (1852-1936).] Torres and his remarkable automatic devices:

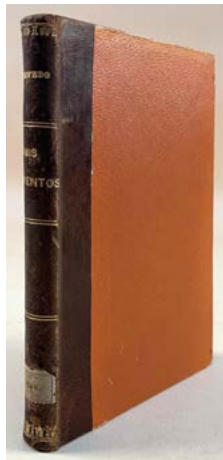
He would substitute machinery for the human mind. In *Scientific American* 80, supplement no. 2079 (6 November 1915): 296-298. Whole number. 390 x 276 mm. Disbound from volume, original front wrapper preserved, stitching holes in left margin. Very good. \$500



First Edition of what is probably the first account in English of Torres Quevedo's automatic chess player ("El Ajedrecista") of 1912, an electromagnetic device that pitted a rook and king against the king of its human opponent. Torres's chess player demonstrated the ability of machines to be programmed to follow specified rules, and marks the beginning of research into the development of artificial intelligence. "Mr. Torres claims that he can make an automatic machine which will 'decide' from among a great number of possible movements to be made, and he conceives such devices, which if properly carried out, would produce some astonishing results. Interesting even in theory, the subject becomes of great practical utility, especially in the present progress of the industries . . . he wishes to prove that there is scarcely any limit to which automatic apparatus may not be applied, and that at least in theory, most or all of the operations of a large establishment could be done by machine, even those which are supposed to need the intervention of a considerable intellectual capacity" (p. 296). 51700

4. Torres Quevedo, Leonardo (1852-1936). Mis inventos y otras páginas de vulgarización.

157pp. Madrid: Editorial Hesperia, 1917. 182 x 116 mm. Quarter morocco, boards ca. 1917, gilt spine, light rubbing and edgewear. Minor staining on half-title and title, light toning, but very good. Ownership stamp on title. \$450



First Edition. Among Torres Quevedo's first inventions were several analog algebraic equation solvers, built between 1893 and 1920, which were composed of both mechanical and electromechanical elements and could solve algebraic equations of any degree. In 1911 he invented the first decision-making automaton—a chess-playing machine that pitted the machine's rook and king against the king of a human opponent. These machines, as well as several others, are described in *Mis inventos*, a work of popular science intended for the general reader. 51679

1920

The Löwenheim-Skolem Theorem

5. Skolem, Thoralf (1887-1963). Logisch-kombinatorische Untersuchungen über der Erfüllbarkeit und Beweisbarkeit mathematischer Sätze nebst einem Theoreme über dichte Mengen. Offprint from *Skrifter utgit av Videnskabselskapet i Kristiania, I. Matematisk-naturvidenskabelig klasse*, 4 (1920). 36pp. 274 x 182 mm. Later wrappers, but very good otherwise. \$3750

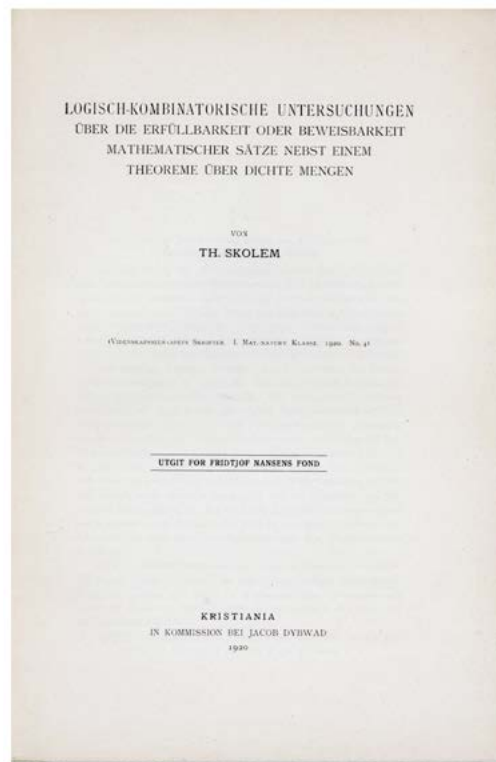
First Edition, Offprint Issue. “Many logicians would agree that Skolem and Gödel are the two greatest logicians of the [20th] century” (Wang, p. 119). In the present paper, Skolem “proved the theorem which is now known as the Löwenheim-Skolem theorem. Briefly, this states that if a finite or countable infinite set of sentences formalized within a first order predicate calculus is satisfiable (or, in other terminology, has a model), then the sentences are satisfiable within a countable domain” (Fenstad, p. 102). Another way of phrasing the theorem would be to state that if a theory has a model, then it has a countable model. The Löwenheim-Skolem theorem is one of the foundations of automated theorem proving.

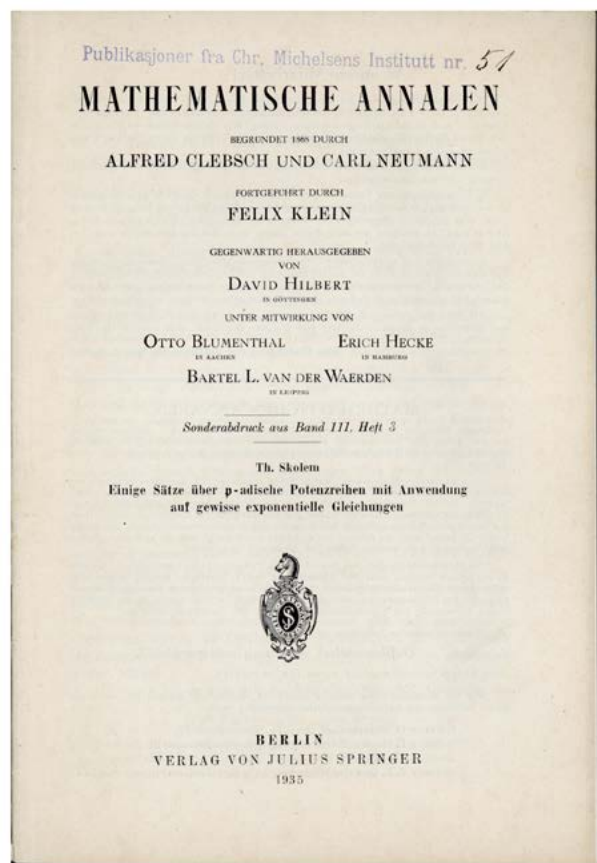
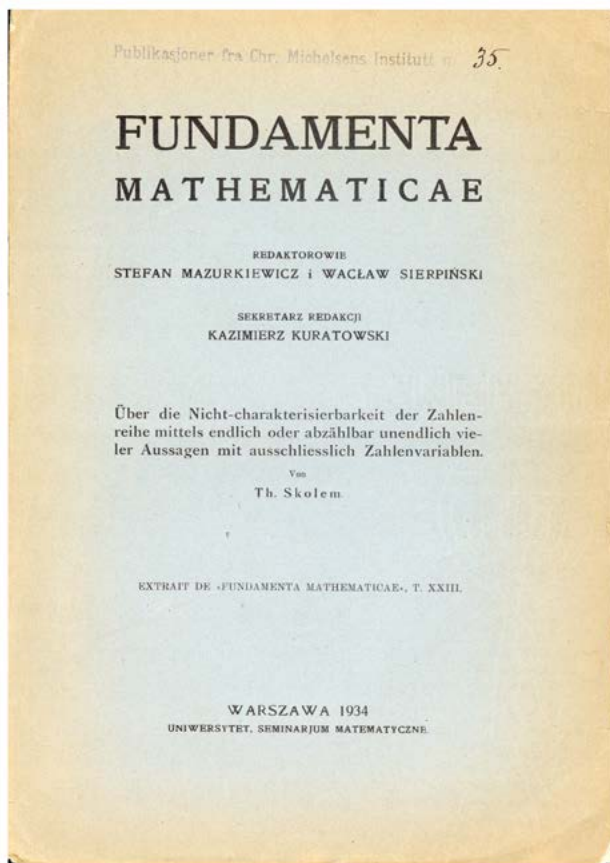
“The key work for automated deduction was that of Skolem. He carried out a systematic study of the problem of the existence of an interpretation which will satisfy a given formula of the predicate calculus, or, as one says, whether the given formula is satisfiable” (Davis, p. 9).

Skolem was an exception to the rule that mathematicians do their best work when young—his first important paper dates from 1919, when he was thirty-two years old, and he continued to publish significant work until the end of his life. The papers that he published from 1920 on “gave him instant recognition as one of the foremost among logicians” (Fenstad, p. 101). M. Davis, “The prehistory and early history of automated deduction,” *Automation of Reasoning: Classical Papers on Computational Logic* (1983): 1-28. J. Fenstad, “Thoralf Albert Skolem 1887-1963: A brief biographical sketch,” *Nordic Journal of Philosophical Logic* 1 (1996): 99–106. Heijenoort, *From Frege to Gödel*, pp. 252-263 (reprinting Skolem’s paper). *Origins of Cyberspace* 365. Wang, “Skolem and Gödel,” *Nordic Journal of Philosophical Logic* 1 (1996): 119-132. 51663

1934

6. Skolem, Thoralf (1887-1963). (1) Über die Nicht-charakterisierbarkeit der Zahlenreihe mittels endlich oder abzählbar unendlich vieler Aussagen mit ausschliesslich Zahlenvariablen. Offprint from *Fundamenta mathematicae* 23 (1934). 150-161pp. Original printed wrappers. With:
(2) Einige Sätze über p -adisch Potenzreihen mit Anwendung auf gewisse exponentielle Gleichungen. Offprint from *Mathematische Annalen* 111 (1935). 399-424pp. Original printed wrappers. With:





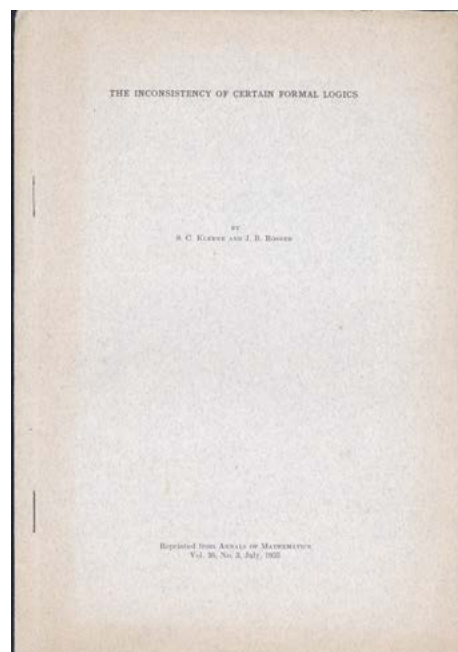
(3) Collection of 24 more offprints on mathematics and mathematical logic; click [here](#) for listing. 1930-1953. All in original wrappers except as noted in the listing. Some wrappers chipped and sunned, but overall very good. From the library of Martin Davis (1928-2023). \$2750

First Editions, Offprint Issues. Pier, *Development of Mathematics 1900-1950*, p. 699 (nos. [1] and [2]). Skolem, *Selected Works in Logic*, pp. 355-366 (no. [1] only). 51688

1935

7. Kleene, Stephen C. (1904-94); J. Barkley Rosser (1907-89). The inconsistency of certain formal logics. Offprint from *Annals of Mathematics* 36 (1935). 630-636pp. 251 x 174 mm. Original printed wrappers, lightly sunned, a few tiny tears. Very good. \$4500

First Edition, Extremely Rare Offprint Issue. “Kleene, along with Rózsa Peter, Alan Turing, Emil Post and others, is best known as a founder of the branch of mathematical logic known as recursion theory, which subsequently helped to provide the foundations of theoretical computer science. Kleene’s work grounds the study of computable functions. A number of mathematical concepts are named after him: Kleene hierarchy, Kleene algebra, the Kleene star (Kleene closure), Kleene’s recursion theorem and the Kleene fixed-point theorem. He also invented regular expressions in 1951 to describe McCull-

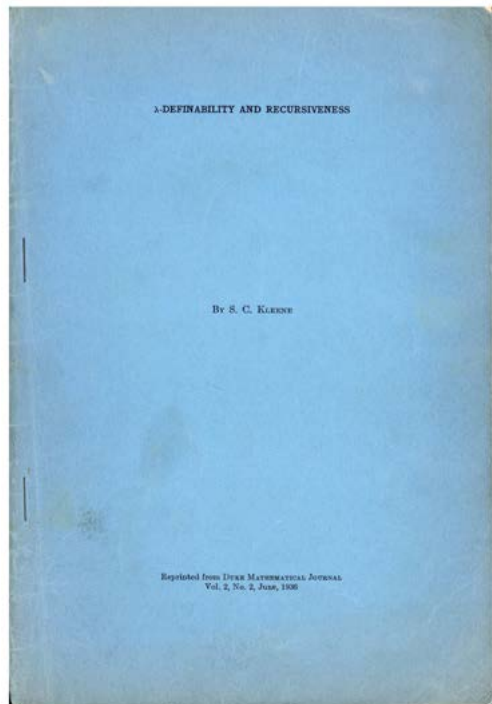


och-Pitts neural networks, and made significant contributions to the foundations of mathematical intuitionism” (Wikipedia article on Kleene).

“In mathematics, the Kleene-Rosser paradox is a paradox that shows [Alonzo] Church’s original lambda calculus is inconsistent. It is similar to Russell’s paradox, in that it is a statement that asserts its own falsehood if and only if it is true; that is, it is a self-negating statement or *reductio ad absurdum*. . . The resolution of the paradox is the recognition that recursion is central and fundamental to the notion of computation” (*Paradoxes: Situations which Defy Intuition* [online ebook]). See the Wikipedia article on the Kleene-Rosser paradox. From the library of Martin Davis. 51656

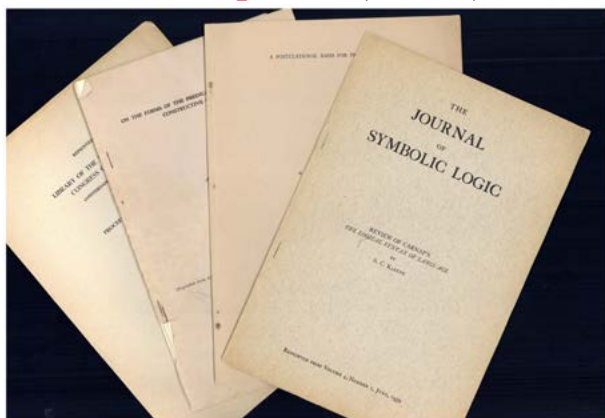
1936

- 8. Kleene, Stephen C.** (1909-94). λ -definability and recursiveness. Offprint from *Duke Mathematical Journal* 2 (1936). 340-353pp. 255 x 175 mm. Original printed wrappers, a bit soiled and worn. Very good. \$5000

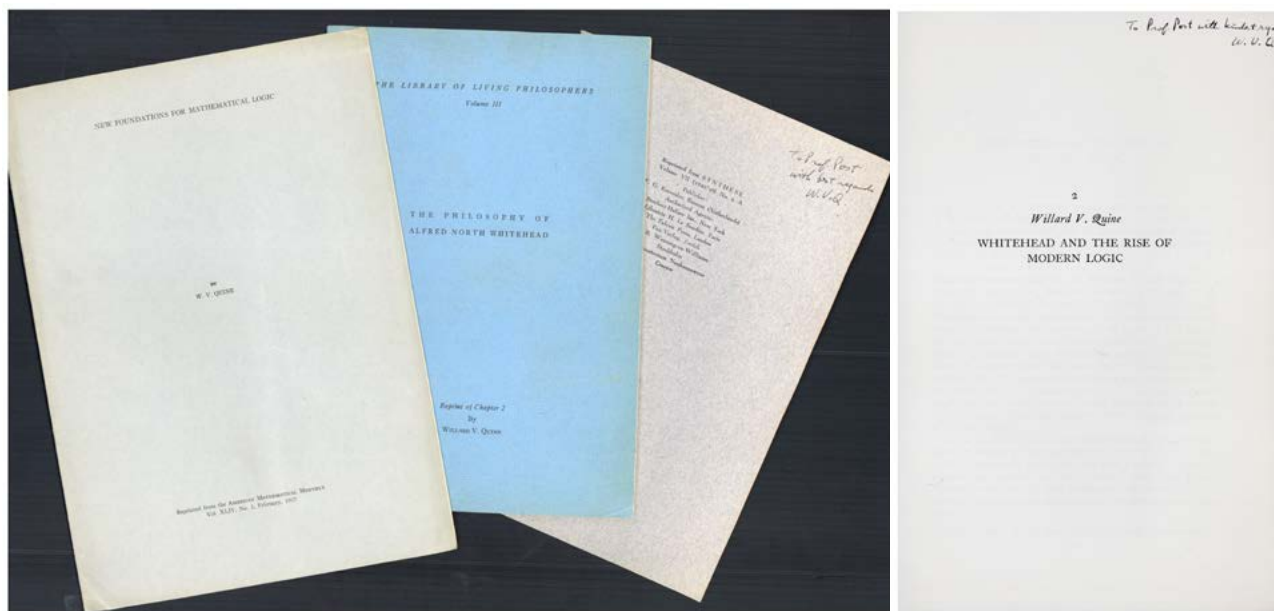


First Edition, Extremely Rare Offprint Issue. Alonzo Church’s λ -calculus, introduced just prior to Turing’s universal computing machine, is one of the first computation models. In this paper “Kleene proved in 1936 that all the computable functions (recursive functions) in the sense of Herbrand and Gödel are definable in the λ -calculus, showing that the λ -calculus has universal computing power” (*Encyclopedia of Mathematics* [online]). The following year Turing published a paper proving that Kleene’s general recursive functions, Church’s λ -definable functions and his own computable functions were all identical. From the library of Martin Davis. 51661

- 9. Kleene, Stephen C.** (1909-94). Collection of 28 offprints, pamphlets, etc. on mathematical logic, click [here](#) for listing. 1936-81. Various sizes; the largest measuring 282 x 215 mm. Original wrappers except as noted in the listing. Occasional staining and wear, but very good; see [list](#) for condition details. From the library of Martin Davis (1928-2023), with two of the offprints bearing his signature. 51695 \$3500



Selection of offprints from no. 8



Inscribed to Emil Post

10. Quine, Willard van Orman (1908-2000). (1) New foundations for mathematical logic. Offprint from *American Mathematical Monthly* 44 (1937). 70-80pp. 256 x 183 mm. Original printed wrappers. With:

(2) Whitehead and the rise of modern logic. Offprint from *The Philosophy of Alfred North Whitehead* (Evanston, IL: Northwestern University, 1941). [2], 127-163pp. 233 x 158 mm. Original printed wrappers. *Presentation Copy*, inscribed to Emil Post (1897-1954) on the first leaf: "To Prof. Post with kindest regards W. V. Q." With:

(3) On decidability and completeness. Offprint from *Synthese* 7 (1948/49). 441-446pp. 232 x 165 mm. Original printed wrappers. *Presentation Copy*, inscribed to Emil Post (1897-1954) on the front wrapper: "To Prof. Post with best regards W.V.Q."

Together 3 items. Very good apart from slight toning and creasing.

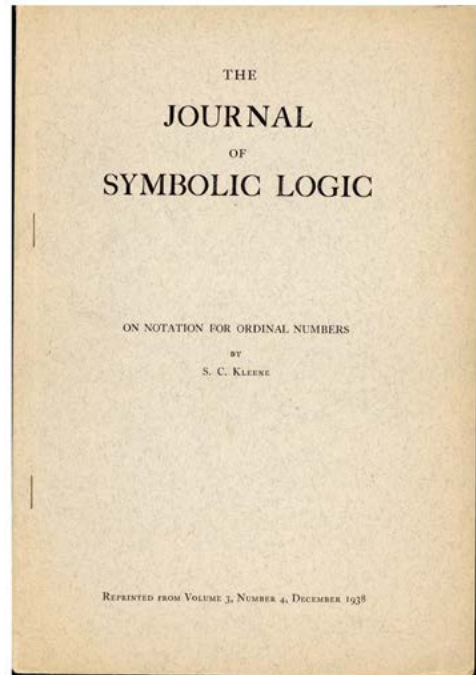
\$950

First Editions, Offprint Issues. Quine, one of the most influential American philosophers and logicians of the twentieth century, is best known in computer science for the Quine-McCluskey method (1952-55), a means of simplifying Boolean expressions used to automate the design of logical circuits and chips so as to minimize the number of gates or interconnections. Quine inscribed two of the three papers we are offering here to mathematical logician Emil Post, best known for his work in computability theory. From the library of Martin Davis. 51673

1938

11. Kleene, Stephen C. (1909-94). On notation for ordinal numbers. Offprint from *Journal of Symbolic Logic* 3 (1938). 150-155pp. 255 x 176 mm. Original printed wrappers, slightly sunned. Very good. \$2750

First Edition, Offprint Issue, extremely rare, of this classic paper in computability theory, introducing Kleene's \mathcal{O} , a canonical subset of the natural numbers when regarded as ordinal notations; it contains ordinal notations for every computable ordinal. The paper includes proofs of Kleene's recursion theorems, a pair of fundamental results about the application of computable functions to their own descriptions. From the library of Martin Davis.51658

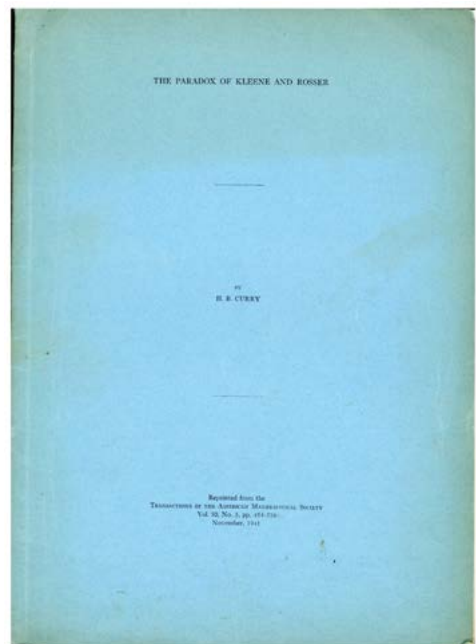


1941

12. Curry, Haskell B. (1900-1982). The paradox of Kleene and Rosser. Offprint from *Transactions of the American Mathematical Society* 50 (1941). 454-516pp. 274 x 198 mm. Original printed wrappers, a bit sunned, a few stains on back wrapper, small crease in upper left corner. Very good. \$2750

First Edition, Offprint Issue. Very rare. "Haskell Brooks Curry was a mathematical logician who developed a distinct philosophy of mathematics. Most of his work was technical: he was the major developer of *combinatory logic*, which nowadays plays a role in theoretical computer science. This formalism was originally intended to be a basis for a system of symbolic logic in the usual sense, but the original system turned out to be inconsistent, and the core which was consistent later became a formalism that is a kind of prototype of the computer languages called *functional*, in which programs are allowed to apply to and change other programs" (*Internet Encyclopedia of Philosophy*).

In 1932 Curry learned of Alonzo Church's lambda-calculus and developed his own system based on it, but in 1934 he was informed that Kleene and Rosser had proved both Church's and Curry's systems inconsistent. In the present paper Curry recognized the implication of the Kleene-Rosser paradox, which implied that the *combinatorial completeness* and *deductive completeness* properties of combinatory logic were incompatible. The next year Curry developed the Curry paradox which, together with the Kleene-Rosser paradox, played a major role in showing that formal logic systems based on self-recursive expressions are inconsistent. From the library of Martin Davis. 51666



First Editorial Cartoon to Feature an Electronic Digital Computer

13. [ENIAC.] Alexander, Franklin Osborne (1897-1993). Completed just in time. Pen-and-ink drawing for the political cartoon published in the *Philadelphia Evening Bulletin* newspaper on 22 March 1946, framed with a copy of the printed cartoon. 314 x 283 mm. (drawing); 220 x 185 mm. (printed cartoon); 648 x 403 mm. (frame). Fine. \$20,000

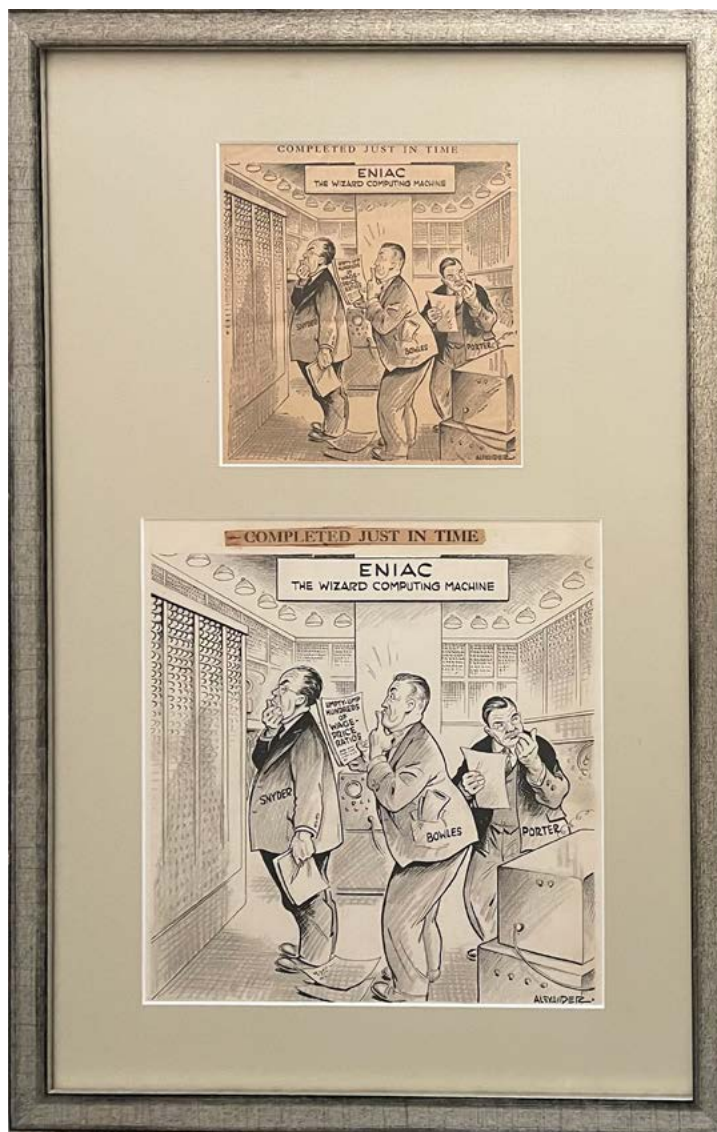
The original, unique drawing for the first cartoon depicting an electronic digital computer. The drawing comes from the personal papers of J. Presper Eckert (1919-95), the co-inventor of the ENIAC, and was most probably given to him by the cartoonist.

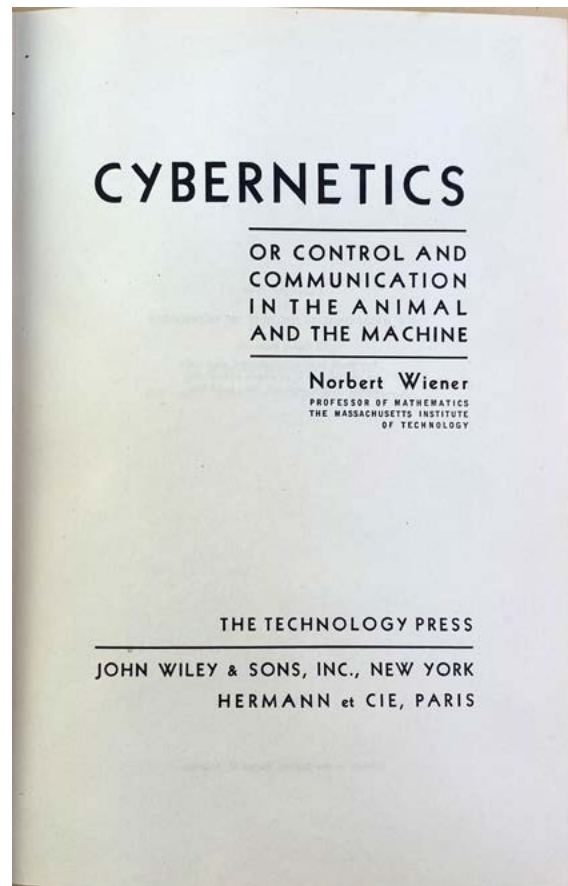
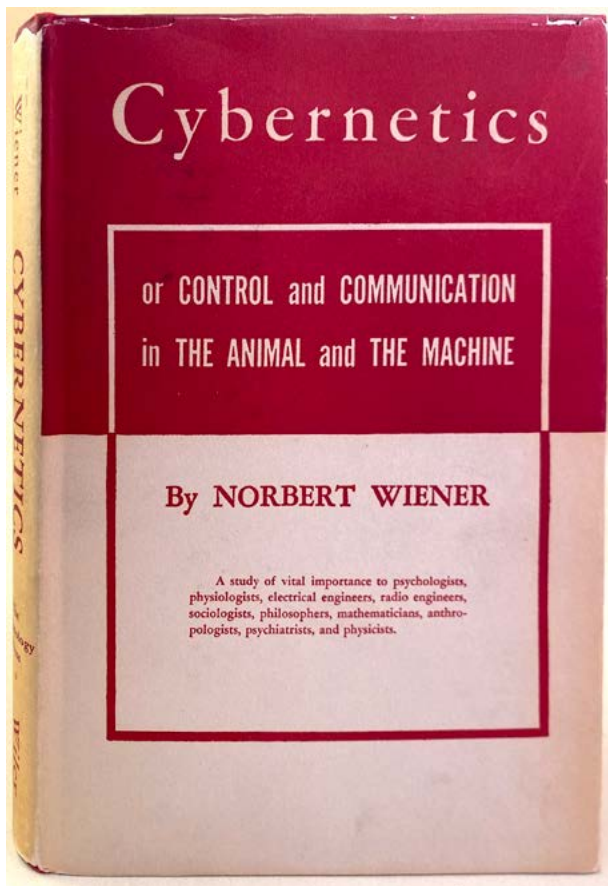
The ENIAC, the world's first programmable electronic general-purpose digital computer, was designed and built during World War II at the University of Pennsylvania's Moore School of Engineering. It was announced to the public at a press conference held on 14 February 1946. At that press conference photographs were taken of the machine and reproduced in newspaper articles, as well as in the first magazine article about the ENIAC, "Lightning strikes mathematics," written by Allen Rose and published in *Popular Science* in April 1946.

Alexander's cartoon, published five weeks after the 14 February press conference, depicts three men standing in bewilderment before the room-sized ENIAC: U.S. Treasury Secretary John W. Snyder (1895-1985); Chester Bowles (1901-86) of the Office of Price Administration; and Paul R. Porter, who chaired the War Production

Board's Shipbuilding Stabilization Committee during World War II. The three men, who obviously understand nothing about computers, are looking to the machine to calculate all the data they need to control post-war inflation; Bowles holds in his right hand a paper headed "Umpty-ump hundreds of wage-price ratios."

The cartoonist Franklin Osborne Alexander, commonly known as F. O. Alexander, was the staff editorial cartoonist at the *Philadelphia Evening Bulletin* from 1941 to 1967. *Origins of Cyberspace* 1115. 44694

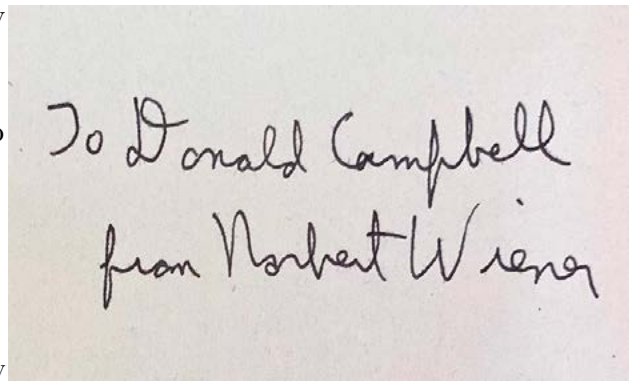




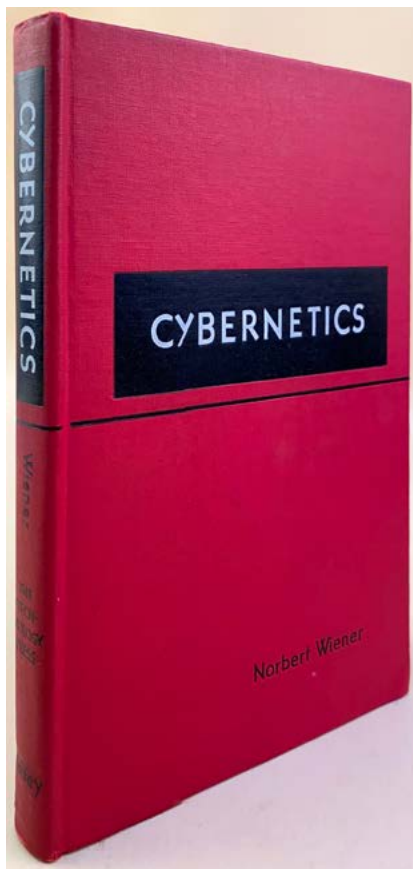
1948

The First Conventionally Published Scientific Book to Include a Theoretical Discussion of Electronic Computing—Inscribed by the Author

14. Wiener, Norbert (1894-1964). *Cybernetics or control and communication in the animal and the machine*. 8vo. [2], 194pp. New York: John Wiley & Sons; Paris: Hermann et Cie., 1948. 229 x 152 mm. Original red cloth, red and gray printed dust-jacket (a little chipped). Fine. Inscribed by Wiener to Donald Campbell (1916-96) on the front free endpaper: "To Donald Campbell from Norbert Wiener." \$6500



First American Edition, following shortly after the French edition that appeared in English the same year. We have never seen or heard of a presentation copy of the French edition, and this is the only the second presentation copy of the American edition we know of. Wiener presented this copy to Donald T. Campbell, the highly influential psychologist, social scientist and information philosopher whose investigations of creative thought led him to come up with the concept of "Blind Variation and Selective Retention" (BVSr), a fundamental principle of cybernetics:



Blind variation and selective retention (BVSr) is a phrase introduced by Donald T. Campbell to describe the most fundamental principle underlying cultural evolution. In cybernetics, it is seen as a principle for describing change in evolutionary systems in general, not just in biological organisms. For example, it can also be applied to scientific discovery, memetic evolution [i.e., the evolution of cultural memes] or genetic programming. As such, it forms a foundation for what has later been called Universal Darwinism (Wikipedia).

Cybernetics, Wiener's widely circulated and influential treatise on feedback, applied theories of information and communication to both biological systems and machines. In it were the roots of various elements of computer science, which by the mid-1950s had broken off from cybernetics to form their own specialties. The work influenced a generation of scientists working in a wide range of disciplines, including information theory, computer learning, and artificial intelligence.

Cybernetics was the first conventionally published book (as opposed to technical report) to include a serious discussion of electronic computing. Wiener, independently of Claude Shannon, conceived of communications engineering as a brand of statistical physics and applied this viewpoint to the concept of information; writing as a mathematician rather than an engineer, his discussion was theoretical rather than specific. Computer-related words beginning with the "cyber-" prefix, including "cyberspace," originate from Wiener's book. The chapter on "Time series, information, and communication" contained the first publication of Wiener's formula describing the probability density of continuous information. This is remarkably close to Shannon's formula dealing with discrete time pub-

lished in "A mathematical theory of communication" (1948). *Cybernetics* also contained a chapter on "Computing machines and the nervous system," a theoretical discussion, influenced by McCulloch and Pitts, of differences and similarities between information processing in the electronic computer and the human brain. It contains a discussion of the difference between human memory and the different computer memories then available. Tacked on at the end of *Cybernetics* were speculations by Wiener about building a chess-playing computer, predating Shannon's first paper on the topic.

Wiley had the first edition of Wiener's book typeset and printed by letterpress in France by the French publishers Hermann et Cie, probably because the French firm was a specialist in mathematical publications. The first edition was thus issued in Paris. The first American edition was printed offset from the French sheets and issued by John Wiley in New York, also in 1948. Because the typesetting was done in Europe Wiener likely did not have the opportunity to read proofs carefully, as the first edition contained many typographical errors which were repeated in the American edition. These remained uncorrected through the various printings of the American edition until a second edition was published by John Wiley and MIT Press in 1961.

Regarding the notable paucity of books inscribed by Wiener, my colleague Arthur Freeman emailed me this story in October 2012: "Norbert, whom I grew up nearby (he visited our converted barn in Belmont, Mass., constantly to play frantic theoretical blackboard math with my father, an economist/statistician at MIT, which my mother, herself a bit better at pure math, would have to explain to him later), was a notorious cheapskate. His wife once persuaded him to invite some colleagues out for a beer at the Oxford Grill in Harvard Square, which he did, and after a fifteen-minute sipping session, he got up to go, and solemnly collected one dime each from each of his guests. So when *Cybernetics* appeared on the shelves of the Harvard Coop Bookstore, my father was surprised and flattered that Norbert wanted him to have an inscribed copy, and together they went to Coop, where Norbert duly picked one out, wrote in it, and carried it to the check-out counter—where he ceremoniously handed it over to my father to pay for. This was a great topic of family folklore." *Origins of Cyberspace* 992. 43511

Inspiration for the “Turing Test”

15. Jefferson, Geoffrey (1886-1961). The mind of mechanical man. Offprint from *The British Medical Journal* (25 June 1949). 16pp. 217 x 141 mm. Original printed wrappers. Slight wear and creasing, but very good. \$4500

First Edition, Offprint Issue. *Extremely rare.* Jefferson’s 1949 paper on the differences between electronic computers and the human brain inspired Alan Turing to respond with his famous paper on “Computing machinery and intelligence” (1950), which introduced the “Turing Test” of a machine’s ability to exhibit human-like intelligence. Jefferson, a distinguished neurological surgeon, practiced at the Manchester Royal Infirmary; he was aware of the Manchester “Baby” stored-program computer and likely knew of the work of Turing, who became chief programmer on the Manchester computer project in September 1948. In a later postscript to his paper, written in 1960, Jefferson noted that

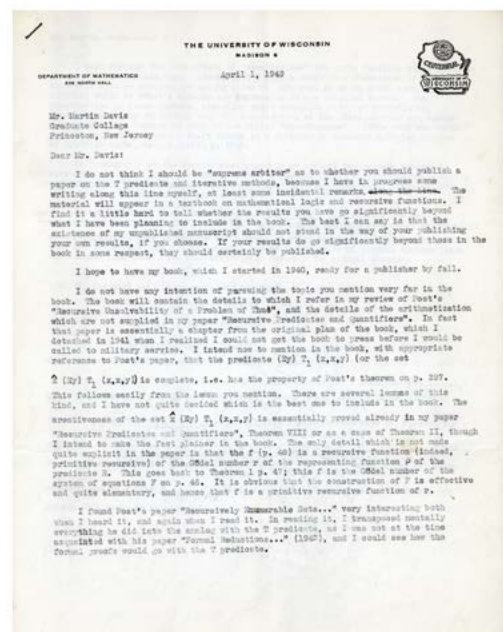
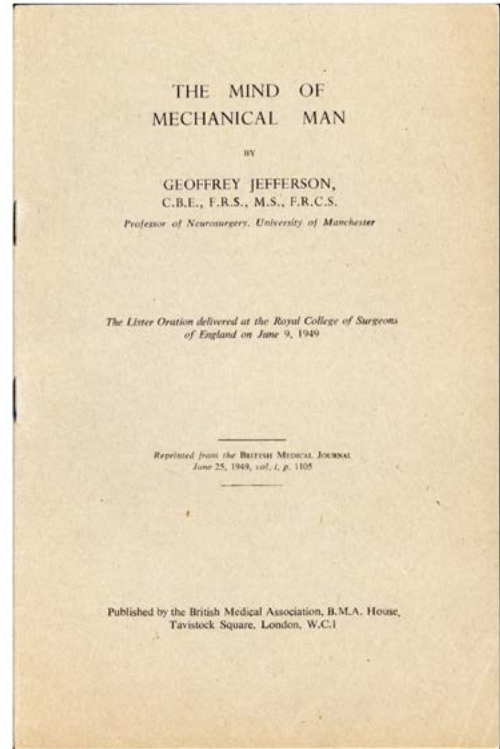
Mine was the first paper by a neurologist faced with the new electronic computing machines, for which much greater identification with the action of the brain was claimed than was in my opinion justifiable. It was a protest against jumping to conclusions . . . My friend and most ingenious mathematical colleague, the late Alan Turing, F.R.S., believed passionately that the computing machines had all but solved at once the intricacies of the mind-brain problem. He said that although a machine might not write a sonnet that I could understand, he was sure that it would write one soon that another computer might enjoy!

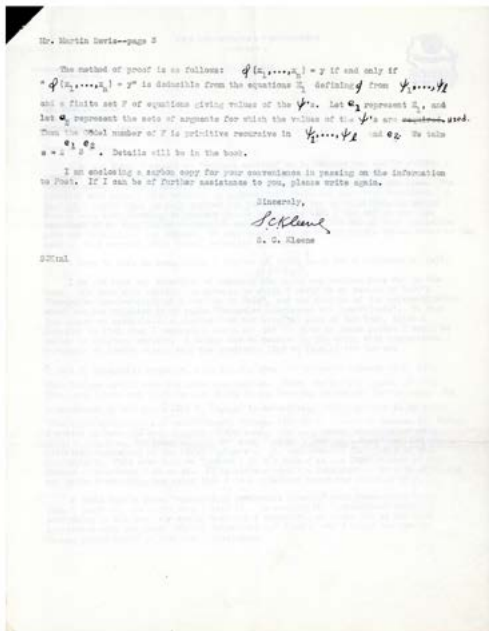
Norman, *From Gutenberg to the Internet*, pp. 651-661 (reproducing Jefferson’s paper). This is the only copy of the offprint of this paper that we have every seen or heard of. 51511

16. Kleene, Stephen C. (1909-94). Typed letter signed to Martin Davis (1928-2023). 3pp. on 3 sheets, University of Wisconsin letterhead. Madison, WI, 1 April 1949. 280 x 217 mm. Light wear along folds but very good. \$1250

Letter with excellent content from Stephen Kleene, one of the founders of theoretical computer science. Kleene, who did his doctoral work under Alonzo Church at Princeton, was one of the originators of the branch of mathematical logic known as recursion theory; his work grounds the study of computable functions. A number of mathematical concepts are named for him, such as the Kleene hierarchy (for classifying certain sets) and Kleene’s recursion theorem; he also invented regular expressions to describe McCulloch-Pitts neural networks. He was the author of two standard textbooks of mathematical logic: *Introduction to Metamathematics* (1952) and *Mathematical Logic* (1967), both still in print.

Kleene’s letter to mathematical logician Martin Davis, another of Church’s doctoral students, discusses one of his forthcoming publications, most likely *Introduction to Metamathematics*:





I do not think I should be “supreme arbiter” as to whether you should publish a paper on the T predicate and iterative methods, because I have in progress some writing along this line myself, at least some incidental remarks. The material will appear in a textbook on mathematical logic and recursive functions . . .

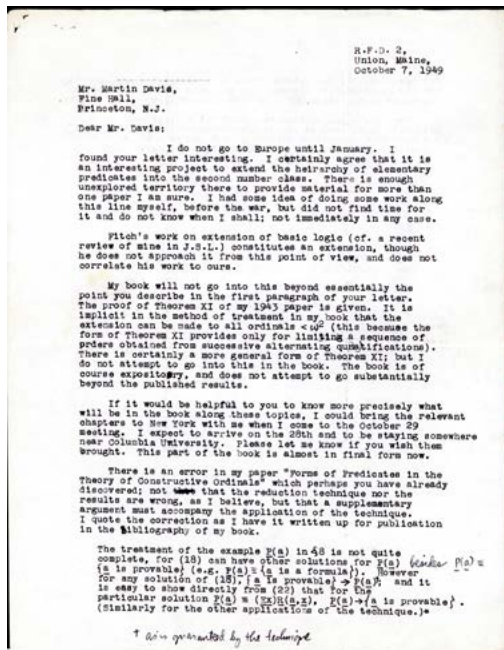
I do not have any intention of pursuing the topic you mention very far in the book. The book will contain the details to which I refer in my review of [Emil] Post’s “Recursive Unsolvability of a Problem of Thue,” and the details of the arithmetization which are not supplied in my paper “Recursive Predicates and Quantifiers” . . .

I must confess that the notion of “creativity” was quite familiar to me (without the term) from earlier work. Around 1935 I made a study of a succession of by adding rules of inference number-theoretic systems obtained by adding rules of inference so as to prove some of the formulas which by Gödel’s theorem are unprovable in the original system . . .

In remarking that the creativity property of certain recursively enumerable sets was in a sense known previously to Post’s paper, I do not wish to disparage Post’s contributions. I am well aware that he did much thinking along these lines fifteen years earlier than any of the rest of us . . .

51654

17. Kleene, Stephen C. (1904-94). Typed letter signed (with a few manuscript additions) to Martin Davis (1928-2023). 1+ pages on single sheet. Union, Maine, 7 October 1949. 280 x 218 mm. Staple-holes in upper left corner, light wear and soiling but very good.



\$1250

Writing from his farm in Maine, Kleene continues his epistolary discussion of Davis’s graduate work and his own forthcoming book, and corrects an error in one of his published papers:

I do not go to Europe until January. I found your letter interesting. I certainly agree that it is an interesting project to extend the hierarchy of elementary predicates into the second number class. There is enough unexplored territory there to provide material for more than one paper I am sure . . .

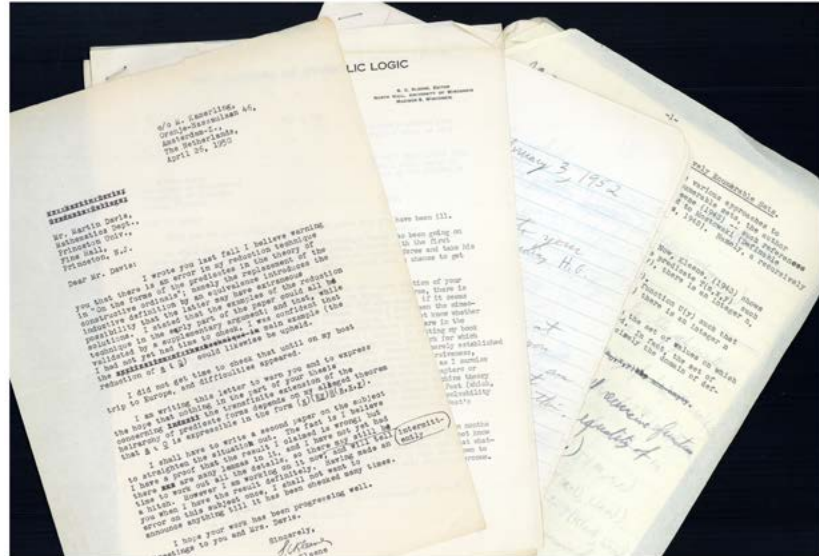
My book will not go into this beyond essentially the point you describe in the first paragraph of your letter [not present here]. The proof of Theorem XI of my 1943 paper is given. It is implicit in the method of treatment in my book that the extension can be made to all ordinals $< \omega^2$ (this is because the form of Theorem XI provides only for limiting a sequence of orders obtained from successive alternating quantifications). There is certainly a more general form

of Theorem XI; but I do not attempt to go into this in the book . . .

There is an error in my paper “Forms of Predicates in the Theory of Constructive Ordinals” which perhaps you have already discovered . . . I quote the correction as I have it written up for publication in the bibliography of my book . . . [correction follows]

The results you mention as coming out of your work on Hilbert’s tenth problem sounds interesting, though I am not sure if I understand correctly what you mean by a “primitive recursive set” of Diophantine equations.

Davis’s doctoral thesis on Hilbert’s tenth problem, *On the Theory of Recursive Unsolvability* (1950), led to the MRDP theorem for Diophantine sets. 51655



A selection of materials from no. 18

18. Kleene, Stephen C. (1909-94); **Martin Davis** (1928-2023). Collection of correspondence and other materials, consisting of:

- (1) 8 typed letters signed from Kleene to Davis. 8 sheets total. 1950-52.
- (2) Autograph letter signed from Davis to Kleene plus 2 draft versions of another of Davis's letters to Kleene. 15 sheets total. 1951-52.
- (3) **Davis**. Some preliminary remarks on recursively enumerable sets. Typed and autographed draft. 25 sheets total. N.d. [1952].
- (4) **Rice, Henry Gordon** (1920-2003). Classes of enumerable sets and their decision problems. Offprint from Transactions of the American Mathematical Society 74 (1953). 358-366pp. 255 x 179 mm. Original printed wrappers, vertically creased, light soiling.

Some creasing, soiling and fraying, but very good. See the calendar below for a complete listing.

\$4500

Excellent scientific correspondence between two outstanding mathematical logicians. In No. 1 (see the calendar below), dated 26 April 1950, Kleene warned Davis of an error in his (Kleene's) 1944 paper "On the forms of the predicates in the theory of constructive ordinals," and expresses "the hope that nothing in the part of your thesis concerning the transfinite extension of the hierarchy of predicate forms depends on my alleged theorem that $a \in O$ is expressible in the form $(x) (Ey) R(A, x, y) . . .$ "

Nos. 2 – 7, written between March and October 1952, center on Davis's "Arithmetical problems and recursively enumerable predicates," a paper he had submitted earlier that year to the *Journal of Symbolic Logic*, of which Kleene was the editor. The *JSL* had sent the paper to a referee for review (per Kleene's letter to Davis of 18 April), which, as Davis informed Kleene, "is giving rise to one of those rather futile author-referee wrangles I have heard so much about . . . I replied to the original referee's report claiming that his proof was incorrect as I had been unable to fill in several gaps in his proposed argument. The referee counter-replied showing me how the gaps might be filled in; his argument now seems to me to be correct. There remain, then, two questions: 1) Is the referee's proof superior to mine? 2) If so, in what form should it be published? . . ."

On 7 May Kleene replied that "we shall easily settle the author-referee wrangle . . . I shall simply submit the paper, together with the first referee's reports, to an experienced second referee and take his verdict." This 7 May letter (no. 5) also includes some discussion of Davis's work compared to Kleene's own: "In regard to pub-

lication of the material from the second section of your thesis, it is a little hard to advise you. For one thing, of course, there is some question of competition between your material and mine . . . Until I have seen the mimeographed student notes on the course which you are giving, I will not know whether your development is substantially different from developments that are in the literature or will be in the literature when and if I succeed in getting my book [*Introduction to Metamathematics*] published . . .” On 4 June (No. 6) Kleene informed Davis that “I now have the second referee’s report on your paper . . . I am returning the manuscript to you, for you to revise in accordance with the referee’s suggestions.” On 2 October, per Kleene’s letter of that date (No. 7), Davis’s paper was sent to the first referee for a final check.

Nos. 8 – 12, written in January and February 1952, concern a report that Davis was preparing at Kleene’s request on H. G. Rice’s “Classes of recursively enumerable sets and their decision problems,” a paper Rice had submitted to the *JSL*. “You will recall that I mentioned to you at the Bryn Mawr meetings (or was it Providence?) that, owing to the fact our pages are very crowded now, and the length of the paper of H. G. Rice, we may wish to transfer it. Under these circumstances it is embarrassing to us to hold it too long before raising this question with the author . . . Could I have [your] report within the next week . . .” (letter of 29 January).

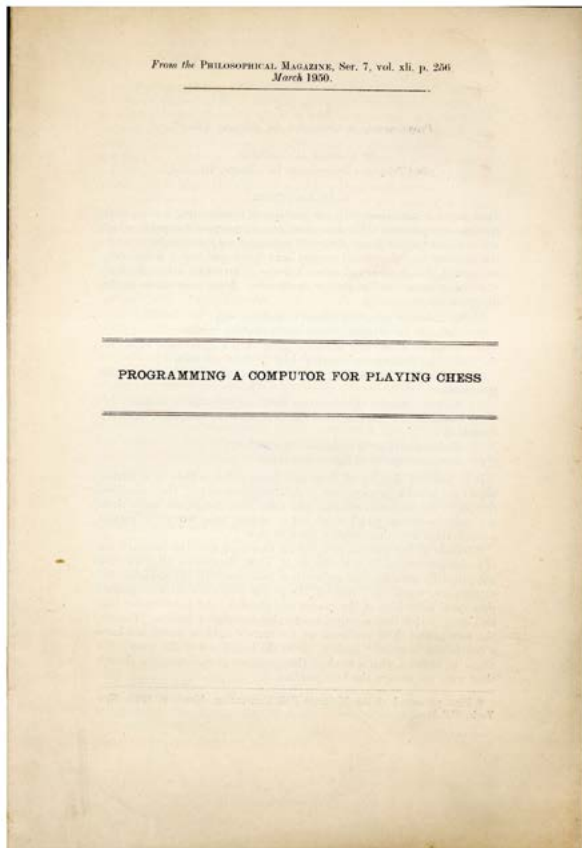
Davis replied on 3 February: “Although I told you at Providence, that I would let you have my report very soon, I am afraid that it is not yet ready. There are two reasons for this. The first of these is that my initial reading of the paper convinced me that it should be revised considerably before publication. As a result a more detailed report will be required than would ordinarily have been necessary . . .” By 18 February, per Kleene’s letter of that date (no. 12), Davis had sent in his “exceedingly careful and thorough report” (No. 11), which recommended that Rice’s paper “be rewritten with Parts II and IV omitted.” A copy of Rice’s paper is included with this collection. 51696

Calendar of letters and other autograph/typed materials in the collection:

No.	Author	Date	Notes
1	Kleene	1950/04/26	Typed letter signed. 1 page. “I wrote you last fall I believe warning you that there is an error in my reduction technique in ‘On the forms of the predicates in the theory of constructive ordinals’ . . .”
2	Davis	1951/03/13	Carbon typescript draft letter, unsigned. 2pp. on 2 sheets. “This is in reference to my paper ‘Arithmetical problems and recursively enumerable sets’ . . .”
3	Kleene	1951/04/18	Typed letter signed. 1 page. “We are holding your manuscript entitled ARITHMETICAL PROBLEMS AND RECURSIVELY ENUMERABLE PREDICATES here pending your response to Henkin’s letter of February 6, 1951 . . .”
4	Davis	[1951/05/02]	Typed draft letter signed, with extensive autograph additions; typed text the same as in the carbon draft of 3-13-51 (no. 2 above). 4pp. on 2 sheets. “Thank you for your letter of April 18. I have not written earlier because of a rather protracted illness from which I have now fully recovered . . .” [manuscript addition].
5	Kleene	1951/05/07	Typed letter signed. 2pp. on 2 sheets. “Thank you for your letter of May 2. I am sorry you have been ill. We shall easily settle the author-referee wrangle . . .”
6	Kleene	1951/06/04	Typed letter signed. 1 page. “I now have the second referee’s report on your paper . . . He concurs in the recommendation of the first referee . . .”
7	Kleene	1951/10/02	Typed letter signed. 1 page. “I have sent your revised manuscript, ARITHMETICAL PROBLEMS AND RECURSIVELY ENUMERABLE PREDICATES, to the first referee for a final check . . .”
8	Kleene	1952/01/29	Typed letter signed. 1 page. “You will recall that I mentioned to you at the Bryn Mawr meetings (or was it Providence?) that, owing to the fact our pages are very crowded now, and the length of the paper of H. G. Rice, we may wish to transfer it . . .”
9	Davis	1952/02/03	Autograph letter signed (pencil draft). 11 sheets. “This is in reply to your letter of January 29 regarding H. G. Rice’s paper . . . My initial reading of the paper convinced me that it should be revised considerably . . .”
10	Kleene	1952/02/07	Typed letter signed. 1 page. “Thank you for your letter of February 3. I shall look forward for the rest of your report in about ten days . . .”
11	Davis	1952/02/00	Some preliminary remarks on recursively enumerable sets. Typed and autograph draft. 25 sheets.
12	Kleene	1952/02/18	Typed letter signed. 1 page. “Thank you very much for your exceedingly careful and thorough report on Rice’s paper, ‘CLASSES OF RECURSIVELY ENUMERABLE SETS AND THEIR DECISION PROBLEMS’ . . .”

The First Technical Paper on Computer Chess

- 19. Shannon, Claude E.** (1916-2001). Programming a computer for playing chess. Offprint from *Philosophical Magazine*, ser. 7, 41 (1950). 256-275pp. 253 x 173 mm. Original printed self-wrappers. Light toning, a few faint smudges but very good. From Shannon's library, with letter attesting to the provenance. \$10,000



First Edition, Offprint Issue of the first technical paper on computer chess. “Shannon pioneered computer chess as we know it today, and his ideas have been employed in almost every chess program ever written” (Levy, p. 1). Shannon's paper was first presented at the National IRE Convention on 9 March 1949; he submitted it to the *Philosophical Magazine* in November 1949, which published the paper in the March 1950 issue. The offprint has the misspelling “computer” on the front wrapper; the word is spelled correctly on the paper's first page.

In their paper on “Chess-playing programs and the problem of complexity,” (1958) Newell, Shaw and Simon had this to say about Shannon's paper:

The relevant history [of chess-playing programs] begins with a paper by Claude Shannon in 1949. He did not present a particular chess program, but discussed many of the basic problems involved. The framework he introduced has guided most of the subsequent analysis of the problem . . .

The basic framework introduced by Shannon for thinking about

chess problems consists of a series of questions:

1. Alternatives

Which alternative moves are to be considered?

2. Analysis

a. Which continuations are to be explored and to what depth?

b. How are positions to be evaluated strategically—in terms of their patterns?

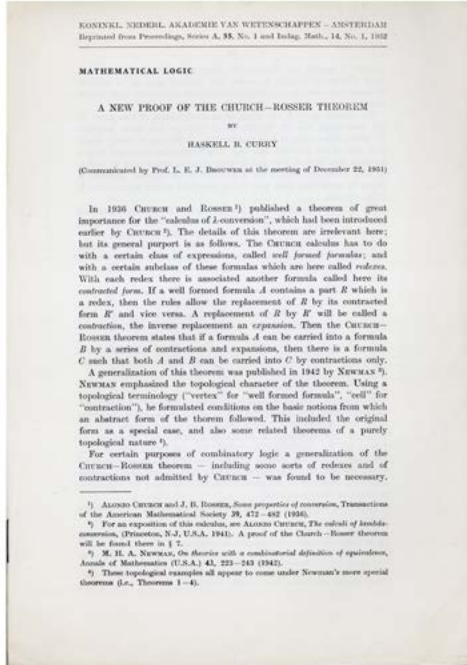
c. How are the static evaluations to be integrated into a single value for an alternative?

3. Final choice procedure

What procedure is to be used to select the final preferred move?

We would hazard that Shannon's paper is chiefly remembered for the specific answers he proposed to these questions: consider all alternatives; search all continuations to fixed depth, n ; evaluate with a numerical sum; minimax to get the effective value for an alternative; and then pick the best one (Newell and Simon, pp. 42–44).

Newell and Simon, “Chess-playing programs and the problem of complexity” [1958], reprinted in Feigenbaum, E. A. and Feldman, J., *Computers and Thought* (New York: McGraw-Hill, 1963): 39–70. *Origins of Cyberspace* 882. Sloane and Wyner, *Claude Elwood Shannon: Collected Papers*, no. 54. 46526

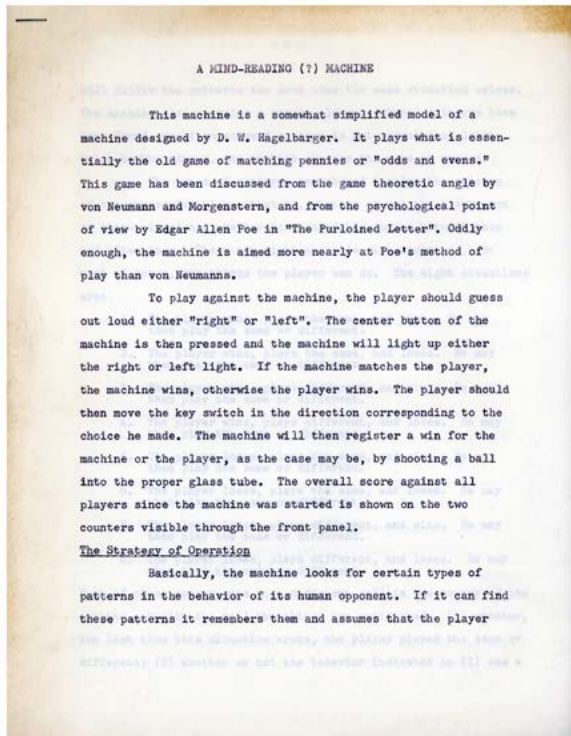


20. Curry, Haskell B. (1900-1982). A new proof of the Church-Rosser theorem. Offprint from Koninkl. Nederl. Akademie van Wetenschappen—Amsterdam, *Proceedings*, series A, 55 (1952). 16-23pp. Mimeographed errata slip laid in. 260 x 182 mm. Without wrappers as issued. Slight creasing but very good. \$1250

First Edition, Offprint Issue. Curry’s paper containing his new proof of the Church-Rosser theorem—which proves pure λ -calculus consistent—precedes by six years the proof he and Feys published in their major textbook *Combinatory Logic* (1958). Our copy includes the errata slip noting that “Professor M. H. A. Newman has called attention to the fact that the condition J2 does not apply to the lambda calculus. On account of this fact, the theorem in question, although presumably correct, does not have the intended application.” 51667

An Original Typescript

21. Shannon, Claude E. (1916-2001). A mind-reading (?) machine. Typescript, signed “C. E. Shannon” in type on the last leaf. 4ff. [Murray Hill, NJ: Bell Laboratories], 18 March 1953. 278 x 215 mm. Stapled. Uneven toning particularly on the first sheet, a few short tears and creases. Very good. From Shannon’s library, with letter attesting to the provenance. \$8500



This machine is a somewhat simplified model of a machine designed by D. W. Hagelbarger. It plays what is essentially the old game of matching pennies or “odds and evens.” This game has been discussed from the game theoretic angle by von Neumann and Morgenstern, and from the psychological point of view by Edgar Allen Poe in “The Purloined Letter”. Oddly enough, the machine is aimed more nearly at Poe’s method of play than von Neumann’s.

To play against the machine, the player should guess out loud either “right” or “left”. The center button of the machine is then pressed and the machine will light up either the right or left light. If the machine matches the player, the machine wins, otherwise the player wins. The player should then move the key switch in the direction corresponding to the choice he made. The machine will then register a win for the machine or the player, as the case may be, by shooting a ball into the proper glass tube. The overall score against all players since the machine was started is shown on the two counters visible through the front panel.

The Strategy of Operation

Basically, the machine looks for certain types of patterns in the behavior of its human opponent. If it can find these patterns it remembers them and assumes that the player will repeat them. The machine then chooses its own strategy to beat the player’s strategy.

Original Typescript of Shannon’s paper, which Sloane and Wyner, the editors of Shannon’s collected papers, describe as a “Bell Laboratories memorandum” (*Claude Elwood Shannon: Collected Papers*, p. 688). The paper is unpublished apart from its inclusion in the collected papers. The paper describes a machine that plays the game of odds and evens, trying to predict the player’s moves; it discusses the strategy of operation and the theory of beating it. As Shannon put it in the paper’s first paragraph,

The machine is a somewhat simplified model of a machine designed by D. W. Hagelbarger. It plays what is essentially the old game of matching pennies or “odds and evens.” This game has been discussed from the game-theoretic angle by von Neumann and Morgenstern and from the psychological point of view by Edgar Allen Poe in “The Purloined Letter.” Oddly enough, the machine is aimed more nearly at Poe’s method of play than von Neumann (f. 1) 46527

An Historic, Elegantly Penned Letter

22. Church, Alonzo (1903-95). Autograph letter signed to Martin Davis (1928-2023), on letterhead of the *Journal of Symbolic Logic*. 5pp. on 3 sheets. Princeton, NJ, 6 May 1953. 280 x 215 mm. Fine. \$5000

Historic, essay length letter (over 1500 words) from Alonzo Church, who made major contributions to mathematical logic, including the lambda calculus (a universal model of computation), the Church-Turing thesis on the nature of computable functions, and his proof of the unsolvability of Hilbert's famous *Entscheidungsproblem*. Together with his doctoral student, Alan Turing, Church is considered one of the founders of computer science. His correspondent, Martin Davis, was a mathematical logician and computer scientist who had done his Ph.D. work under Church at Princeton; his doctoral thesis on Hilbert's tenth problem led to the MRDP theorem for Diophantine sets.

Church was a founding editor of the *Journal of Symbolic Logic*, and edited its review sections for over forty years. In the present letter he critiques Davis's forthcoming review for the *JSL* of Paul Rosenbloom's *The Elements of Mathematical Logic* (1951), taking particular issue with Davis's and Rosenbloom's comparisons of the human brain's operations to those of a suitably powerful computer. Church's analysis of the logical fallacies behind such a comparison covers over three pages of the letter, amounting to a short essay on the subject.

In his review Davis had suggested that "if it should turn out that the human brain is equivalent in operation to a computing machine, then one can imagine a suitably programmed machine which would, when presented with a complete description of the human brain, produce a proposition A of elementary arithmetic, such that it could prove that, *if the human brain were consistent*, then A would be true, but not provable by the human brain" (*Journal of Symbolic Logic* 18 [1953]: 280). Church responded as follows:

If it's really some particular human brain unaided that you mean to compare with the computing machine, then the proposition A mentioned in [your review] can surely be a relatively simple one. For most people have only a very limited ability to do mental arithmetic, and even the professional lightning calculator will have an upper limit of his ability to do mental calculations that will look quite small as compared to what must be done and is done in order, for instance, to compute an eclipse.

THE JOURNAL OF SYMBOLIC LOGIC

ALONZO CHURCH, EDITOR
FINE HALL
PRINCETON, NEW JERSEY

May 6, 1953

Dear Dr. Davis,

Please review for the Journal:
Andrzej Mostowski. An undecidable arithmetical statement.
Fundamenta Mathematicae, vol. 36 (1949), pp. 143-164.

I am holding the review copy of this for the moment, in order to be sure of your address, as I believe the Institute term ends on May first. Please let me know, and I'll send the review copy at once.

The delay in getting this paper assigned for review is just one more indication of the mess that the affairs of the Journal have gotten into because of the situation which gradually developed, by which a greater share of the work fell on me than one man could possibly carry. We are engaged in reorganizing the work for the Journal, as you probably know, and I hope we are approaching the point at which my remaining share of the work will be something manageable. Meanwhile the work of processing and assigning material for review has fallen badly behind, and a major task is facing myself and (I fear also) others in catching up.

By the way, when you do leave Princeton, please remember to keep me in touch with your address.

I have written to Dr. Sokol in your behalf.

In your review of Rosenbloom I am making a few very minor changes. In the last line of page 2, I am changing "last" to "latter"

When I say that M_2 is also "just as good as" the human mathematician. For of course there is a language or code (albeit a somewhat complicated one) in which each separate sequence of digits printed by M_2 means one of the theorems of Z , and in fact the n th sequence of digits printed by M_2 means the same theorem of Z which was printed by M_1 (in another code) as its n th theorem. — Of course my point is, I regard this result as a sort of reductio ad absurdum of the original contention, not in the sense of reducing it to a contradiction, but in the sense of showing it to have unacceptable consequences.

The foregoing remarks are not a direct comment on your paragraph. But they do show or suggest some sort of difference of opinion between us, in consequence of which the same paragraph would probably have had a different emphasis if I had written it. As I said, I am writing about my own view just as a matter of interest.

But I do add one other thing that is more of a direct comment. Assuming "human brain" to mean human brain plus hands and some plus pencil and paper; and abstracting from such things as shortcuts of human life and liability to inadvertent error, I think the human brain is already a universal Turing machine (or the equivalent of one) and so is at least "as good as" the best conceivable computing machines. I indeed I would not speak of the human brain as proving certain things, simply, but as proving certain things from or as consequences of certain axioms (or certain hypotheses). — But then apparently Rosenbloom looks at the matter differently, to judge from your report of him (I haven't the book itself before me as I write).

Sincerely yours,
Alonzo Church

By the way, when you do leave Princeton, please remember to keep me in touch with your address.

I have written to Dr. Sokol in your behalf.

In your review of Rosenbloom I am making a few very minor changes. In the last line of page 2, I am changing "last" to "latter"

In fact I feel sure that the comparison that you (and Rosenbloom) really intended to make, in order to be a reasonable comparison and not a triviality, must not be a comparison of just the computing machine and the human brain. But the second term of the comparison must be the human brain *plus* hands and arms with their apparatus of muscles and nerves, *plus* a supply of pencils and paper . . .

Granted this, I think that a little reflection will then show that the first term in the comparison cannot be the computing machine alone, but must again be a complex of things, namely the human brain (plus bodily apparatus such as hands and arms), *plus* the computing machine. For the computing machine must have its problem given to it by a human agent in some manner, let us say by coding the problem and punching the resulting set of symbols on a tape . . . And the result of the machine's operation is a physical thing or event—let us say that it is again a tape with a certain set of symbols punched into it or printed on it. These symbols on the tape are read by the human operator according to a certain code. But this last is only possible because the human operator knows the code . . .

Thus the machine, like the pencil and paper, requires a human agent. To me it makes as little sense to say that a machine proves anything as it would to speak of the pencil and paper as proving something . . .

The foregoing remarks are not a direct comment on your [review]. But they do show or suggest some sort of difference of opinion between us . . . As I said, I am writing about my own view just as a matter of interest.

But I do add one other thing that is more of a direct comment. Assuming “human brain” to mean human brain plus hands and arms plus pencil and paper, and abstracting from such things a shortness of human life and liability to inadvertent error, **I think the human brain is already a universal Turing machine (or the equivalent of one) and so is at least “as good as” the best conceivable computing machine . . .** [emphasis ours].

51646



23. Meszar, John. Switching systems as mechanized brains. In *Bell Laboratories Record* 31 (1953): 63-69. Whole volume. 248 x 177 mm. Cloth ca. 1953, a bit shaken, minor edgewear, scuffing and soiling. Very good. \$750

First Edition, journal issue. Meszar's paper, written in the earliest days of automatic switching systems when few electronic computers existed, raised the question of whether certain aspects of human thought are computable and others are not. Meszar argued for “the necessity of divorcing certain mental operations from the concept of thinking,” in order to “pave the way for ready acceptance of the viewpoint that automatic systems can accomplish many of the functions of the human brain.” Meszar was a director of switching systems at Bell Laboratories. 51686

1954

First Use of a Computer to Write Literary Text: Love Letters!

24. Strachey, Christopher (1916-75). The “thinking” machine. In *Encounter: Literature, Arts, Politics* 3 (1954): 25-31. Whole number. 255 x 183 mm. Original printed wrappers, somewhat soiled, light wear. Very good. \$300

First Edition, journal issue. Strachey, a British computer scientist, was a pioneer in programming language design and computer time-sharing; his computer checkers (draughts) program, developed in 1951, has been called the world’s first video game. In 1954, as described in the present paper, Strachey programmed a love-letter generator for the Ferranti Mark I; the results represent the first example of computer-generated literature. A sample: “Darling sweetheart, You are my avid fellow feeling. My affection curiously clings to your passionate wish. My liking yearns for your heart. You are my wistful sympathy, my tender liking. Yours beautifully, M. U. C.” 42714



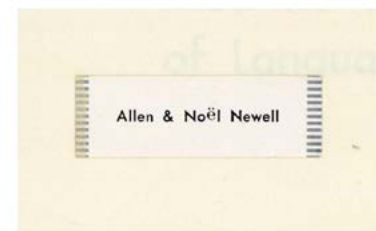
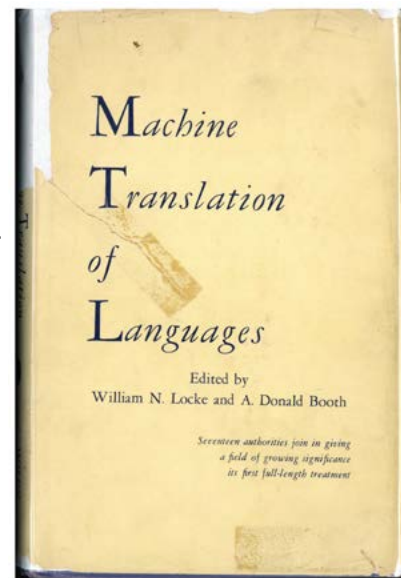
1955

From the Library of Allen Newell

25. Locke, William N.; Andrew D. Booth (1918-2009), eds. Machine translation of languages. xii, 243 [1]pp. New York: John Wiley & Sons; London: Chapman & Hall, 1955. 229 x 147 mm. Original blue cloth, buff printed dust-jacket (some tears, tape repairs and staining, upper portion of spine lacking). Very good. From the library of computer scientist and AI researcher **Allen Newell** (1927-92), with his address label on the front free endpaper. \$350

First Edition. The first book on the application of computers to language translation, co-edited by computer pioneer A. D. Booth, an important early contributor to the development of computer memory technology. This copy is from the library of Allen Newell, one of the founders of artificial intelligence.

The book’s historical introduction, by Booth and Locke, represents the first history of machine translation. The book also contains a reprint of Weaver’s twelve-page memorandum entitled “Translation,” written on 15 July 1949 and circulated privately to about two hundred people; Weaver’s memorandum “was the first suggestion that most had ever seen that language translation by computer techniques might be possible” (p. 15n). Also included is Erwin Reifler’s paper, “The mechanical determination of meaning,” in which he made the prescient claim that “all human pre-editorial work, which I had previously considered a *conditio sine qua non*, could be completely mechanized” (p. 137). Pages 227–36 contain an annotated bibliography of the subject, most of which consists of mimeographed articles. *Origins of Cyberspace* 497. 51671



“The First Heuristic Program Fully Realized on a Computer, the First Foray by Artificial Intelligence Research into High-Order Intellectual Processes”

26. Newell, Allen (1927-92); **Herbert Simon** (1916-2001). The logic theory machine: A complex information processing system. Reproduced typescript. Offprint from *IRE Transactions on Information Theory* IT-2 (September 1956). 61-79pp. 278 x 218 mm. Without wrappers as issued. Punched for a 3-ring binder. Boxed. Light toning, slight edgewear and creasing, but very good. \$20,000

First Edition, Offprint Issue. *Extremely rare.*

During 1955 and 1956 computer scientist and cognitive psychologist Allen Newell, political scientist, economist and sociologist Herbert A. Simon and systems programmer John Clifford Shaw, all working at the Rand Corporation in Santa Monica, California, developed the Logic Theorist, the first program deliberately engineered to mimic the problem-solving skills of a human being. They decided to write a program that could prove theorems in the propositional calculus like those in *Principia Mathematica* by Alfred North Whitehead and Bertrand Russell. As Simon later wrote,

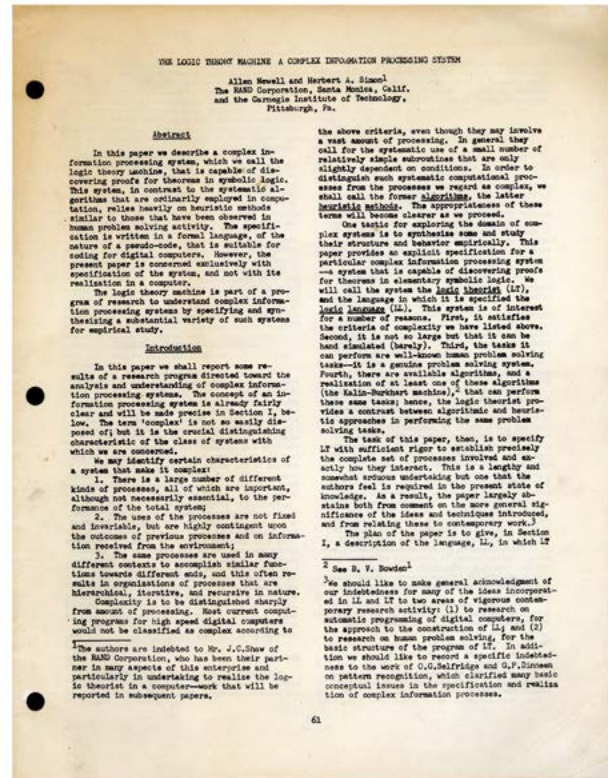
“LT was based on the system of *Principia mathematica*, largely because a copy of that work happened to sit in my bookshelf. There was no intention of making a contribution to symbolic logic, and the system of *Principia* was sufficiently outmoded by that time as to be inappropriate for that purpose. For us, the important consideration was not the precise task, but its suitability for demonstrating that a computer could discover problem solutions in a complex nonnumerical domain by heuristic search that used humanoid heuristics” (Simon, “Allen Newell: 1927-1992,” *Annals of the History of Computing* 20 [1998]: 68).

The collaborators wrote the first version of the program by hand on 3 x 5-inch cards. As Simon recalled:

In January 1956, we assembled my wife and three children together with some graduate students. To each member of the group, we gave one of the cards, so that each one became, in effect, a component of the computer program . . . Here was nature imitating art imitating nature (quoted in the Wikipedia article on Logic Theorist).

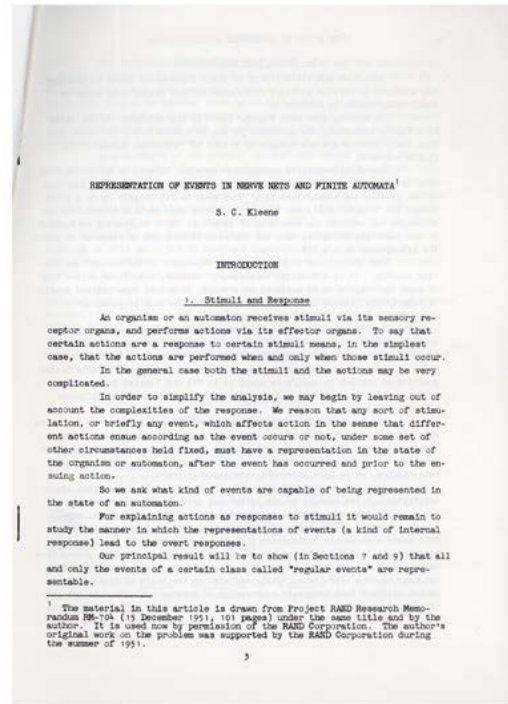
The team showed that the program could prove theorems as well as a talented mathematician. Eventually Shaw was able to run the program on the computer at RAND’s Santa Monica facility. It proved 38 of the first 52 theorems in *Principia Mathematica*. For Theorem 2.85 the *Logic Theorist* surpassed its inventors’ expectations by finding a new and better proof. This was the “the first foray by artificial intelligence research into high-order intellectual processes” (Feigenbaum and Feldman, *Computers and Thought* [1963]).

Newell and Simon first described the Logic Theorist in Rand Corporation report P-868 issued on June 15, 1956, entitled *The Logic Theory Machine. A Complex Information Processing System*. As far as we know, no copy of that report has ever appeared in commerce. The report was first officially published in September, 1956 under the same title in *IRE Transactions on Information Theory* IT-2, 61-79. Newell and Simon demonstrated the program at the Dartmouth Summer Session on Artificial Intelligence (August-September 1956) in which AI was formally named Artificial Intelligence. *Origins of Cyberspace* 815 (journal issue) 45290



27. Kleene, Stephen C. (1909-94). Representation of events in nerve nets and finite automata. Offprint from *Automata Studies*, ed. C. E. Shannon and J. McCarthy (Princeton: Princeton U.P., 1956). 41pp. 256 x 174 mm. Without wrappers; stapled. First leaf detached from lower staple, slight wear, but very good. From the library of Martin Davis, with his signature. \$2750

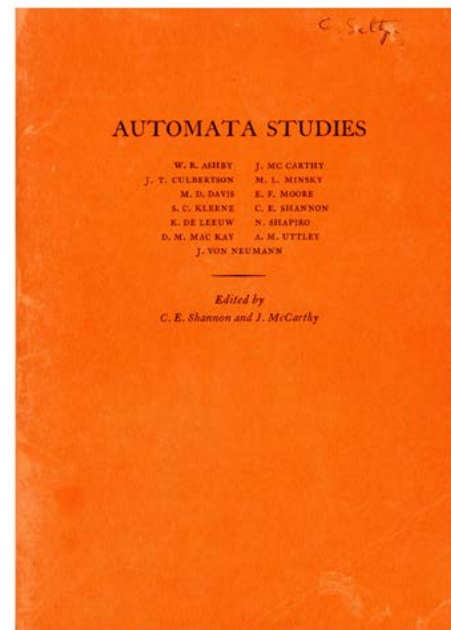
First Edition, Offprint Issue, extremely rare, of Kleene's paper introducing the concept of *regular expressions*; i.e., sequences of characters that specify match patterns in text. "Regular expressions originated in 1951, when mathematician Stephen Cole Kleene described regular languages using his mathematical notation called *regular events*. These arose in theoretical computer science, in the subfields of automata theory (models of computation) and the description and classification of formal languages . . . Regular expressions entered popular use from 1968 in two uses: Pattern matching in a text editor and lexical analysis in a compiler" (Wikipedia article on regular expression). A familiar example of a regular expression is the use of the asterisk (*; also known as "Kleene's star") to indicate strings of text in find-and-replace operations. This copy is from the library of Martin Davis, a mathematician and computer scientist who made significant contributions to computability theory. 51657



1956, June to August: The Dartmouth Summer Research Project on Artificial Intelligence Defines the Field for the First Time

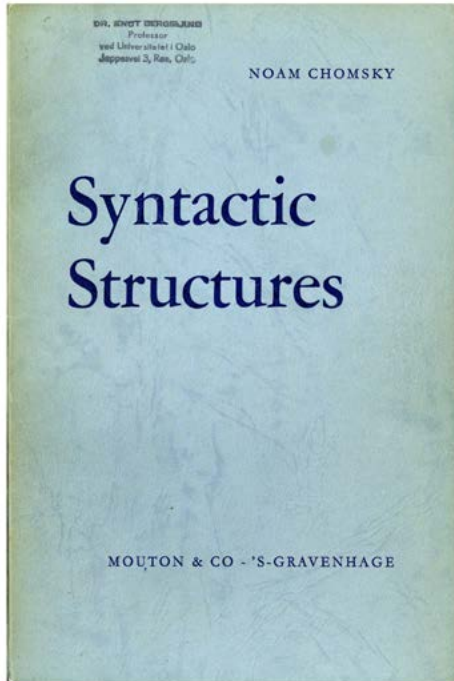
28. Shannon, Claude E. (1916-2001); **John McCarthy** (1927-2011), editors. *Automata studies*. viii, [2], 285, [1]pp. Princeton: Princeton University Press, 1956. 255 x 178 mm. Original printed wrappers, light wear and soiling, faint crease in front wrapper. Very good. Ownership signature on the front wrapper. \$500

First Edition. A collection of papers on automata theory, edited by two of the founders of AI, with contributions by other attendees at the Dartmouth Summer Research Project on Artificial Intelligence. "The papers have been divided into three groups. The first group consists of papers dealing with automata having a finite number of possible internal states [i.e., the brain and all actual physical machines] . . . The second group of papers deals with the theory of Turing machines and related questions, that is to say, with automata having an unlimited number of possible states . . . The third section of the book contains papers relating more directly to the synthesis of automata which will simulate in some sense the operation of a living organism" (pp. vi–viii). Included are papers by John von Neumann ("Probabilistic logics and the synthesis of reliable organisms from unreliable parts"), Marvin Minsky ("Some universal elements for finite automata"), John McCarthy ("The inversion of functions defined by Turing machines"), and Claude E. Shannon ("A universal Turing machine with two internal states" and "Computability by probabilistic machines," with K. de Leeuw, E. F. Moore, and N. Shapiro). *Origins of Cyberspace* 893. 51669

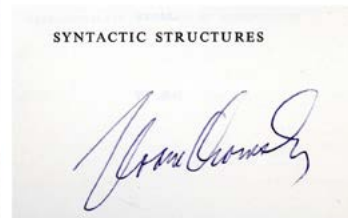


Autographed by Chomsky

- 29. Chomsky, Noam** (1928-). Syntactic structures. 116pp. 'S-Gravenhague: Mouton & Co., 1957. 227 x 150 mm. Original printed wrappers, spine darkened, slight edgewear and finger-soiling. Very good. Ownership stamp of Dr. Knut Bergslane, professor at the University of Oslo, on front wrapper. *Signed by Chomsky* on the half-title.



First Edition of Chomsky's classic text on the underlying structures of natural language. Expanding on ideas first presented in his paper, "Three models for the description of language" (1956), Chomsky's work develops two key concepts: "Chomsky's hierarchy" of syntactic forms, which has been widely applied in the construction of artificial computer languages; and—most importantly—his concept of transformational grammar. The cognitive scientist David Marr, who



developed a general account of information-processing systems, described Chomsky's theory of transformation grammar as a top-level computational theory, in the sense that it deals with the goal of a computation, why it is appropriate, and the logic of the strategy used to carry it out (Anderson

and Rosenfeld, *Neurocomputing: Foundations of Research*, pp. 470–72). Chomsky's work has had profound influence in the fields of linguistics, philosophy, psychology, and artificial intelligence. *Origins of Cyberspace* 532. 42206

The First Precisely Specified, Computationally Oriented Neural Network, and an Algorithm for Machine Learning

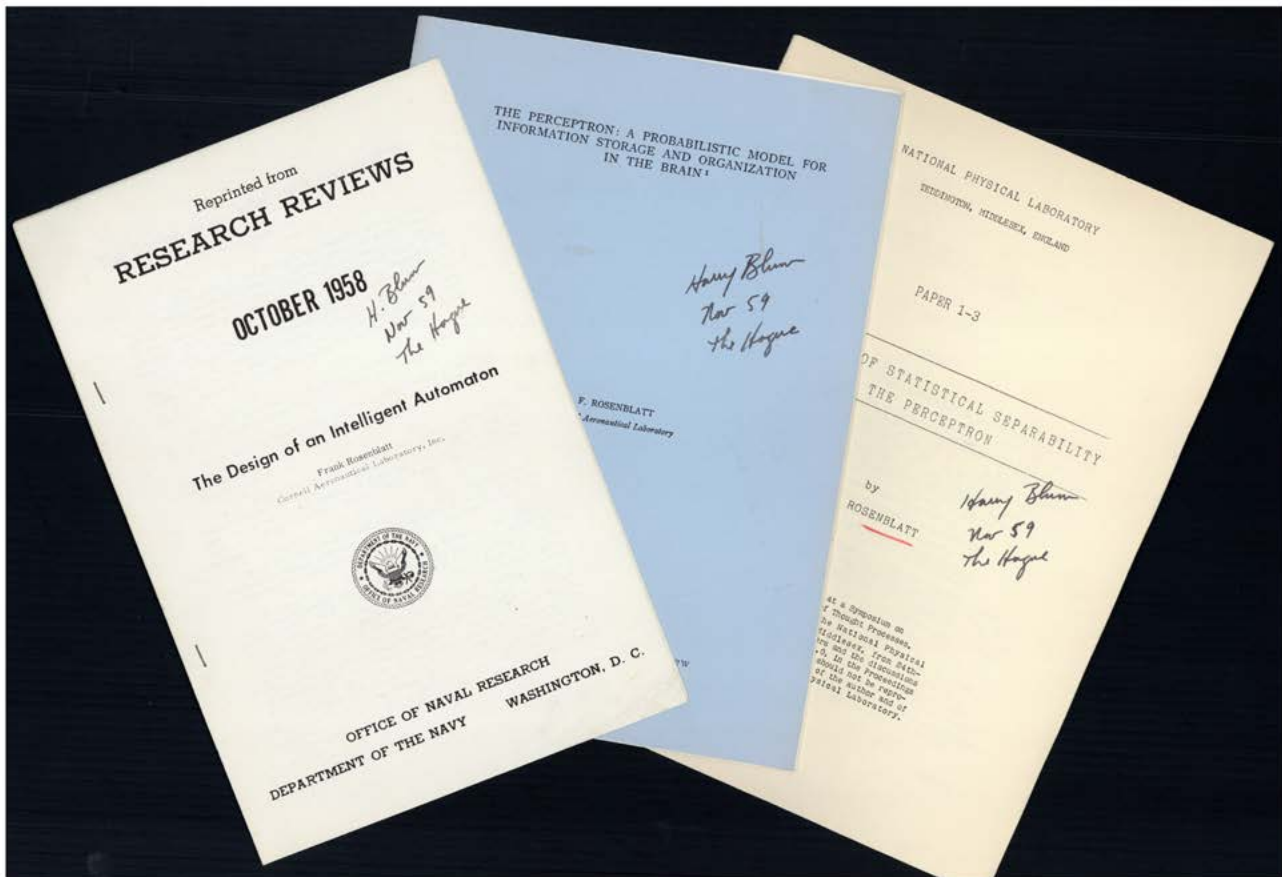
- 30. Rosenblatt, Frank** (1928-71). (1) The perceptron: A probabilistic model for information storage and organization in the brain. Offprint from *Psychological Review* 65 (November 1958). 386–408pp. 230 x 165 mm. Original blue printed wrappers. With:

(2) Two theorems of statistical separability in the perceptron. Reproduced typescript. Teddington, Middlesex, England: National Physical Laboratory, 1958. 239 x 175 mm. Without wrappers as issued. With:

(3) The design of an intelligent automaton. Offprint from *Research Reviews* (October 1958). Washington DC: Office of Naval Research. 5-13pp. 230 x 154 mm. Original printed wrappers.

Together three items, boxed. Signature of Harry Blum (1924-1987), dated November 1959, on each item; see no. 48 below. Very good. \$30,000

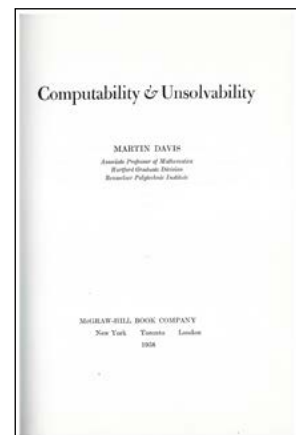
First Editions, Offprint Issues, Extremely rare, of (1) and (3); **Preprint Issue** of no. (2). The three papers listed above represent the **first published works on Rosenblatt's perceptron**, the first precisely specified, computationally oriented neural network, and an algorithm for machine learning. All three works are *extraordinarily rare* in this form.

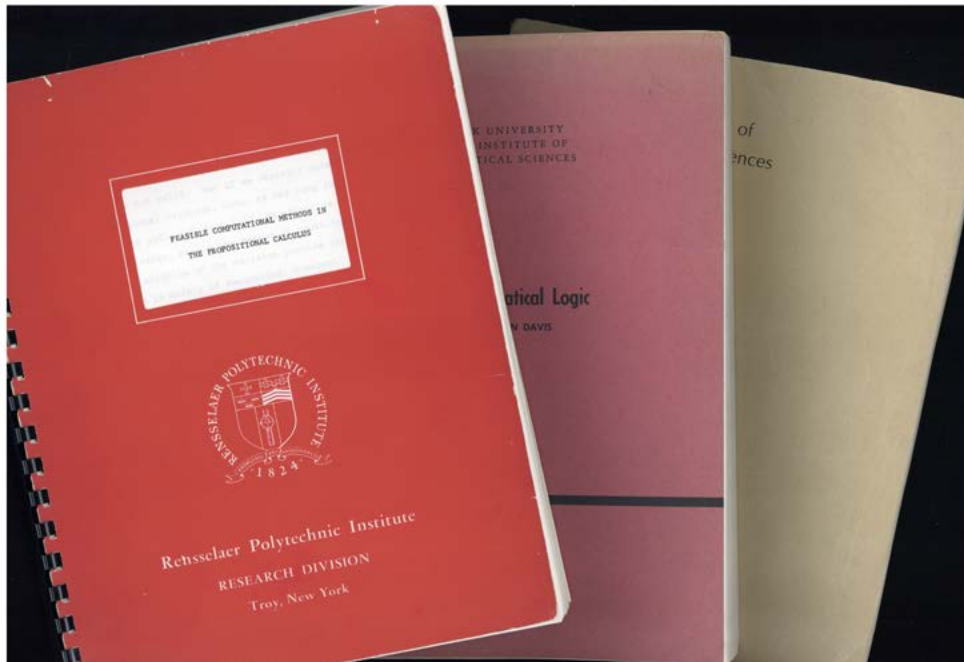


Rosenblatt based the perceptron on McCulloch and Pitts' mathematical model of an artificial neuron, described in their seminal paper "A logical calculus of the ideas immanent in nervous activity" (1943), but made some significant improvements. "Rosenblatt's major achievement has been to show that, by relaxing some of the MCP's rules (namely the absolute inhibition, the equal contribution of all inputs as well as their integer nature), artificial neurons could actually learn from data. More importantly, he came up with a supervised learning algorithm for this modified MCP neuron model that enabled the artificial neuron to figure out the correct weights directly from training data by itself . . ." (Loiseau). The first perceptron machine, built by Rosenblatt in 1957, had the ability to recognize patterns and to associate new patterns with ones it had "seen" before on the basis of similarity; like the brain, it could function in the presence of "noise" and with damaged or missing connections. Later models were capable of trial-and-error learning and could be taught to emit ordered sequences of responses. Loiseau, Jean- Christophe B. "Rosenblatt's Perceptron, the Very First Neural Network." *Medium*, Towards Data Science, 10 Jan. 2022 (web). *Origins of Cyberspace* 870 (first paper, journal issue). 45215

31. Davis, Martin (1928-2023). *Computability & unsolvability*. xxv, 210pp. New York: McGraw-Hill, 1958. 227 x 150 mm. Original printed boards, light gewear. Very good. \$200

First Edition of Davis's classic work on the theory of computability, computable functions, operations on computable functions, Turing machines self-applied, unsolvable decision problems, applications of general theory, mathematical logic, Kleene hierarchy, computable functionals, classification of unsolvable decision problems and more. From Martin Davis's library but not signed. 51676





32. Davis, Martin (1928-2023). (1) [with **Hilary Putnam** (1926-2016)]. Feasible computational methods in the propositional calculus. Reproduced typescript. [1], 62ff. Troy, NY: Rensselaer Polytechnic Institute, 1958. 280 x 218 mm. Original printed wrappers, comb-bound, light wear. First leaf loose, but otherwise very good. With:

(2) Lecture notes on mathematical logic. Based on student notes by Allen Weingarten. Reproduced typescript. [4], 91, 6ff. New York: New York University, Courant Institute of Mathematical Sciences, 1959. 281 x 218 mm. Original printed wrappers, cloth backstrip, uneven fading. Very good. With:

(3) Computability. Notes by Barry Jacobs. Reproduced typescript. v, 248pp. New York: New York University, Courant Institute of Mathematical Sciences, 1973-74. 274 x 214 mm. Original printed wrappers, a bit soiled and worn, light creasing. Very good.

Together 3 items.

\$950

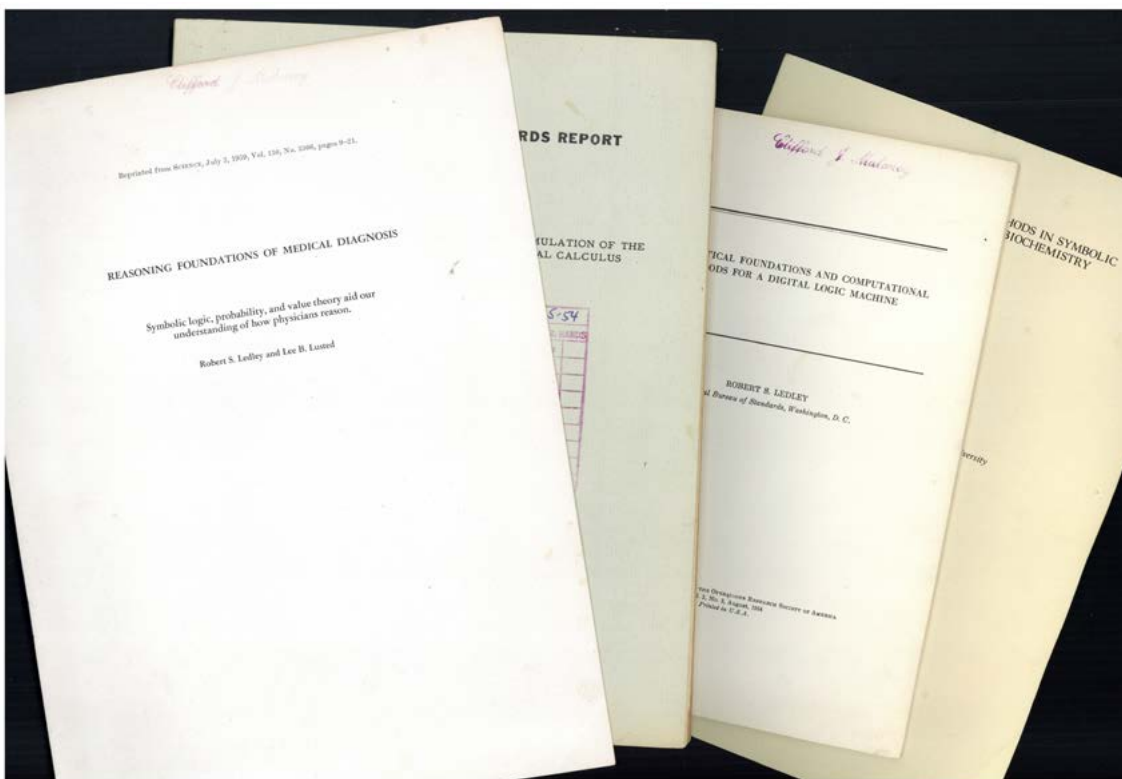
First Editions. 51689

1959

The First Expert System for Medicine

33. Ledley, Robert S. (1926-2012) and **Lee B. Lusted** (1922-94). (1) Reasoning foundations of medical diagnosis. Offprint from *Science* 130 (1959). 13pp. Text illustrations. 287 x 211 mm. Original printed wrappers, ownership stamp on front wrapper.

(2) **Ledley.** National Bureau of Standards Report 3363. A digitalization, systematization and formulation of the theory and methods of the propositional calculus. Offset typescript. [2], v, 82pp. Text diagrams. Washington, DC: U.S. Department of Commerce, National Bureau of Standards, Feb. 1, 1954. 268 x 206 mm. Original printed wrappers, stamp on front wrapper dated "9-15-54" in manuscript.



(3) **Ledley.** Mathematical foundations and computational methods for a digital logic machine. Offprint from *Journal of the Operations Research Society of America* 2 (1954). 249-274pp. Text diagrams. 230 x 152 mm. Original printed wrappers, ownership stamp on front wrapper.

(4) **Ledley.** Digital computational methods in symbolic logic, with examples in biochemistry. Offprint from *Proceedings of the National Academy of Science* 41 (1955). 498-511pp. Text diagrams. 258 x 176 mm. Original printed wrappers. Together 4 items. Very minor spotting on some wrappers, but very good overall. \$7500

First Editions; Offprint Issues, Extremely rare, of nos. (1), (3) and (4). Extremely rare. Ledley pioneered the use of computers in biology and medicine. Trained as both a physicist and a dentist, Ledley joined the National Bureau of Standards in 1952, where he was introduced to electronic computing through his wife, one of the x programmers on the Standards Eastern Automatic Computer (SEAC). Recognizing the enormous potential importance of computers to biomedical research, Ledley devoted the rest of his career to advancing the use of computing in biology and medicine. In 1960 he founded the National Biomedical Research Foundation (NBRF), which he headed until his retirement in 2010. His major accomplishments at the NRBF include the invention of the ACTA whole-body CT scanner (1973) and the establishment of the Protein Information Resource in the 1980s.

Ledley’s “Reasoning foundations of medical diagnosis,” written in collaboration with radiologist Lee Lusted, represents the beginning of the development of clinical decision support systems (CDSS)—interactive computer programs, or expert systems, designed to assist physicians and health care professionals with decision-making tasks.

Areas covered included: symbolic logic, Bayes’ theorem (probability) and value theory. In the article, physicians were instructed how to create diagnostic databases using edge-notched cards to prepare for a time when they would have the opportunity to enter their data into electronic computers for analysis. Ledley and Lusted expressed hope that by harnessing computers, much of physicians’ work would become automated and that many human errors could therefore be avoided. Within medicine, Ledley and Lusted’s article has remained influential for decades, especially within the field of medical decision-making (Wikipedia).

While at the National Bureau of Standards, Ledley devoted most of his time to solving military and intelligence problems using the techniques of operations research. Nos. (2) and (3) above (no. [3] is a revised version of no. [2]) discuss the use of Boolean algebra to simplify complex military decision-making processes. After leaving the NBS in 1954 Ledley joined the Operations Research Office at Johns Hopkins; one of his colleagues there was physicist George Gamow, who had become interested in molecular biology after Watson and Crick's discovery in 1953 of the double helix structure of DNA. Gamow sponsored Ledley for membership in the elite RNA Tie Club and enlisted Ledley's computing expertise in an attempt to crack the genetic code. Ledley's results were published in no. (4) above:

Ledley's main work for the RNA Tie Club was an effort to generate a set of contingency tables for the purpose of writing a computer program that would determine the correspondence between any three-letter sequence (triplet) of nucleotide bases and any amino acid . . . Sponsored by Gamow, Ledley published his work in 1955 in the *Proceedings of the National Academy of Sciences*. Though Ledley had produced a combinatorial table that could theoretically be used to determine which three-letter sequence of DNA bases corresponded to which amino acid, the problem required several thousand years of computation time on the world's fastest computers (circa 1955) to produce a solution (Wikipedia).

43185

1960

The First Advanced AI Program

34. Gelernter, Herman (1929-2015); **J. R. Hansen; Donald W. Loveland** (1934-). Empirical explorations of the geometry theorem machine. In *Proceedings of the Western Joint Computer Conference* 17 (1960): 143-149. Whole volume. 279 x 217 mm. Original printed wrappers, front wrapper scuffed, lower spine reinforced with clear tape, library markings effaced with ink. Good to very good. \$450



First Edition. Gelernter's geometry theorem machine, a software program he developed at IBM, was “the first advanced artificial intelligence program, and the third AI program ever. It is a logical AI system that can prove theorems in planar geometry about parallel lines, congruence, and equality and inequality of segments and angles” (Wikipedia article on Gelernter). The program “makes use of heuristic methods where they are most effective, but it also applies more powerful, more direct symbol manipulation processes where these are useful. Of special interest in the geometry proof program is the use of the diagram as a heuristic device in guiding search of the subproblem structure” (Feigenbaum and Feldman, p. 108). Feigenbaum and Feldman, *Computers and Thought*, 153-163 (reprinting this paper). 51677

Introduction of LISP, the Initial Programming Language of Choice for AI

35. McCarthy, John (1927-2011). Recursive functions of symbolic expressions and their computation by machine, part I [all published]. Offprint from *Communications of the ACM* 3 (1960). 184-195pp. 280 x 216 mm. Original printed wrappers, creased horizontally, slight spotting and soiling. Punched for a 3-ring binder. Very good. \$3750

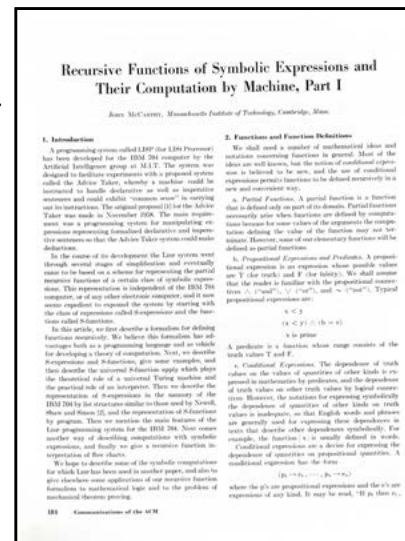
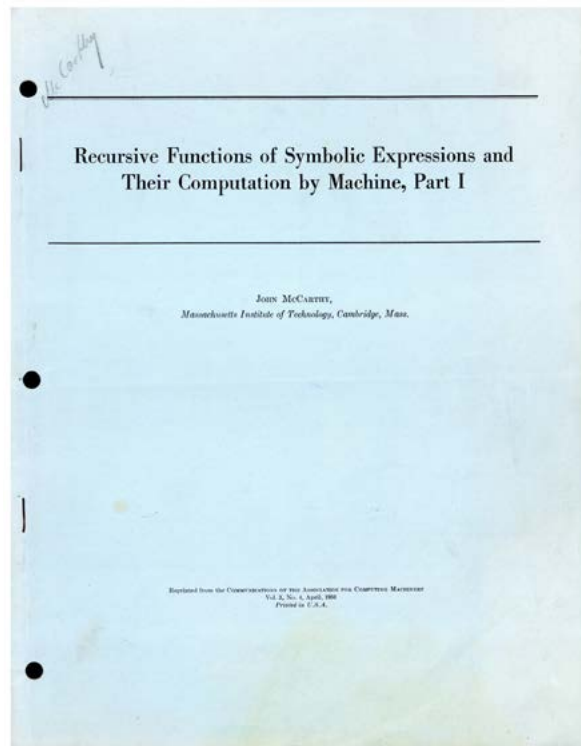
First Edition, Offprint Issue, Extremely rare, of the paper that introduced the LISP programming language, the second-oldest high-level programming language still in use (after FORTRAN), and the initial programming language of choice for artificial intelligence. McCarthy, one of the founders of AI, began developing LISP (short for “list processing”) in the late 1950s, after discovering that primitive recursive functions could be extended to compute with symbolic expressions. He later wrote that

Simplifications [involving memory management, CONS, etc.] made LISP into a way of describing computable functions [which was] much neater than the Turing machines or the general recursive definitions used in [partial] recursive function theory . . . I decided to write a paper describing LISP as both a programming language and as a formalism for doing recursive function theory. The paper was *Recursive functions of symbolic expressions and their computation by machine, part I* . . . Part II was never written but the intent was to contain applications to computing with algebraic expressions” (quoted in Stark, *LISP, Lore and Logic*, p. 104).

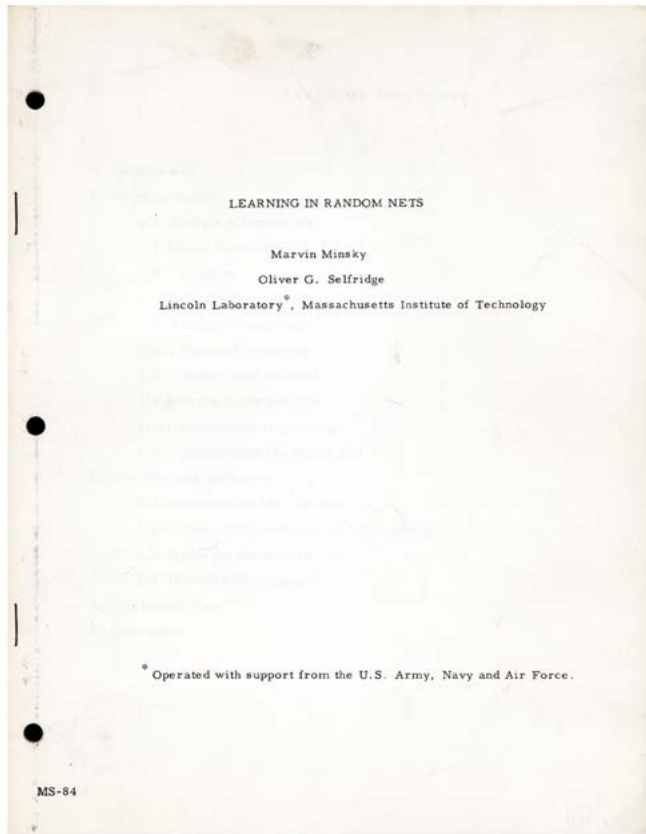
From the library of Martin Davis. 51681

36. McCarthy, John (1927-2011). Recursive functions of symbolic expressions and their computation by machine, part I [all published]. In *Communications of the ACM* 3 (1960): 184-195. Whole number. 281 x 218 mm. Original printed wrappers, slight wear at extremities, ownership signature on front wrapper. Very good. \$750

First Edition, journal issue. 51672



37. Minsky, Marvin (1927-2016); **Oliver Selfridge** (1926-2008). Learning in random nets. Reproduced typescript. [3], 17 [5]ff. Text diagrams. [Cambridge:] Lincoln Laboratory, Massachusetts Institute of Technology, [1960]. Without wrappers as issued. 281 x 217 mm. Slight soiling and creasing but very good. \$9500



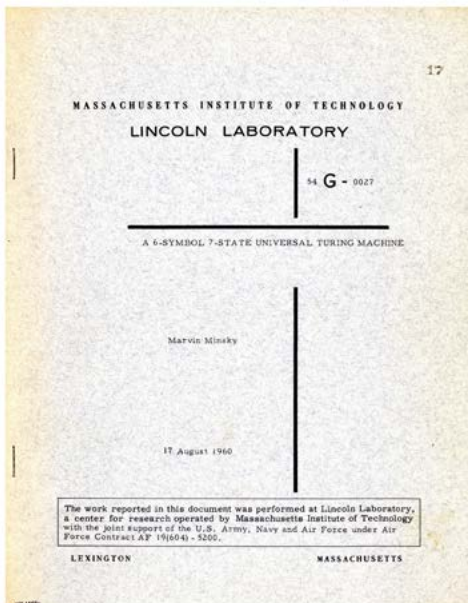
First Printing, Very Rare Preprint Edition. Minsky, one of the pioneers of artificial intelligence, joined the staff at MIT's Lincoln Laboratory in 1958, and in 1959 he and John McCarthy founded what eventually was named the MIT Computer Science and Artificial Intelligence Laboratory. One of his mentors was Oliver Selfridge, whom he met at the Lincoln Laboratory. Minsky and Selfridge were among the 11 attendees at the Dartmouth Summer Research Project on Artificial Intelligence, considered the founding event of AI as a field.

In the present paper, one of Minsky's first on artificial intelligence,

We consider several kinds of learning and how random nets might achieve them. The models range from simple one-to-one switching nets to recognition of compound stimuli and to optimization with respect to a task . . . No plausible and feasible suggestions have been made about how random nets can accomplish real generalizations or construct new concepts" (f. 1).

This paper was published in *Proceedings of the 4th London Symposium on Information Theory*, ed. C. Cherry (London: Butterworth, 1961). *Origins of Cyberspace* 798 (1961 edition) 44651

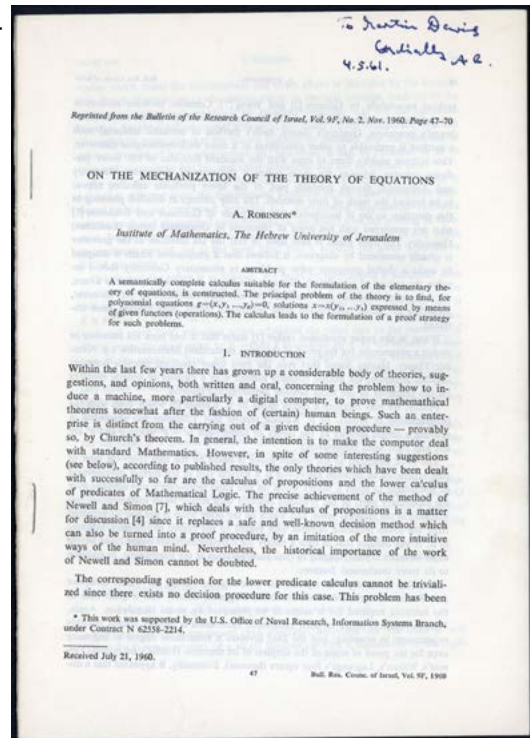
38. Minsky, Marvin (1927-2016). A 6-symbol 7-state universal Turing machine. Reproduced typescript. 8ff. Text diagrams. Lexington, MA: MIT Lincoln Laboratory, 1960. 281 x 217 mm. Original printed wrappers, slightly sunned. Very good. \$3750



First Edition. In 1956 Claude Shannon posed the question of finding the smallest possible universal Turing machine; i.e., the simplest computing model powerful enough to calculate all possible functions that can be calculated. In 1960 Minsky published the present paper describing a 6-symbol 7-state machine—the programming for which was “fiendishly complex” (f. 1)—and two years later he came up with a 7-state 4-symbol machine; smaller universal Turing machines have since been discovered. From the library of Martin Davis. 51665

39. Robinson, Abraham (1918-74). On the mechanization of the theory of equations. Offprint from *Bulletin of the Research Council of Israel* 9F (1960). 47-70pp. 241 x 170 mm. Without wrappers. Very good. *Presentation Copy*, inscribed by Robinson to Martin Davis (1928-2023) on the first page: "To Martin Davis Cordially A. R. 4.5.61." \$2750

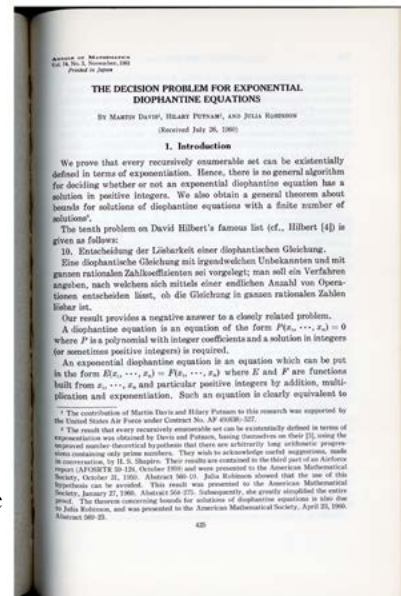
First Edition, Offprint Issue. Robinson is best known for developing nonstandard analysis, which reincorporated infinitesimal and infinite numbers into mathematics. In the present paper, which addresses "the problem of how to induce a machine, more particularly a digital computer, to prove mathematical theorems somewhat after the fashion of (certain) human beings," he constructed "a semantically complete calculus for the formulation of the elementary theory of equations" leading to "the formulation of a proof strategy for such problems" (p. 47). 51685



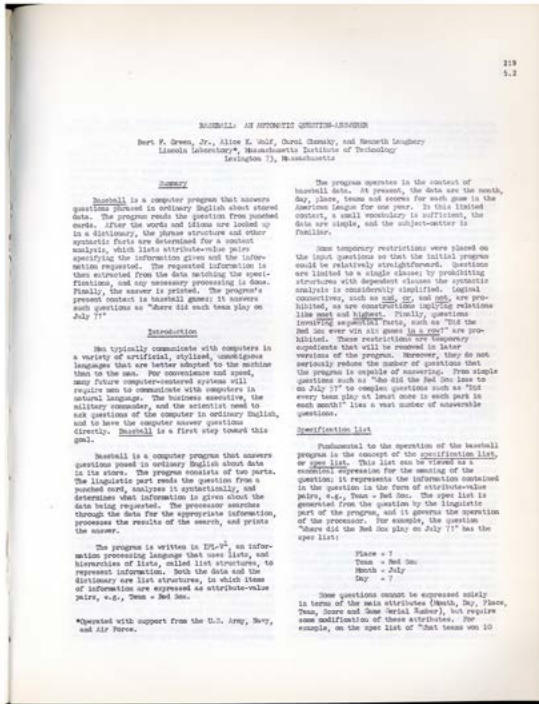
1961

40. Davis, Martin (1928-2023); **Hilary Putnam** (1926-2016); **Julia Robinson** (1919-85). The decision problem for exponential Diophantine equations. In *Annals of Mathematics* 74 (1961): 425-436. Whole volume. 249 x 166 mm. Library buckram; original printed wrappers of all three numbers bound in. Very good. Library stamp on fore-edge. \$750

First Edition. Davis, Putnam and Robinson's investigation of Hilbert's tenth problem—given a Diophantine equation, is there an algorithm that can decide if the equation is solvable?—resulted in the MRDP theorem (1970), which states that "every computably enumerable set is Diophantine, and the converse" (Wikipedia article on MDRP theorem). Davis, in his Ph.D. thesis (1950) had conjectured that Hilbert's tenth problem was unsolvable, a conjecture borne out by the MDRP theorem. The "M" in MRDP stands for Yuri Matiyasevich, the Russian mathematician who came up with the final theorem; Matiyasevich relied heavily on the earlier work of Davis, Putnam and Robinson. 51684



41. Green, Bert F.; Alice Wolf; Carol Chomsky; Kenneth Laughery. Baseball: An automatic question-answerer. In **Institute of Radio Engineers; American Institute of Electrical Engineers; Association for Computing Machinery.** Proceedings of the Western Joint Computer Conference: Papers read at the joint IRE-AIEE-ACM computer conference, Los Angeles, Calif, May 9-11, 1961 (1961): 219-224. Whole volume. 280 x 217 mm. Original printed wrappers, some fading especially at spine, owner's name effaced on front wrapper, lower spine reinforced with clear tape, minor soiling. First three leaves detached but present. Good to very good. \$500



The program operates in the context of baseball facts. As presented, the data are the month, day, place, team and scores for each game in the American League for one year. In this limited context, a small vocabulary is sufficient, the data are simple, and the subject-matter is familiar.

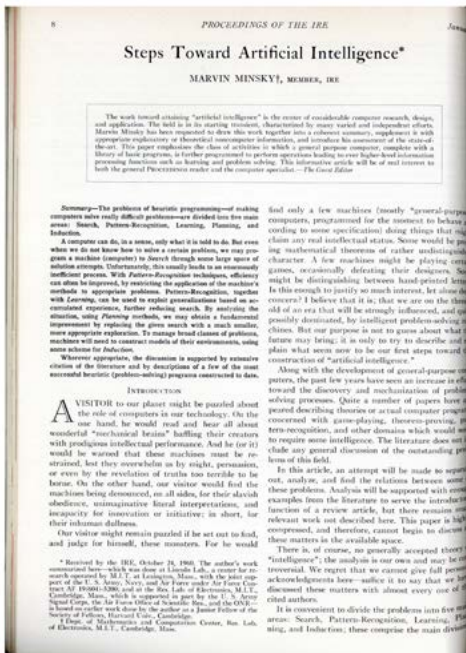
Some temporary restrictions were placed on the input questions so that the initial program could be relatively straightforward. Questions were limited to a simple question form: a question structure with dependent clauses the syntactic analysis is considerably simpler. (Complex questions, such as 'Did the Red Sox win on July 11?' are prohibited, as are non-orthodox phrasings like 'Did the Red Sox win on July 11?' are prohibited. These restrictions for temporary expedients that will be removed in later versions of the program. However, they do not seriously reduce the number of questions that the program is capable of answering. From simple questions such as 'Did the Red Sox win on July 11?' to complex questions such as 'Did every team play at least once in each part of each month?' like a vast number of unanswerable questions.

First Edition. An early example of a “question-answering” computer program that enables the computer to be interrogated in natural language about a more or less circumscribed universe of discourse—in this case, baseball. Such programs grew out of AI investigations into ways of communicating with computers more directly, and the AI community’s quest to discover an information-processing theory to explain the basic mechanisms of language comprehension.

Other key AI papers included in this volume are: H. A. Simon, “Modeling human mental processes”; “E. Feigenbaum, “The simulation of verbal learning behavior”; M. Minsky, “Descriptive language and problem solving”; and W. R. Asby, “What is an intelligent machine?” Minsky, “A selected descriptor-indexed bibliography to the literature on artificial intelligence,” in Feigenbaum, E. A. and Feldman, J., eds., *Computers and Thought* (New York: McGraw-Hill, 1963), pp. 453–523. *Origins of Cyberspace* 639. 51678

“Call to Arms” for a Generation of AI Researchers

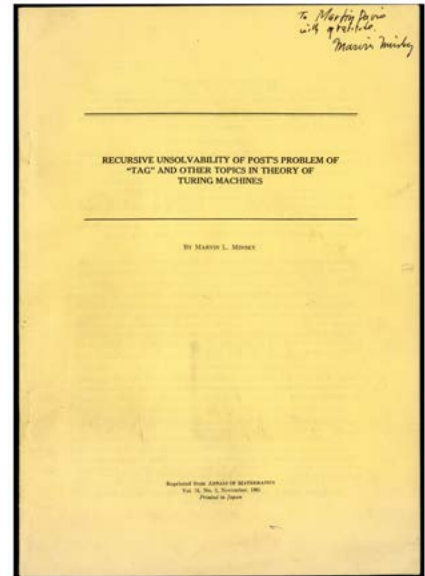
42. Minsky, Marvin (1927-2016). Steps toward artificial intelligence. In *Proceedings of the IRE* 49 (1961): 8-30. Whole number. 281 x 215 mm. Original printed wrappers, some wear and spotting, a few small tears at edges, ownership inscription on front wrapper. Good to very good. \$600



First Edition of Minsky’s “seminal” paper on artificial intelligence, which “surveyed and analyzed what had been done before, and outlined many major problems that the infant discipline would later need to face” (MIT). “Many consider [Minsky’s] 1960 paper, “Steps toward Artificial Intelligence,” to be the call-to-arms for a generation of researchers. That paper established symbol manipulation—divided into heuristic search, pattern recognition, learning, planning, and induction—to be at the center of any attempt at understanding intelligence” MIT, “Brief academic biography of Marvin Minsky” (web). Accessed 21 Dec. 2023. “Marvin Minsky - A. M. Turing Award Laureate.” *A. M. Turing Award*, ACM (web). Accessed 21 Dec. 2023. 51670

Inscribed to Martin Davis, who Inspired This Paper

43. Minsky, Marvin (1927-2016). Recursive unsolvability of Post's problem of "tag" and other topics in theory of Turing machines. Offprint from *Annals of Mathematics* 74 (1961). 437-455pp. 254 x 178 mm. Original printed wrappers, light soiling and creasing. Very good. *Presentation Copy*, inscribed by Minsky to Martin Davis (1928-2023) on the front wrapper: "To Martin Davis with gratitude Marvin Minsky." \$3750

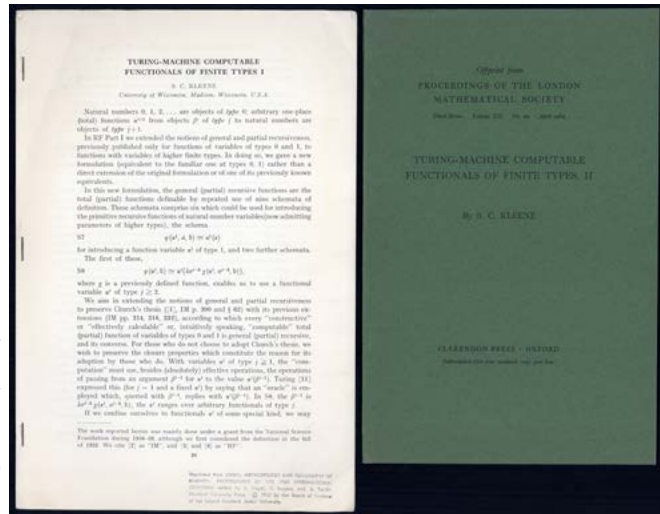


First Edition, Offprint Issue. Minsky proved in this paper that the deterministic models of computation known as "tag systems," introduced by Emil Post in 1943, are recursively unsolvable. The problem had been suggested to Minsky by mathematical logician Martin Davis, recipient of the present copy, who was then preparing a collected edition of Post's papers on unsolvable problems and computable functions; Minsky acknowledged Davis's contribution on p. 438. 51664

1962

44. Kleene, Stephen C. (1909-94). (1) Turing-machine computable functionals of finite types I. Offprint from *Logic, Methodology and Philosophy of Science: Proceedings of the 1960 International Congress*, ed. E. Nagel, P. Suppes and A. Tarski (Stanford: Stanford University Press, 1962). 38-45pp. 262 x 179 mm. Without wrappers; stapled. Light creasing. With:

(2) Turing-machine computable functionals of finite types II. Offprint from *Proceedings of the London Mathematical Society*, 3rd series, 12 (1962). 245-258pp. 237 x 153 mm. Original printed wrappers.



Together 2 items. Very good.

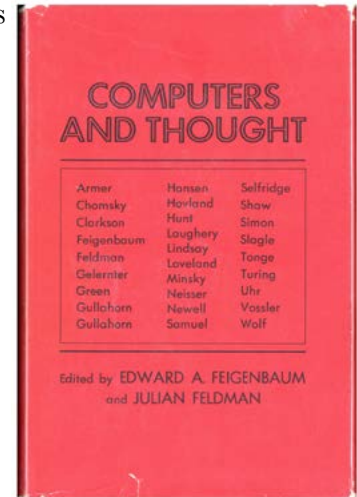
\$1500

First Editions, Offprint Issues. In the 1950s and 60s "Kleene opened the frontiers of computability on higher type objects" (Soare, p. 22); i.e., those greater than type 0 (numbers) and type 1 ($n + 1$). In the present papers Kleene developed Turing-machine computable functionals of higher types. R. Soare, "Computability and recursion," *Bulletin of Symbolic Logic* 2 (1996): 284-321. From the library of Martin Davis. 51660

45. Feigenbaum, Edward A. (1936-); **Julian Feldman.** Computers and thought. xvi, 535pp. New York: McGraw-Hill, 1963. 228 x 151 mm. Original cloth, dust-jacket (minor chips and tears). Very good.

\$50

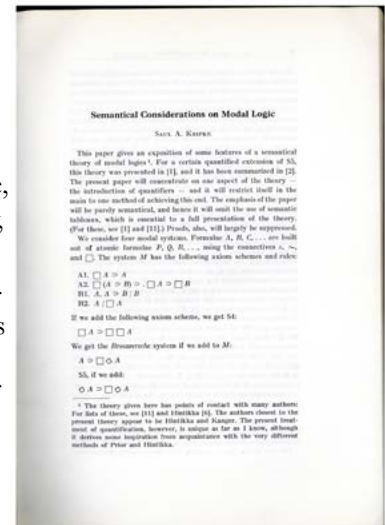
Later printing. The first anthology on artificial intelligence, consisting of twenty papers by experts in the field plus a comprehensive bibliography by Marvin Minsky of published works on AI. "With two exceptions (one being the famous survey paper of early AI by Minsky), a critical selection criterion [for each paper] was that the paper had to describe the experimental results from a running computer program. The view was that if a cognitive theory on which you were basing your approach to AI was worthy of the time and attention of others, it had to have been stated in a language of a computer; and it had to have run on a set of appropriate cognitive tasks to demonstrate at least the sufficiency of the theory" (Feigenbaum, preface to the 1995 edition, p. iii). See *Origins of Cyberspace* 599. 38142



46. Kripke, Saul (1940-2022). Semantical considerations on modal logic. In *Acta philosophica fennica* 16 (1963): 83-94. Whole number. 251 x 177 mm. Original printed wrappers, light soiling and wear, spine a bit darkened. Very good.

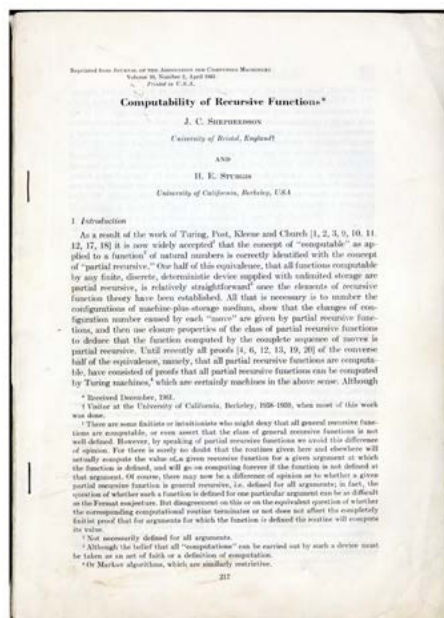
\$300

First Edition of Kripke's second paper on "Kripke semantics." Kripke, one of the most important philosophers of the latter half of the 20th century, is best known for creating the now-standard Kripke semantics (also known as relational semantics) for modal logic, the kind of logic used to represent statements about necessity and possibility. "Kripke semantics is a formal semantics for non-classical logic systems. It was first made for modal logics, and later adapted to intuitionist logic and other non-classical systems. The discovery of Kripke semantics was a breakthrough in the making of non-classical logics, because the model theory of such logics was absent before Kripke" (Wikipedia article on Kripke). Kripke semantics play an important role in theoretical computer science. 51693



The Shepherdson-Sturgis Register Machine

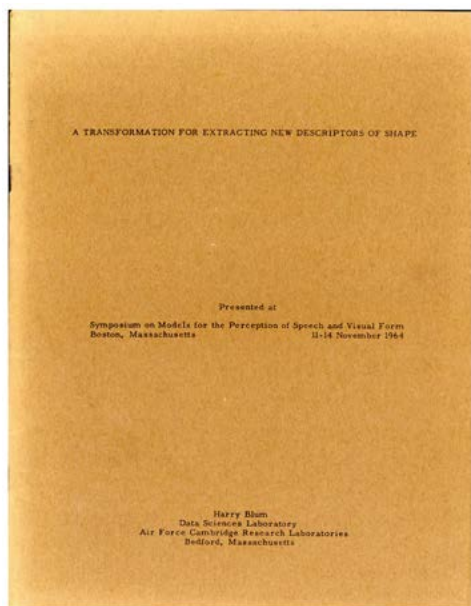
- 47. Shepherdson, John C.** (1926-2015); **H. E. Sturgis.** Computability of recursive functions. Offprint from *Journal of the Association for Computing Machinery* 10 (1963). 217-255pp. 248 x 175 mm. Without wrappers; stapled. Some soiling, wear and creasing. Good to very good. \$950



First Edition, Offprint Issue. “Shepherdson was a British mathematician who worked in ring theory and mathematical logic . . . His interest in recursive functions led to many other papers on the topic, in particular his joint paper with Howard Sturgis entitled “Computability of recursive functions” (1963). This paper contained an idea similar to a Turing machine, now known as the Shepherdson-Sturgis Register machine. In many ways this is easier to work with than a Turing machine and has proved an important idea” (MacTutor). “John Shepherdson - Biography.” Maths History (web). Accessed 22 Dec. 2023. From the library of Martin Davis. 51674

1964

- 48. Blum, Harry** (1924-87). (1) A transformation for extracting new descriptors of shape. Reproduced typescript. 17, [5]pp. Bedford, MA: Data Sciences Laboratory, Air Force Cambridge Research Laboratories, 1964. 280 x 218 mm. Original printed wrappers. With:



(2) Symposium on models for the perception of speech and visual form. Collection of documents including *21 typed or reproduced abstracts of papers; 11 letters*; the preliminary program for the conference; 16-page list of attendees; and related drafts, photocopies, etc. Approx. 100 sheets total. N.p., 1964. 280 x 218 mm. In folder labeled “Symp. on model for perception / Submitted abstracts & papers.” Very good. \$2750

First Printing. Blum, a specialist in biological and visual shape description, is best known for two key concepts in image processing: The *medial axis*; i.e., the set of all points on an object having more than one closest point on the object’s boundary, and the *grassfire transformation*; i.e., the computation of the distance from a pixel to the border of a region. He introduced these concepts in his 1964 paper,

“A transformation for extracting new descriptors of shape,” which was presented at the Air Force Cambridge Research Laboratory’s 1964 “Symposium on Models for the Perception of Speech and Visual Form.” The paper was published three years later in the proceedings of the symposium (1967).

Blum began his work on shape analysis while employed at the AFCRL’s Data Sciences Lab, where he worked from 1960 to 1967. Blum came up with the idea for the AFCRL’s 1964 symposium and was one of the conference’s principal organizers. 51691

The Beginning of Algorithmic Information Theory

49. Solomonoff, Ray R. (1926-2009). A formal theory of inductive inference. Part I [II]. In *Information and Control* 7 (1964): 1-22; 224-254. Whole volume. 221 x 141 mm. Library buckram. Very good. \$850

First Edition, journal issue. Solomonoff was a founder of the branch of AI based on machine learning, prediction and probability. He invented algorithmic probability, a mathematical method of assigning a prior probability to a given observation. He introduced this concept in a preliminary report published in 1960 and gave it a much fuller treatment in the present two-part paper, which is considered the beginning of algorithmic information theory.

Prior to the 1960s, the usual method of calculating probability was based on frequency: taking the ratio of favorable results to the total number of trials. In his 1960 publication, and, more completely, in his 1964 publications, Solomonoff seriously revised this definition of probability. He called this new form of probability “Algorithmic Probability” and showed how to use it for prediction in his theory of inductive inference. As part of this work, he produced the philosophical foundation for the use of Bayes rule of causation for prediction [a method now known as Solomonoff’s induction] . . . In the years following his discovery of Algorithmic Probability he focused on how to use this probability and Solomonoff Induction in actual prediction and problem solving for A.I. (Wikipedia article on Solomonoff).

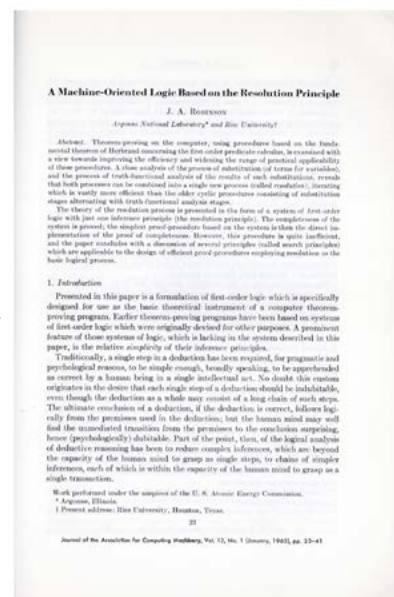
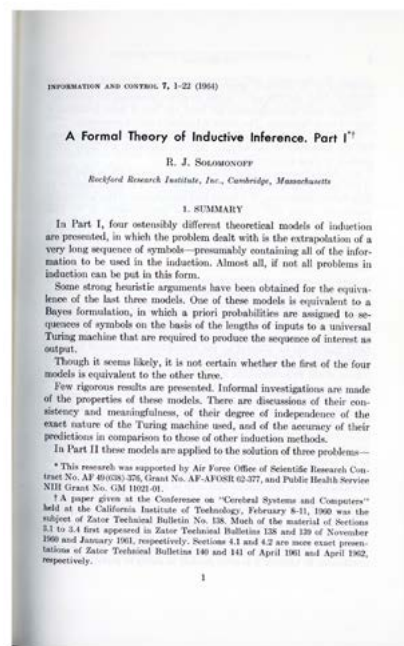
Solomonoff was one of the original 11 attendees at the 1956 Dartmouth Summer Research Conference on Artificial Intelligence, which introduced AI as a science. 51683

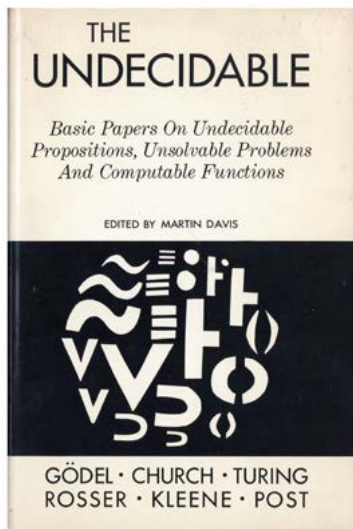
1965

Robinson’s Resolution Principle

50. Robinson, John A. (1930-2016). A machine-oriented logic based on the resolution principle. In *Journal of the Association for Computing Machinery* 12 (1965): 23-41. Whole number. 254 x 174 mm. Original printed wrappers, light wear and soiling. Very good. \$750

First Edition. Robinson’s famous resolution principle for automatic theorem proving, introduced in the present paper, represents a major advancement in automated reasoning technology. “If one event can be pinpointed as marking [automated theorem proving’s] emergence as a mature subject, it would be the publication in which J. A. Robinson announced the resolution principle . . . Robinson’s method of resolution introduced in his highly influential [paper] revolutionized the subject. . . The three decades since the first implementations of resolution have seen an outpouring of research devoted to automated reasoning systems” (Davis, pp. 10-11). Davis, “The early history of automated deduction,” in *Handbook of Automated Reasoning* (2001), pp. 5-15. 51662





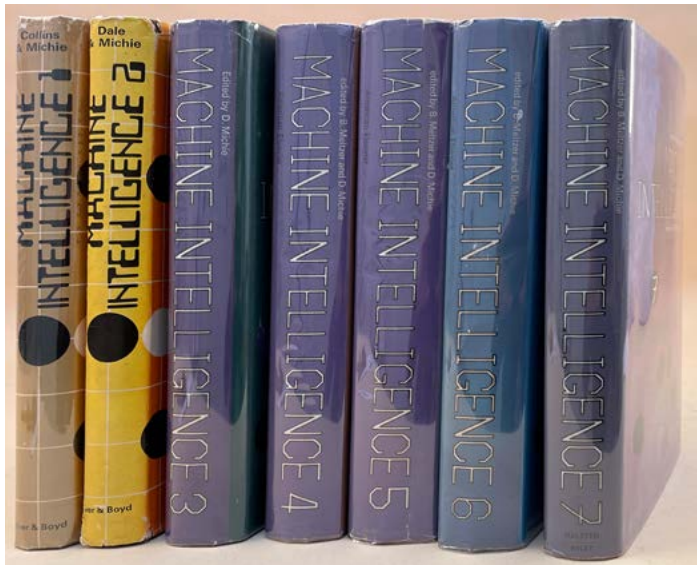
51. Davis, Martin (1928-2023), ed. *The undecidable: Basic papers on undecidable propositions, unsolvable problems and computable functions*. [4], 440pp. Hewlett, NY: Raven Press, 1965. 234 x 156 mm. Original cloth, dust-jacket (tiny tears at edges, light spotting). Very good. \$150

First Edition. “This book is an anthology of fundamental papers dealing with undecidability and unsolvability . . . Included are the basic papers of Gödel, Church, Turing and Post in which the class of recursive functions was singled out and seen to be just the class of functions that can be computed by finite algorithms . . . Nearly half the volume is devoted to hitherto unpublished or newly translated material” (dust-jacket). 51687

1967

Including a Previously Unpublished Paper by Turing

52. Michie, Donald (1923-2007) *et al.*, eds. *Machine intelligence 1 [-7]*. Multi-volume set. Vp., 1967-1972. 248 x 155 mm. Original cloth (vols. 1-2) and boards (vols. 3-7), dust-jackets (light wear, a few tears). Very good. \$500



First Editions of the first seven volumes of this series, containing papers presented at the first through seventh Machine Intelligence workshops held at Edinburgh University between 1965 and 1971. The series was founded by British AI researcher Donald Michie, director of Edinburgh University’s Department of Machine Intelligence and Perception, who had worked with Alan Turing at Bletchley Park. Michie was editor-in-chief of the first seventeen volumes of the series.

These seven volumes include the following important papers:, including a *previously unpub-*

lished one by Turing: **J. A. Robinson**, “The generalized resolution principle” (Vol. 3, pp. 77-93); **D. W. Loveland**, “Theorem-provers combining model elimination and resolution” (Vol. 4, pp. 73-86); **B. Buchanan, G. Sutherland and E.A. Feigenbaum**, “Heuristic DENDRAL: A program for generating explanatory hypotheses in organic chemistry” (Vol. 4, pp. 209-254); **J. McCarthy and P. J. Hayes**, “Some philosophical problems from the standpoint of artificial intelligence” (Vol. 4, pp. 463-502); **A. M. Turing**, “Intelligent machinery” (Vol. 5, pp. 3-23); **Z. Manna and J. McCarthy**, “Properties of programs and partial function logic” (Vol. 5, pp. 27-37); **E. A. Feigenbaum, B. G. Buchanan and J. Lederberg**, “On generality and problem solving: A case study using the DENDRAL program” (Vol. 6, pp. 165-190); **B. G. Buchanan, E. A. Feigenbaum and N. S. Sridharan**, “Heuristic theory formation: Data interpretation and rule formation” (Vol. 7, pp. 267-290). 51690

Highlighting Important Problems that Needed to be Overcome in Order to Make Neural Networks More Useful and Powerful

53. Minsky, Marvin (1927-2016); **Seymour Papert** (1928-2016). Perceptrons and pattern recognition. Artificial intelligence memo no. 140. Reproduced typescript. [viii], 26, 15, 11, 8, 10, 3, 26, 24, 19, 9, 14, 12, 8pp. [Cambridge, MA:] Massachusetts Institute of Technology, September 1967. 278 x 214 mm. Without wrappers, stapled and punched for a 3-ring binder; preserved in cloth drop-back box. Tiny tears in first leaf, light toning but very good. Ownership signature on the title.
\$20,000

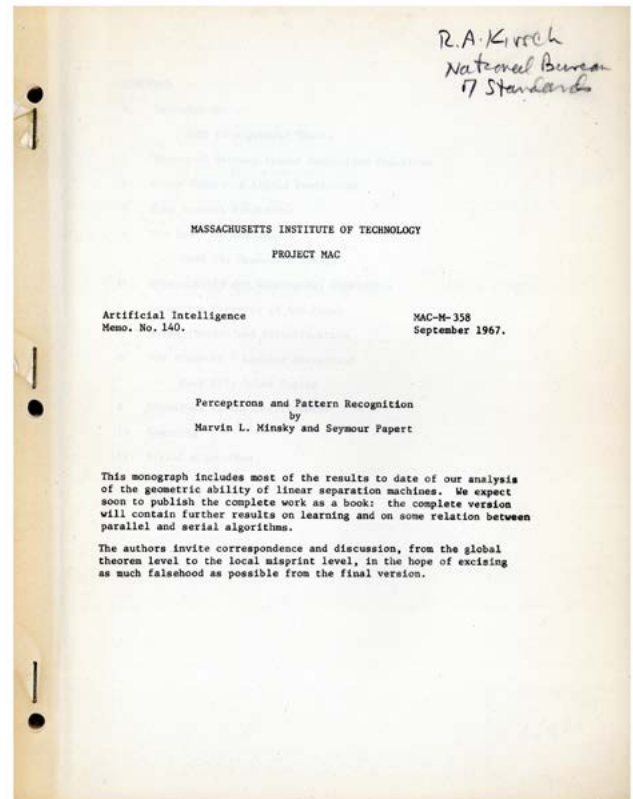
First Edition, Extremely Rare Pre-Publication Issue, of a seminal early work on artificial intelligence, containing the first systematic study of parallelism in computation. The work was published in book form in 1969 under the title *Perceptrons*; the pre-publication issue is *extremely rare*, with only two copies listed in OCLC (Stanford and the National Research Council in Canada) and no copies in the auction records.

Minsky and Papert's work was the first example of a mathematical analysis carried far enough to show the exact limitations of "connectionist" neural networks, a class of computing machines consisting of circuits of connected units designed to simulate intelligent behavior. It contained a critical analysis of the simple neural network known as a perceptron—an algorithm which allows for learning the process of deciding whether an input belongs to some given class or not—which had been developed in 1958 by Minsky's former schoolmate Frank Rosenblatt; Rosenblatt optimistically predicted that perceptrons might eventually be able to learn, make decisions and translate languages. An active research program into perceptrons was carried out throughout the 1960s but came to a sudden halt with the publication of Minsky and Papert's work, which suggested that there were severe limitations to what perceptrons could do and that Frank Rosenblatt's predictions had been grossly exaggerated. The effect of Minsky and Papert's book was devastating: Virtually no research at all was done in connectionism until the mid-1980s, when the work of John Hopfield, David Rumelhart and others revived large-scale interest in neural networks.

"In 1969, together with Seymour Papert, an expert on learning, Minsky wrote a book called *Perceptrons*, which pointed to key problems with nascent neural networks. The book has been blamed for directing research away from this area of research for many years.

"Today, the shift away from neural networks may seem like a mistake, since advanced neural networks, known as deep learning systems, have proven incredibly useful for all sorts of tasks.

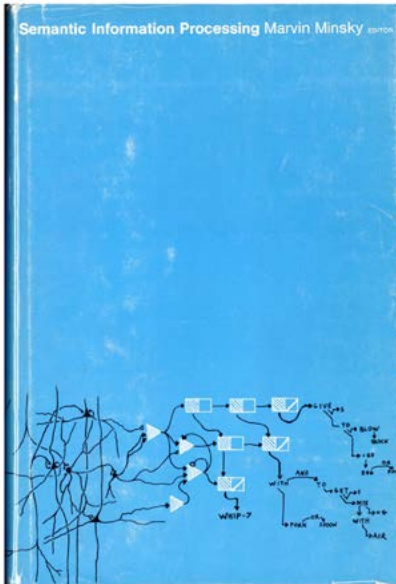
"In fact, the picture is a little more complicated. *Perceptrons* highlighted important problems that needed to be overcome in order to make neural networks more useful and powerful; Minsky often argued that a purely 'connectionist' neural network-focused approach would never be sufficient to imbue machines with genuine intelligence. Indeed, many modern-day AI researchers, including those who have pioneered work in deep learning, are increasingly embracing this same vision" (Knight, "What Marvin Minsky still means for AI," *MIT Technology Review*, 26 January 2016). 45491



1968

From the Library of Arthur L. Samuel

- 54. Minsky, Marvin** (1927-2016), ed. *Semantic information processing*. viii, 438pp. Cambridge, MA: MIT Press, 1968. 229 x 153 mm. Original cloth, dust-jacket (chip in lower spine, some small edge tears, light wear). Very good. *From the library of Arthur L. Samuel (1901-90), pioneer in computer gaming and artificial intelligence, with his signature dated Sept. 1969 on the front free endpaper.* \$450



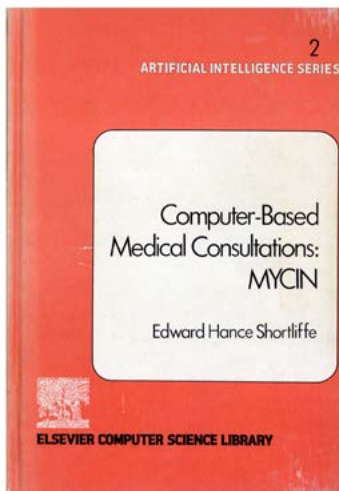
Arthur L. Samuel
Sept 1969
(home copy)

First Edition. This 438-page anthology, consisting primarily of Ph.D. dissertations on AI by Minsky's students at MIT, contains only 9 papers, including Minsky's 32 page introduction. It includes on pp. 33-134 the first published version of Bertram Raphael's *SIR Semantic Information Retrieval*, "on the logical representation of knowledge for question-answering systems." The second paper in the anthology (pp. 135-213) is Daniel G. Bobrow's *Natural Language Input for a Computer Problem-Solving System or STUDENT*. The remaining papers are the Ph.D. dissertations of Minsky's students M. Ross Quillian, Thomas G. Evans, and Fischer Black (2 papers). These are followed by reprints of McCarthy's "Programs with common-sense" and Minsky's "Descriptive languages and problem-solving (1961) and "Mind, matter and models" (1965). The first edition this anthology has an unusual erratum slip pasted to page 433.

This copy belonged to Arthur L. Samuel, an AI pioneer whose checkers-playing program, developed in the late 1950s, is considered to be the world's first self-learning program—"and as such a very early demonstration of the fundamental concept of artificial intelligence" (Wikipedia article on Samuel). 51682

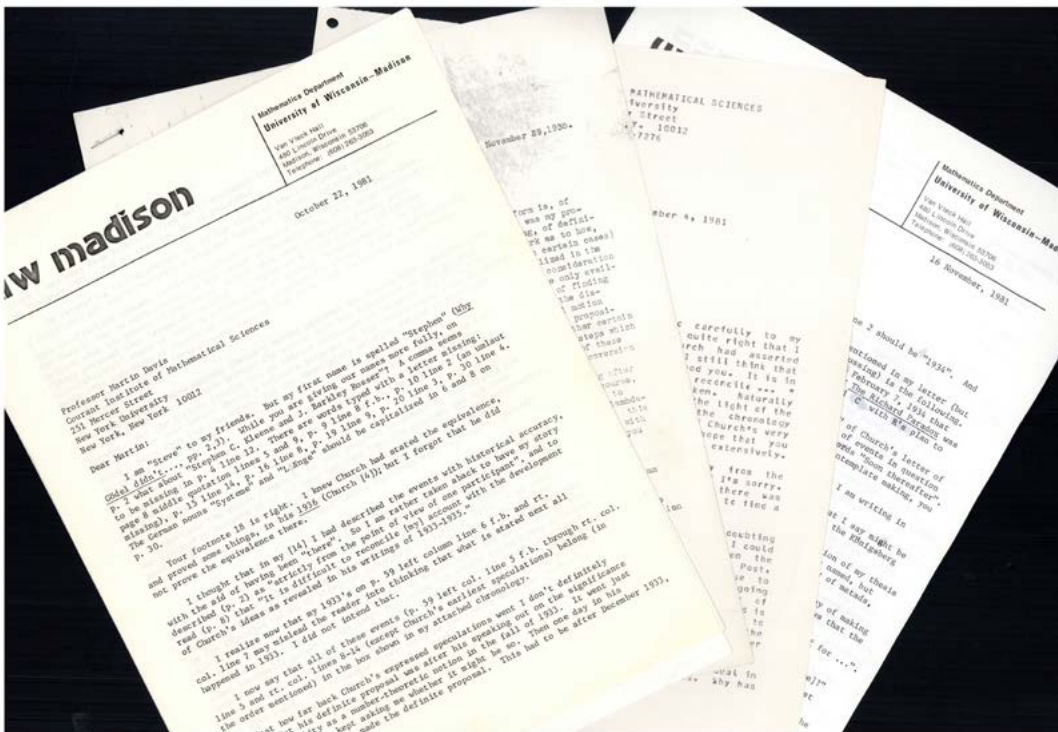
1976

- 55. Shortliffe, Edward H.** (1947-). *Computer-based medical consultations: MYCIN*. xxii, 264pp. New York: Elsevier, 1976. 229 x 157 mm. Original boards, spine faded, slight edgewear. Very good, clean copy. Ownership inscription on the front pastedown. \$150



First Edition. "Shortliffe is a pioneer in the use of artificial intelligence in medicine. He was the principal developer of the clinical expert system MYCIN, one of the first rule-based artificial intelligence expert systems, which obtained clinical data interactively from a physician user and was used to diagnose and recommend treatment for severe infections. While never used in practice (because it preceded the era of local-area networking and could not be integrated with patient records and physician workflow), its performance was shown to be comparable to and sometimes more accurate than that of Stanford infectious disease faculty. This spurred the development of a wide range of activity in the development of rule-based expert systems, knowledge representation, belief nets and other areas, and its design greatly influenced the

subsequent development of computing in medicine" (Wikipedia article on Shortliffe, accessed 12-14-23). See Garrison-Morton.com 9486. 51639



A selection of materials from no. 55

1979

56. Kleene, Stephen C. (1909-94); **Martin Davis** (1928-2023). (1) Group of 16 letters, including 8 typed letters signed and two autograph letters signed, pertaining to Kleene's 1981 paper, "Origins of recursive function theory," and Davis's 1982 paper, "Why Gödel didn't have Church's thesis"; see calendar of letters below. 26 sheets total. October 1981 – 19 February 1982. Very good.

(2) **Kleene**. Origins of recursive function theory. Offprint from *Annals of the History of Computing* 3 (1981). 52-67pp. 282 x 213 mm. Original plain wrappers. Very good. *With 4 corrections in Kleene's hand.* \$4500

Outstanding scientific correspondence between Kleene and Davis. The correspondence, consisting of 16 letters (see the calendar below), centers on Davis's paper, "Why Gödel didn't have Church's thesis" (*Information and Control* 54 [1982]: 3-24), which had been inspired by Kleene's 1979 lecture on "Origins of recursive function theory" given in San Juan, Puerto Rico in 1979 at the 20th annual IEEE *Symposium on Foundations of Computer Science*. In his letter of 11/14/79 (letter 1), Kleene proposed an addition to the published version of his lecture (*Annals of the History of Computing* 3 [1981]: 52-67), based on a suggestion by Davis:

What would you think of adding the following to the second full paragraph of the of the right column of page 378: In a conversation at San Juan on October 31, 1979, Davis . . . expressed to me the opinion that my proof of the equivalence of my definition of general recursiveness to Gödel's (which Gödel called "not quite trivial"), and my normal form theorem, were considerations which combined with Turing's arguments to convince Gödel of the Church-Turing thesis . . .

Sometime in 1981 Davis sent Kleene a preliminary version of "Why Gödel didn't have Church's thesis"—a paper "directly stimulated by your San Juan lecture"—which outlined the development of λ -definability and recursive function theory by Gödel, Church, Turing, Kleene, Post and others in the 1930s. Davis asked for Kleene's comments and corrections to the paper (letter 2); Kleene ended up sending Davis two long letters (letters 4 and 9) with extensive criticisms and additions, clarifying the chronology and priority of discovery, and adding important historical detail, particularly with regard to Church and Gödel. An example:

Just how far back Church's expressed speculations [re λ -definability] went I don't definitely recall. But his definite proposal was after his speaking out on the significance of λ -definability as a number-theoretic notion in the fall of 1933 . . . Then one day in his office in Fine Hall he made the definite proposal. This had to be after December 1933 since I was away from Princeton from early September 1933 till sometime in January or February 1934 . . . And Church, who is very careful, in his letter of November 29, 1935 (copy enclosed), written when his memory of the period should have been reasonably fresh, puts "[his] proposal that lambda-definability be taken as a definition of [effective calculability] ahead of Gödel's introduction of general recursiveness (letter 4, 10/22/81).

Kleene's letter enclosed a photocopy of Church's 1935 letter (letter 6), in which Church described his and Kleene's development of λ -definability ("The notion of lambda-definability in its present form is, of course, the result of a gradual development . . . we seem to be agreed that the statement that the notion of lambda-definability is jointly due to you and me is fair . . .") and gave a brief history of "Gödel and the notions of recursiveness and effective calculability." In his letter of 11/16/81 (letter 9) Kleene supplied further information about Gödel's role vis-à-vis lambda-calculus and recursiveness theory, particularly his failure to credit Church's and Kleene's work:

Now, I hate to say it. But I must acknowledge feeling that Gödel was somewhat less than generous in acknowledging (except only, so far as I know, for the footnote on your p. 72) a role of Church or me in three matters.

In the spring term of 1934, Church had pushed λ -definability at a reluctant Gödel . . . Was it hard for Gödel to admit that Church had in fact been right (though not as persuasive as Turing later was), given Gödel's acceptance of Turing's equivalent?

As my second illustration of Gödel's reluctance to give credit, Gödel has never to my knowledge taken any public notice of my having a role in generalizing his (first) incompleteness theorem . . .

A third—rather trifling—illustration is the notion of "partial recursive function." I remember so vividly the words of Gödel on an occasion in Princeton in 1939-40 . . . when in a conversation with him I mentioned "partial recursive functions" (terminology which, as you well know, I introduced in the J.S.L. in 1938). His exact words were, I swear, "What is a partial recursive function?" . . . (letter 9).

In this letter Kleene also stated that he would send Davis an offprint of "Origins of recursive function theory" in which "I am writing in four corrections" on pp. 52, 57, 59 and 60; this corrected offprint is included in the present collection. Davis gratefully incorporated Kleene's observations into the later drafts of his paper (letters 8 and 11), and Kleene responded with further minor corrections (letters 12, 13, 15 and 16). 51697

Calendar of letters and documents in the collection:

No.	Author	Date	Notes
1	Kleene	1979/11/14	Autograph letter signed to Davis. 2pp. on single sheet. "It was a pleasure to see you at San Juan. There is a chance of a further publication of my San Juan lecture. So I am drafting a few alterations of it . . ."
2	Davis	[1981/00/00]	Computer typescript letter to Kleene, undated. 1 page. "The enclosed article was directly stimulated by your San Juan lecture . . ."
3	Kleene	1981/10/20	Typed letter signed to Davis. 1 page. "Thank you very much for letting me see a preprint of your paper, "Why Gödel didn't have Church's thesis. I shall have some comments . . ."
4	Kleene	1981/10/22	Typed letter signed (first page in photocopy) to Davis. 4pp. on 4 sheets. "I am 'Steve' to my friends. But my first name is spelled 'Stephen' . . ." Letter contains extensive detailed comments and corrections to Davis's paper.
5	Kleene	1981/10/22	"Chronology." Typed document. 1 page. Enclosed with Kleene's 10/22 letter
6	Church	1935/11/29	Typed letter signed to Kleene (photocopy). 2pp. on 2 sheets. "The notion of lambda-definability in its present form is, of course, the result of a gradual development . . ." Enclosed with Kleene's 10/22 letter.
7	Kleene	1981/10/28	Typed letter signed to Davis. 1 page. "I found records which show when I returned to Princeton in the winter of 1933-34 . . ."
8	Davis	1981/11/04	Computer typescript letter to Kleene. 2pp. on 2 sheets. "Thank you for responding so promptly and carefully to my paper . . ."

No.	Author	Date	Notes
9	Kleene	1981/11/16	Typed letter signed to Davis. 4pp. on 4 sheets. “Yes, in my letter of October 22, the ‘1935’ on p. 4 line 2 should be ‘1934’ . . .” Includes extensive comments on Davis’s 11/4 letter and on Gödel role vis-à-vis lambda-calculus and recursiveness theory.
10	Kleene	1981/11/18	Typed letter signed to Davis. 1 page, with 1-page photocopied enclosure. ‘It occurs to me that it may not be convenient for you to consult footnote 1 of my 1978 [paper] . . . So I enclose a xerox of it . . .’
11	Davis	1981/12/30	Computer typescript letter to Kleene. 1 page. “I enclose a copy of my revised historical article . . .”
12	Kleene	1982/01/14	Typed letter signed to Davis. 2pp. on 2 sheets. “I had already found your historical article very interesting, and now with the revisions I am substantially in agreement with how you picture things . . .”
13	Kleene	1982/01/18	Typed letter signed to Davis. 1 page. “This is a postscript to my letter of January 14 . . .”
14	Davis	1982/02/08	Computer typescript letter to Kleene. 1 page. “Thank you for your letters of January 14 and 18 and for the kind words about my article . . .”
15	Kleene	1982/02/19	Autograph letter signed to Davis. 4pp. on 2 sheets. “Thank you for sending me a copy of what you hope is now the final version. I do appreciate and am grateful for the accommodations you have made . . .”
16	Kleene	1982/08/23	Typed letter signed to Davis. 1 page. “It was a pleasure to see you and your wife at Ithaca this summer. I am writing this on the small chance that it will not be too late to include . . . the following additional erratum . . .”

1980

57. Freiherr, Gregory. The seeds of artificial intelligence: SUMEX-AIM. 74pp. Text illustrations. Washington DC: U.S. National Institutes of Health, 1980. 275 x 209 mm. Library buckram, paper shelf label on spine; original printed front wrapper bound in. Some page numbers trimmed, library stamps on title and front free endpaper. Very good. \$150

First Edition. “A semi-popular and extensively illustrated summary of research on artificial intelligence in medicine at Stanford Medical School as directed by Edward A. Feigenbaum, Stanley N. Cohen, Carl Djerassi, and Elliott C. Levinthal” (Garrison-Morton.com 11488). 51640

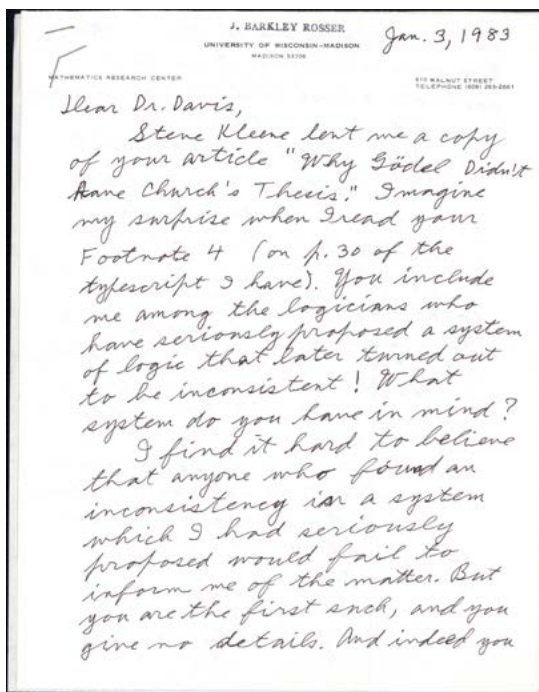


1983

58. Rosser, J. Barkley (1907-89). Two autograph letters signed to Martin Davis (1928-2023), together with Davis’s file copies of his replies. 6pp. on 4 sheets total. 3 January – 23 February 1983. 282 x 220 mm. Light creasing but very good. \$1500

From mathematical logician J. Barkley Rosser, known for the Kleene-Rosser paradox showing that Alonzo Church’s original lambda-calculus was inconsistent; also for his part in the Church-Rosser theorem in lambda-calculus and for his proof of Rosser’s theorem in number theory. His correspondent was Martin Davis, a mathematician and logician who made important contributions to computability theory. Davis’s work on Hilbert’s tenth problem—asking for a general algorithm to decide the solvability of Diophantine equations—led to the Matiyasevich-Robinson-Davis-Putman (MRDP) theorem implying that a solution to this problem is impossible.

The correspondence offered here concerns Martin Davis’s paper, “Why Gödel didn’t have Church’s Thesis” (*Information and Control* 54 [1982]: 3-24), a historical paper outlining the development of λ -definability and



recursive function theory by Gödel, Church, Turing, Kleene, Post and others in the 1930s. Rosser, who had received a typescript version of Davis's paper from Kleene, objected to some of the paper's statements:

Steve Kleene lent me a copy of your article . . . Imagine my surprise when I read your Footnote 4 (on p. 30 of the typescript I have). You include me among the logicians who have seriously proposed a system of logic that later turned out to be inconsistent! What system do you have in mind? I find it hard to believe that anyone who found an inconsistency in a system which I had seriously proposed would fail to inform me of the matter . . .

Davis replied:

The system to which I referred is NF+AC which you very "seriously proposed" in your well known book *Logic for Mathematicians*. As I am sure you know very well, this system was proved inconsistent by Specker many years ago . . .

Rosser countered that "If you look on p. 512 of '*Logic for Mathematicians*,' you will find that I did NOT propose NF+AC as a foundation for mathematics . . . Since I explicitly refrained from assuming AC, and stressed repeatedly that many uses of

AC can be replaced by weaker versions or avoided altogether, it is disheartening to be accused of espousing AC . . ." Several weeks later Davis responded: "I answered your first letter quite hastily, not wanting to leave it while I was abroad . . . you are quite right to object that you had never proposed NF+AC as a 'foundation for mathematics' . . . Nevertheless, I hold to my original statement that placed your name on the 'honor roll' of those 'seriously proposing' systems of symbolic logic that later turned out to be inconsistent . . . 51698

1984

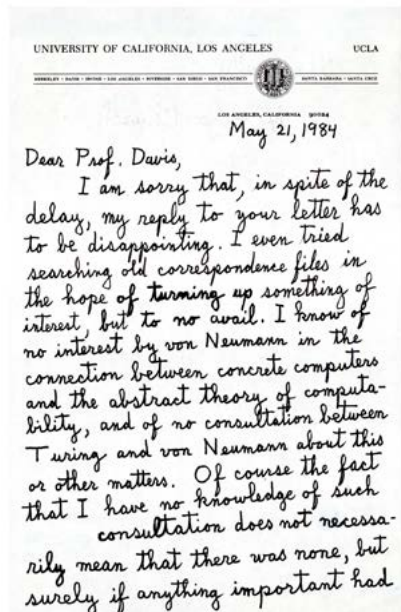
"I Know of no Interest by von Neumann . . ."

59. Church, Alonzo (1903-95). Autograph letter signed to Martin Davis (1928-2023). 1+ pages on single sheet. Los Angeles, 21 May 1984. 215 x 141 mm. Fine. \$1250

From Alonzo Church, who made major contributions to mathematical logic, including the lambda calculus (a universal model of computation), the Church-Turing thesis on the nature of computable functions, and his proof of the unsolvability of Hilbert's famous Entscheidungsproblem. Together with his doctoral student, Alan Turing, Church is considered one of the founders of computer science. His correspondent, Martin Davis, was a mathematical logician and computer scientist who had done his Ph.D. work under Church at Princeton; his doctoral thesis on Hilbert's tenth problem led to the MRDP theorem for Diophantine sets.

Church responds to an inquiry from Davis regarding John von Neumann and Alan Turing:

I am sorry that, in spite of the delay, my reply to your letter has to be disappointing. I even tried searching old correspondence files in the hope of turning up something of interest, but to no avail. I know of no interest by von Neumann in the connection between concrete computers and the abstract theory of computability, and of no consultation between Turing and von Neumann about this or other matters . . .



1986

The Blum Blum Shub (BBS) Pseudorandom Number Generator

60. Blum, Lenore (1942-); **Manuel Blum**, (1938-); **Michael Shub** (1943-). A simple unpredictable pseudo-random number generator. Offprint from *SIAM Journal of Computing* 15 (1986). 364-383pp. 255 x 175 mm. Original printed wrappers. Fine. \$500



First Edition, Offprint Issue. The Blum Blum Shub (BBS) pseudorandom number generator, proposed in 1986 by Lenore Blum, Manuel Blum and Michael Shub, “is based on the operation of squaring numbers modulo the products of two large primes. Its security can be reduced to the computational hardness assumption that integer factorization is infeasible.” See the Wikipedia page for Blum Blum Shub. From the library of Martin Davis. 51650

1989

The Blum-Shub-Smale Machine

61. Blum, Lenore (1942-); **Michael Shub** (1943-); **Stephen Smale** (1930-). On a theory of computation over the real numbers’ NP completeness, recursive functions and universal machines. Offset typescript. 1989. 64pp. 280 x 217 mm. Unbound; stapled. Very good. \$750



computation over the real numbers’ NP completeness, recursive functions and universal machines. Offset typescript. 1989. 64pp. 280 x 217 mm. Unbound; stapled. Very good. \$750

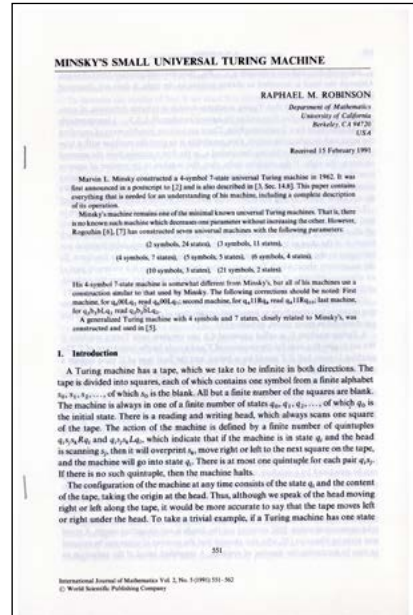
Rare Preprint Edition. “In computation theory, the Blum–Shub–Smale machine, or BSS machine, is a model of computation introduced by Lenore Blum, Michael Shub and Stephen Smale, intended to describe computations over the real numbers. Essentially, a BSS machine is a Random Access Machine with registers that can store arbitrary real numbers and that can compute rational functions over reals in a single time step. It is closely related to the Real RAM model.

“BSS machines are more powerful than Turing machines, because the latter are by definition restricted to a finite set of symbols. A Turing machine can represent a countable set (such as the rational numbers) by strings of symbols, but this does not extend to the uncountable real numbers” (Wikipedia article on Blum-Shub-Smale machine). From the library of Martin Davis. 51651

1991

62. Robinson, Raphael M. (1911-91). Minsky's small universal Turing machine. Offprint from *International Journal of Mathematics 2* (1991). 551-562pp. 248 x 160 mm. Without wrappers as issued. Very good. \$375

First Edition, Offprint Issue. Robinson, a professor of mathematics at UC Berkeley, did major work on the foundations of mathematics. In the present paper, one of Robinson's last publications, he discussed Minsky's 4-symbol 7-state Turing machine, which Minsky constructed in 1962. "This paper contains everything that is needed for an understanding of [Minsky's] machine, including a complete description of its operation. Minsky's machine remains one of the minimal known Turing machines. That is, there is no known such machine which decreases one parameter without increasing the other" (p. 551). From the library of Martin Davis. 51675

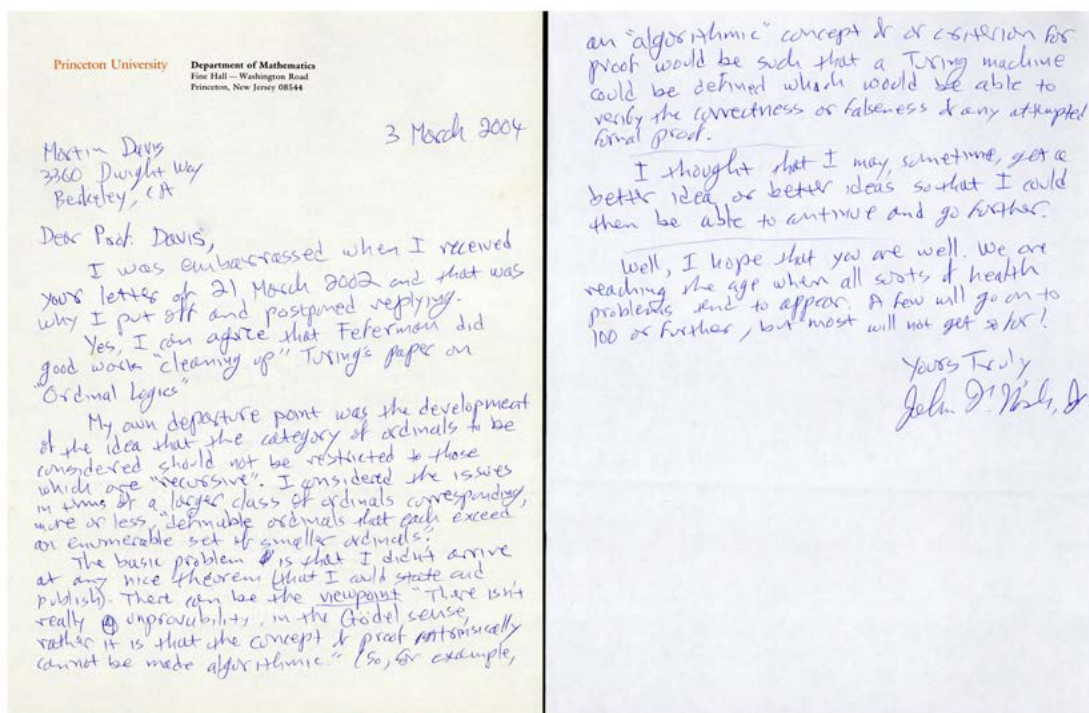


2002

63. Hook, Diana; Jeremy Norman. Origins of cyberspace: A library on the history of computing, networking and telecommunications. With contributions by Michael R. Williams. x, 670pp. 284 illustrations. Novato, CA: Historyofscience.com, 2002. 8.5 x 11". Cloth; silver stamping. Limited to 500 copies. \$500

Origins of Cyberspace describes the Jeremy Norman library of technical reports, books, pamphlets, blueprints, typescripts, manuscripts, photographs, and ephemera on the history of computing and computer-related aspects of telecommunications, from the early seventeenth century to about 1969. Includes 1411 annotated entries. 38301





2004

"I Considered the Issues in Terms of a Larger Class of Ordinals . . ."

64. Nash, John Forbes (1928-2015). Autograph letter signed to Martin Davis (1928-2023). 2pp. on 2 sheets, plus cover. Princeton, NJ, 3 March 2004. 280 x 218 mm. Fine. \$1500

From the renowned mathematician John Nash, who made fundamental contributions to game theory, differential geometry, real algebraic geometry and partial differential equations; and whose complex life, including his bouts with schizophrenia, was brought to the screen in the film *A Beautiful Mind* (2001). Nash's contributions to game theory, made while he was a graduate student at Princeton, earned him a share of the 1994 Nobel Prize in economics.

In the present letter, written to mathematician and computer scientist Martin Davis, Nash discusses his approach to Alan Turing's concept of ordinal logic, which Turing had introduced in his Ph.D. thesis (1938) and in his paper "Systems of logic based on ordinals" (1939).

I was embarrassed when I received your letter of 21 March 2002 and that was why I put off and postponed replying.

Yes, I can agree that Feferman did good work "cleaning up" Turing's paper on "Ordinal logics."

My own departure point was the development of the idea that the category of ordinals to be considered should not be restricted to those which are "recursive." I considered the issues in terms of a larger class of ordinals corresponding, more or less, [to] "definable ordinals that each exceed an enumerable set of smaller ordinals."

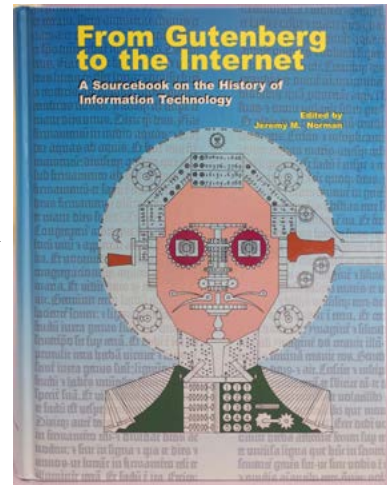
The basic problem is that I didn't arrive at any nice theorem (that I could state and publish). There can be the viewpoint "There isn't really unprovability, in the Gödel sense, rather it is that the concept of proof intrinsically cannot be made algorithmic." (So, for example, an "algorithmic" concept of or criterion for proof would be such that a Turing machine could be defined which would be able to verify the correctness or falseness of any attempted formal proof[]) . . .

“Feferman” refers to mathematical logician Solomon Feferman (1928-2016), whose 1988 paper, “Turing in the land of $\mathcal{Q}(z)$,” was included in R. Herken’s anthology, *The Universal Turing Machine: A Half-Century Survey* (1995). Davis may have written to Nash in connection with his own forthcoming paper, “Computability, computation and the real world,” published in S. Termini’s *Imagination and Rigor* (2006). 51680

2005

65. Norman, Jeremy M., ed. *From Gutenberg to the Internet: A sourcebook on the history of information technology.* xvi, 900pp. 200+ illustrations. Novato, CA: Historyofscience.com, 2005. 8.5 x 11”. Laminated printed boards. \$89.50

From Gutenberg to the Internet presents 63 original readings from the history of computing, networking, and telecommunications arranged thematically by chapters, tracing the basic discoveries from the 1830s to the 1960s that laid the foundation of the world of digital information in which we live. 38950



2019

66. Beta Writer. *Lithium-ion batteries: A machine-generated summary of current research.* xxxv, 247pp. Cham, Switzerland: Springer, 2019. 236 x 157 mm. Original printed boards. Fine. \$200

First Edition of the first machine-generated research book. 51668

