

RESUME

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ACADEMIC

- B.S.** City College of New York, August 1956. Major: physics.
- M.S.E.E.** University of Pennsylvania, August 1962. Major: computer science. Thesis: *Prolegomenon to a Theory of Signal Switching Networks*.
- Ph.D.** University of Pennsylvania, May 1966. Major: computer science. Dissertation: *A New theory for the Analysis, Synthesis, Cutting, and Splicing, of Sequential Switching Networks* (application of switching theory to problems in testing).

PUBLICATION - BOOKS

- 2000** *Software Quality Reflections*, 380 pages, collection of essays and poems .
- 1995.** *Black-Box Testing*. 280 pages, introductory textbook, Wiley. Japanese edition, Nikei Publishing.
- 1990** *Software Testing Techniques (expanded, 2nd edition)*. 560 pages, Van Nostrand Reinhold. Also Japanese Edition, Nikei Publishing.
- 1988** *The Frozen Keyboard: Living With Bad Software*. 275 pages, McGraw-Hill-TAB.
- 1986** *Personal Computer Quality - A Guide for Victims and Vendors*. 275 pages, Van Nostrand Reinhold.
- 1984** *Software System Testing and Quality Assurance*. 360 pages, Van Nostrand Reinhold.
- 1984** *Van Nostrand Handbook of Computers and Computing. Chapter 49 - Software Performance*. Flores and Seidman, Editors, 1984.
- 1984** *Van Nostrand Handbook of Software Engineering. Chapter 19 - Software Performance*. Vick and Ramamoorthy, Editors, 1984.
- 1982** *Software Testing Techniques (First Edition)* 290 pages, Van Nostrand.
- 1980** *The Medusa Conspiracy*. Novel under pseudonym, Ethan I. Shedley, Viking.
- 1979** *Earth Ship and Star Song*. Novel under pseudonym, Ethan I. Shedley, Viking.
- 1978** *Micro-Analysis of Computer System Performance*. 404 pages, Van Nostrand Reinhold. Also Russian edition.
- 1971** *The Architecture and Engineering of Digital Computer Complexes*. Two volumes, 850 pages, Plenum Press. Also Russian, Polish editions.
- 1958** *The Engineering Applications Of Boolean Algebra*. Paperback with co-author, S.W. Leibholz, Electrical Manufacturing.

PUBLICATIONS - PAPERS AND SPEECHES (PARTIAL LIST)

- 4/58 *Extension of Boolean Algebra for the Analysis of Mixed Switch-Diode Networks.* Proceedings of the I.R.E.
- 5/58-9/58 A series of six articles entitled: *The Engineering Applications of Boolean Algebra.* Electrical Manufacturing.
- 4/62 *The Theory of Signal Switching Networks.* Proceedings of the International Symposium on the Mathematical Theory of Automata: Polytechnic Institute of Brooklyn.
- 10/69-1/70 *The Viability of Digital Computer Complexes.* Series of articles in Modern Data Systems.
- 10/70 *Toward a New Theory of Signal Switching Networks.* IEEE Transactions On Electronic Computers, Volume EC-19, #10, October 1970, pp. 939-956.
- 12/70 *Computer Controlled Communications.* Data Management.
- 10/72 *Conference Non-Blocking Networks.* IEEE Transactions on Communications, Vol. COM-20, pp. 942-946.
- 6/77 *Communications Processor System Study.* IEEE Transactions on Communications, Volume C-25, #6; June 1977, pp. 604-608. (With co-author, K.L. Hagstrom).
- 5/85 *The New Model Process.* Second International Conference on Software Testing, November 4-6, 1985, Bethesda MD.
- 9/86 *Making Software Testing More Effective,* Speech, International Test Conference, September 1986.
- 4/87 *Making Software Testing More Effective.* Quality Data Processing, Vol. 1 #2; April 1987. Also, National Test Conference, Sept 29-Oct 1, 1986, Bethesda MD.
- 5/88 *The Combinatorial Tyranny,* Speech at the NCR TIES Conference, Columbia SC, 5/16/88.
- 1,2/87 *Making Software Testing More Effective.* ASTE Review. Volume 2, Jan-Feb, 1988.
- 8/88 *Reflections on Process.* ASTE Review, Volume II #3, Aug 1988. Also National Symposia on Software Quality and Productivity, April 20-22, 1988, Dulles Airport.
- 10/88 *Can One Process Test All Software?* National Conference on Software Testing, Anaheim, CA, October 12, 1988.
- 4/91 *On Becoming the Mainstream.* American Programmer, Vol. 4, # 4, April 1991, pp 11-21.
- 5/91 *Testing Is Obsolete.* Quality Week, 1991. May 14-17, 1991, San Francisco, CA.
- 8/91 *I Don't Do Windows!* Quality Software Report (UK), August 1990
- 8/91 *Testing, State of the Art Versus State of The Practice.* CaseWorld, '91, August 8, 1991.
- 9/91 *The Pepperoni Pizza Paradigm.* Software Maintenance News, Vol 9, #9, pps 27-29
- 11/91 *Honey, I Shrank the Risk. Or did I?* International Conference on Software Testing, Orlando Florida, November 20-22 1991.
- 3/92 *Misk Ranagement 101.* Bay Area Quality Assurance Society, May 21, 1992, San Francisco, CA.
- 5/92 *Don't Do Cost Benefit Analyses.* Quality Week 1992, San Francisco, May 20, 1992.

- 4/92 *Software Test Automation Issues*. International Test Conference newsletter, April 1992.
- 11/92 *Losing It: An Essay on American Test and QA Practices*, CASE TRENDS, Volume 4 #8, pps 44-48. Also CROSSTALK, Vol 34, June/July 1992, Software Quality World, Vol 4 #3.
- 6/93 *Respice, Adspice, Prospice*. 10th International Software Test Conference, Bethesda, MD., 6/15/93.
- 6/93 *Quality is NOT the Goal*. American Programmer, June 1993.
- 11/93 *Testing: Seven Deadly Virtues and Seven Cardinal Sins*. QAI International Conference on Software Testing, Orlando Florida, November 17, 1993.
- 1/94 *Testing Technology, The Growing Gap*. Invited address at Siemens Corporation.
- 4/94 *Retrospective on Software From the Year 2001*. Crosstalk, March 1994. Also speech at Quality Week 1993.
- 5/94 *On Being Competitive*. Quality Week 1994, May 17-20, San Francisco, CA.
- 6/94 *Quality is to Delight*, . International Test Conference, June 16, 1994. Bethesda, Md.
- 10/94 *The Four Horsemen: An Essay on Industry Trends*. Invited talk at the National Institute of Standards and Technology, October 17, 1994.
- 6/95 *Software Engineering Is Illegal*. Address at Quality Week, 1995. June 2, 1995, San Francisco.
- 6/95 *The Pentium Bug: An Industry Watershed*. Address at the 12th International Test Conference, Washington DC, June 12-15, 1995.
- 10/95 *The Cleanroom Process Model: Caution Advised*. Address at The Pacific Northwest Quality Conference, September 28, 1995, Portland Oregon.
- 5/96 *Software Is Different*. Address at Quality Week 1996, May 1996 San Francisco.
- 3/97 *The Cleanroom Process Model: Caution Advised*. IEEE Software, Vol. 14, #2, pps. 14-16, March/April , 1997.
- 5/98 *Common-Sense priorities and Y2K Mythologies*, Quality Week 1998.
- 6/98 *The Black-Box Vampires — Testing Out of the Box*, USPDI Conference, Washington DC.
- 6/98 *Y2K and All of That*, USPDI Conference, Washington DC.

Approximately 25 additional papers and conference talks. Most of the above conference talks and papers have been presented in different venues (e.g., conference talk as published paper or vice versa). Most such duplications are not listed.

PUBLICATIONS - REPORTS: 200+ reports on: testing, software QA, performance analysis, modeling, system architecture, software development, product planning, including: "*The Communication Processor System*", six volumes dealing with system architecture for military communications (Rome Air Development Center); "*Toward a New Model for Communication System Program Development*", 200 pages for Rome Air Development Center; "*TRITAC Model*", 500 pages for GTE; "*NADIN 1A Throughput and Resource Study*", 300 pages for FAA.

PROPOSALS - Extensive contributions to proposals for large-scale communications systems. Major winning proposals are: Philco-Ford—OVERSEAS AUTODIN and EVS; Philips—Weather Message Switching Center and NADIN; GTE—TRITAC, NORAD CSSR.

PUBLICATIONS - MISCELLANEOUS: Short pieces in Software Maintenance News, American Programmer, Datamation, IEEE Software, Crosstalk, Software Quality World, Aviation Week, Yacht Racing and Cruising.

MISCELLANEOUS: Many private and public seminars on software testing and quality assurance. Keynote speaker and general session speaker (1984-1999) and conference board member, International Software Testing Conference; Speaker, 1985 Pharmaceuticals Technology Conference; Conference board member and speaker (1991-1998), Quality Week and Quality Week Europe Conferences; Speaker QAI National Software Test Conference (1987,1988, 1991-1993); Speaker, IBM Westlake Conference on Software Testing, 1988; Speaker, NCR Software Testing Conference, 1988; Speaker NISQP Software Testing, Conference, 1988; Speaker National CASEcon, 1989, CASE WORLD 1991; Philadelphia Writers Guild, 1990; Pacific Northwest Software Quality Conference, 1990; 1995, Moderator Quality Assurance Institute Methods Workshop 1992; Other invited lectures to IEEE, DPMA, ISA, CMG, ACM, local software quality groups, universities, and others on: software testing & QA, optimization of software, software engineering profession, analytical models of software, stochastic cyclic systems, special-purpose operating systems, analytical prerequisites to simulation. Editorial board *Software Testing and Verification*; referee and reviewer for IEEE, ACM, IFIPS, AFIPS, Plenum Press, McGraw Hill/TAB books, Simon & Shuster, Van Nostrand, and Wiley. Software Engineering series editor, Mc Graw Hill/TAB professional and Reference books. Listed in: Wiley Encyclopedia of Software Engineering.

EXPERIENCE

1/83 to Present

As an independent consultant, consults to industrial, computer, and software clients on software testing and performance; provides training, policy formation, software development process design and critiques, seminars, research, and other technical services related to software testing and quality assurance, system analysis and modeling to clients such as: Abbott Laboratories, Applied Materials Inc., AT&T, Banker's Trust, Banyan Systems, Beckman, Bell Northern Research, Contel ASC, Cray, DEC, EDS, Ericsson, Exxon, General Instruments, General Motors, GTE, Hewlett-Packard, IBM, Intermec, Israel Aircraft Industries, Kodak, Lotus, Mentor Graphics, MCI, Microsoft, Miles Laboratories, NCR, Nokia, Nortel, Novell, Pitney Bowes, Sandia, SCO, Shlumberger Geoquest, Siemens, Software Digest, S.W.I.F.T., Verilog, US Defense Communications Agency.

Representative consulting tasks have been: 1) Evaluation of testing and software quality assurance practices for HP, IBM, ISM, MCI and GTE. 2) study, architecture, development of requirements, writing the technical section of the statement of work, vendor selection criteria, assistance in vendor selection, technical vendor evaluation, and continuing support for TAMS, a large-scale, comprehensive software testing system for the MCI. 3) Evaluation of software testing and quality assurance practices and development of a curriculum on software test and QA for a Hewlett Packard. 4) Evaluation of software test and QA practices for Pitney Bowes. 5) Evaluation of test and QA practices for a supercomputer manufacturer. 6) detailed product critique for several test tool vendors. 7) Independent analysis of market structure and potential for several test tool vendors. 8) Expert Witnessing on software testing issues. 9) Evaluation of Y2K testing practices.

7/66 to 9/87

DSA Inc., Pennsauken, New Jersey

Chief Scientist

Telecommunications software development firm of 200 employees. Clients were system manufacturers, military and civil carriers (e.g. FAA, DCA, U.S. Army, etc.), foreign carriers and PTT's, and large corporate carriers.

The work at DSA included: 1) software testing, validation, quality assurance, and security testing; 2) system capacity measurement, modeling, testing, and planning, 3) system architecture: hardware, software, product planning, critiques, and specifications; 4) applied research related to the above. As director of these activities, directed groups ranging in size from 5 to 20 technical persons. My projects have cut across all product lines. There have been more than 50 projects ranging in size from a few work-months to ten work-years. The following highlight the activities I have directed in each of the above areas:

- 1. TESTING AND QUALITY ASSURANCE:** Testing and quality assurance work consisted of: 1) consulting to clients on setting up a testing and software quality assurance department, and 2) design of system tests such as formal acceptance tests. Design and implementation of test automation methods. System test designs for: the FAA's WMSC, Siemens communication system. Consulting in test and QA for RCA, Canadian Department of Defense, Stratcomm-Fort Huachuca. Directed independent testing for the FAA's Weather Message Switching Center (WMSC), which was in operation for over 20 years without failure and which the FAA called "The best telecommunications system in the FAA".
- 2. CAPACITY MEASUREMENT AND PLANNING:** Studies in this area included: 1) capacity planning for new systems, and 2) evaluation of existing systems. Studies required gathering data from the field and processing it by a variety of means, such as regression analyses, resulting in capacity predictions and identification of capacity limiting factors. Where field data was not available because the system was being developed, analytical models were used to evaluate capacity. A third variation was measurements of capacity on a test-bed. Capacity measurement studies were done for: Mitsubishi (RCA Globecom), Western Union International (two systems), Republic of Korea, FAA, Swedish PTT, Telephonos De Mexico, Venezuelan PTT. Analytical models for U.S. Army TRITAC office, FAA, SITA, Republic of Korea, NORAD, Siemens, Philco-Ford, Rome Air Development Center, Defense Communications Agency, ITT, Litton, and Philips. Consulting related to capacity planning for: Canadian Department of National Defense, ITT, Philips, FAA, Siemens. Development of proprietary software tools in support of capacity planning including: four large software packages (STATS, GASM, and S-6403), and a load generator for General Electric.
- 3. SYSTEM ARCHITECTURE:** For N.V. Philips: critique of hardware and software for the DS-714 telecommunications computers; product planning support for system components in many studies aimed at providing guidance for hardware-software tradeoff. For Siemens: product planning and market studies for the EMX-1010 office telex system; product planning and architecture study for the Siemens EPABX product line. For Plessey Radar: critique of a military communications system based on the Plessey PP-250 computer. For Rome Air Development Center (subcontract to North Electric Corp): hardware-software

architecture study for a family of military computers designed to meet voice, data, packet, etc. communications for the 80-90 time frame: design of instruction repertoire, interfaces, processing modules, chip specifications, backed by modeling and simulations against application scenarios. Architecture of the FAA Weather Message Switching Center. For Ollivetti, Ivrea, Italy: product planning and market study for a family of smart terminals. For Trans-Systems International: study of architecture for a shared resource insurance brokerage systems, vendor evaluation, participation in specification writing, and vendor selection. For SITA (world-wide carrier for private aviation and reservation traffic) study of architecture and capacity requirements for a shared passenger reservation system. Evaluation of major computer manufacturer's super-computer offerings and associated airline reservation software packages. Specification of the U.S. Army AMME system (base communications system): study of Pentagon telecommunications consolidation plan. For Philco-Ford: matrix design and system architecture for the FAA's EVS voice communication system. For Rome Air Development Center under subcontract to SOFTECH: study of higher order language requirements for communications software.

4. **APPLIED RESEARCH.** Applied research as an outgrowth and in support of the above work. Personal original contributions include: development of analytical models of program running times; analysis of deterministic and stochastic cyclic systems; application of graph-theoretic methods to performance analysis, modeling, and testing; statistical methods for measurement and prediction of system performance; non-blocking and conference non-blocking switching arrays. Additional research in: languages for telecommunications software development; barriers and problems to software transportability; software tools; investigation of problems related to testing and validation of security and security kernels; security kernel design study for military message switch; cryptographic checksum guard for military communications; study of automatic language translation for a large-scale military message switching system (U.S. Defense Communications Agency).

3/63-7/66:

Pennsylvania Research Associates, Phila. Pa.

Director, Software Development

Consulting firm associated with the University of Pennsylvania specializing in system architecture, modeling, and simulation. Directed the following: cartographic software system for Rome Air Development Center—this system became the basis of many cartographic systems in use today; design of a radar landmass simulator for Naval Training Devices Center and software system development for same—this was one of the first practical application of digital video technology; mathematical modeling of a ballistic missile defense system for the Institute for Defense Analysis; modeling of hardware/software architecture of Overseas AUTODIN for Philco-Ford; factory automation study for Ford Motor Corporation; study of torpedo countermeasures for Naval Research Laboratory; study of process control systems for Dupont; technical member of management-technical consulting team for Packard Bell Computer division. Critique of the PB-440 system, competition analysis, product planning for new computers.

12/61-3/63

Navigation Computer Corporation, Valley Forge Pa. (defunct)

Chief Logic Designer

Small manufacturer that produced a product-line of digital modules. Designed the company's 400 series product line and special-purpose computers. Design of a personal computer.

8/59-12/61:

Philco-Ford Corporation, Computer Division, Willow Grove Pa.

Project Engineer.

Research and design of discrete component switching systems that operated at 3 nanosecond rates. Study processing requirements for cabled hydrophone submarine warning system. Research in logic design, switching theory, and system architecture.

5/58-8/59

Airborne Instrument Laboratories, Farmingdale, Long Island.

Senior Engineer:

Requirements analysis, modeling, operations research, and system design for a satellite-borne intelligence systems. Simulation of signal environment and model construction. Support studies of problems related to spaceborne computer and ELINT systems.

8/56-5/58

Republic Aviation Corporation, Farmingdale, Long Island.

Senior Engineer:

Analysis of air-inlet instabilities and control problems for the XF-103 and F105B aircrafts. Design of wind tunnel test program. Simulation of aircraft environment controls.

9/54-8/56

Columbia University, College of Physicians and Surgeons,

Department of Anesthesiology,

Junior Engineer:

Under direction of senior engineering and medical staff, development of: blood pH meter, Courant needle anti-coagulation system, temperature following system, remote controlled cardiac catheter: constructed, maintained, and/or operated instruments used in monitoring of pH, blood flow and pressure, pO₂, pCO₂, air flow and pressure, EKG, EMG, and EEG.