

Operations Research Time Line

- 1665 Newton's Method for Finding a Minimum Solution of a Function, I. Newton
- 1736 Königsberg Bridge Problem, L. Euler
- 1738 St. Petersburg Problem, D. Bernoulli
- 1763 Bayes' Rule, T. Bayes
- 1788 Lagrangian multipliers, *Mécanique Analytique*, J. L. Lagrange
- 1795 Method of Least Squares, C. F. Gauss, A. Legendre
- 1823 Solution of Inequalities, J. Fourier
- 1823 Principle of Utility, J. Bentham
- 1824 Kriegspiel (war gaming), von Reisswitz
- 1826 Solution of Linear Equations, C. F. Gauss
- 1833 Analytical Engine, C. Babbage
- 1873 Solution of Equations in Nonnegative Variables, P. Gordon
- 1880 Markov Chains, A. Markov
- 1896 Pareto Optimal/Efficient Solution, V. Pareto
- 1896 Solution of Linear Equations as a Combination of Extreme Point Solutions, H. Minkowski
- 1900 Time Studies/Scientific Management, F. Taylor
- 1900 Gantt Charts, H. Gantt, F. Taylor
- 1903 Solution of Inequality Systems, J. Farkas
- 1909 "The Theory of Probabilities and Telephone Conversations," A. K. Erlang
- 1913 Inventory Economic Order Quantity (EOQ), F. W. Harris
- 1914 Lanchester's Equations, F. W. Lanchester
- 1915 Positive Solution to Linear Equations, E. Stiemke
- 1927 "Application of the Theory of Probability to Telephone Trucking Problems," E. C. Molina
- 1928 *Probability Theory and Its Engineering Uses*, T. C. Fry
- 1930 Econometric Society founded
- 1931 Quality Control Charts, W. Shewart
- 1933 Hypothesis Testing, J. Neyman, E. Pearson
- 1936 Transposition Theorem, Linear Inequalities, T. Motzkin
- 1936 Facility Location, E. Weiszfeld aka A. Vazsonyi

- 1937 Time Zero: British military applications – the term Operational Research first used**

- 1939 "Mathematical Methods of Organization and Production," L. Kantorovich
- 1939 Optimality Condition for Constrained Problems (Master's thesis, U. Chicago), W. Karush
- 1941 *The Structure of the American Economy* (Inter-industry Economics), W. W. Leontief
- 1941 Transportation Problem, F. Hitchcock
- 1942 USAF military OR
- 1942 Antisubmarine Warfare Operations Research Group (first U.S. civilian group engaged in military OR)
- 1942 UK Naval Operational Research, P. Blackett
- 1942 Search Theory, P. Morse, R. Rinehart, B. Koopman, G. Kimball

- 1943 Neural Networks, W. McCulloch, W. Pitts
- 1944 *Theory of Games and Economic Behavior*, J. von Neumann, O. Morgenstern
- 1944 Utility Theory, J. von Neumann, O. Morgenstern
- 1944 Exponential Smoothing, R. Brown
- 1945 Project RAND (Douglas Aircraft Co.)
- 1945 USN Operations Evaluation Group (OEG)
- 1945 "The Cost of Subsistence" (Diet Problem), G. Stigler
- 1946 "Methods of Operations Research" [OEG Report (Classified)], P. M. Morse, G. E. Kimball
- 1947 Linear Programming Model, G. B. Dantzig
- 1947 Simplex Method, G. B. Dantzig
- 1947 Project SCOOP (USAF Scientific Computation of Optimal Programs)
- 1947 *Theory of Games and Economic Behavior*, 2nd edition, J. von Neumann, O. Morgenstern
- 1948 The RAND Corporation
- 1948 Johns Hopkins US Army Operations Research Office (ORO)
- 1948 First courses in OR at MIT
- 1948 Operational Research Club of Great Britain
- 1949 Monte Carlo Simulation, S. M. Ulam, J. von Neumann
- 1949 "Programming of Inter-Dependent Activities I, General Discussion," M. Wood, G. Dantzig.
- 1949 "Programming of Inter-Dependent Activities II, Mathematical Model," G. Dantzig
- 1949 *Dynamic Equipment Policy*, G. Terborgh
- 1949 Cowles Commission Conference on "Activity Analysis of Production and Allocation"
- 1950 Quality Control, W. E. Deming
- 1950 *Operational Research Quarterly*, first OR journal, now the *Journal of Operational Research*
- 1950 Nash Equilibrium, J. Nash
- 1950 Simulation/War Games
- 1950 Decision Analysis, W. Edwards, R. Luce, H. Raiffa, R. Howard, R. Keeney
- 1950 Navy Operations Evaluation Group (OEG)
- 1950 Military Gaming
- 1950 *An Introduction to Probability Theory and Its Applications*, vol. I, W. Feller
- 1950 Dynamic Programming, R. Bellman
- 1950 Shortest Path Problem
- 1950 OR in Industrial Sector: British Iron and Steel Industry Research Association, C. Goodeve; British National Coal Board, P. Rivett
- 1950 First Solution of the Transportation Problem on a Computer, SEAC, National Bureau of Standards
- 1951 Unclassified version of *Methods of Operations Research*, P. M. Morse, G. E. Kimball
- 1951 First computer-based simplex algorithm, SEAC, National Bureau of Standards
- 1951 First Symposium on "Linear Inequalities and Programming"
- 1951 *Activity Analysis of Production and Allocation*, Koopmans, T. C. (ed.)
- 1951 *The Structure of the American Economy*, (Inter-industry Economics) W. Leontief
- 1951 "Nonlinear Programming," (optimality condition for constrained problems), H. Kuhn, A. Tucker
- 1951 "Maximization of a Linear Function of Variables Subject to Linear Inequalities," (Simplex Method), G. Dantzig
- 1951 "Some Problems in the Theory of Queues," D. Kendall
- 1951 Naval Post Graduate School OR program
- 1951 "Study of Negro Manpower in Army," Johns Hopkins Operations Research Office
- 1951 Primal-dual Linear Programs, J. von Neumann, G. Dantzig, A. Tucker

- 1951 OR group established at Courtland (UK fiber producer)
- 1951 "Application of the Simplex Method to a Transportation Problem," G. Dantzig
- 1951 "A Proof of the Equivalence of the Programming Problem and the Game Problem," G. Dantzig
- 1952 *Operations Research*, First OR journal in the United States
- 1952 Operations Research Society of America (ORSA) founded
- 1952 Portfolio Analysis, H. Markowitz
- 1952 First OR Application in Agriculture, C. Thornthwaite
- 1952 First degree program (MA and Ph.D.) formed at Case Institute of Technology, Cleveland, Ohio
- 1952 *Introduction to the Theory of Games*, J. McKinsey
- 1952 Product Form of the Inverse, A. Orden
- 1952 Blending Aviation Gasoline, A. Charnes, W. W. Cooper, B. Mellon
- 1952 UNIVAC I installed in The Pentagon to solve U.S. Air Force linear-programming problems
- 1953 The Institute of Management Sciences (TIMS) founded
- 1953 *The Theory of Inventory Management*, T. Whitin
- 1953 Operational Research Society (UK) founded
- 1953 *An Introduction to Linear Programming*, A. Charnes, W.W. Cooper, A. Henderson,
- 1953 Alternate Algorithm for the Revised Simplex Method: Using a Product Form of the Inverse, G. Dantzig, W. Orchard-Hays
- 1954 "Traffic Delays at Toll Booths," L. C. Edie
- 1954 Parametric Programming, S. I. Gass, T. L. Saaty
- 1954 *Operations Research for Management*, J. McCloskey, F. Trefethen (eds.)
- 1954 *Naval Research Logistics Quarterly* established
- 1954 FORTRAN programming language, J. Backus, I. Ziller
- 1954 Sequencing and Scheduling (Johnson's Theorem), S. Johnson
- 1954 Dual Simplex Method, C. Lemke, E. Beale
- 1954 First ORSA Frederick W. Lanchester Prize to L. C. Edie
- 1954 *The Compleat Strategyst*, J. Williams
- 1955 Military Battle Models
- 1955 Traveling Salesman Problem, M. Flood
- 1955 Bounded Rationality/Satisficing, H. Simon
- 1955 Stochastic Programming, G. B. Dantzig
- 1955 Operations Research Center at MIT, P. Morse
- 1955 Hungarian Method for Transportation Problem, H. Kuhn, E. Egerváry
- 1956 Trim (cutting stock) Problem, A. E. Paull
- 1956 PERT/CPM/MPM, J. Kelley, Jr., W. Walker/D. Malcolm, J. Roseboom, C. Clark, W. Fazar/B. Roy
- 1956 *The Theory of Games and Linear Programming*, S. Vajda
- 1956 Quadratic Programming, M. Frank, P. Wolfe
- 1957 First International Conference on OR (IFORS), Oxford
- 1957 Quadratic Assignment Problem, T. C. Koopmans, M. Beckmann
- 1957 *Introduction to Operations Research*, C. Churchman, E. Arnoff, R. Ackoff
- 1957 *Dynamic Programming*, R. Bellman
- 1957 *Games and Decisions: Introduction and Critical Survey*, R. D. Luce, H. Raiffa
- 1957 Jackson Networks, J. Jackson
- 1957 *Proceedings of the First International Conference on Operational Research*, M. Davies, R. T. Eddison, T. Page (eds.)

- 1958 *Linear Programming and Associated Techniques: A Comprehensive Bibliography*, V. Riley, S. I. Gass
- 1958 SIMSCRIPT, H. Markowitz
- 1958 *Linear Programming: Methods and Applications*, S. I. Gass
- 1958 Integer Programming, R. Gomory
- 1958 *Readings in Linear Programming*, S. Vajda
- 1958 *Queues, Inventory and Maintenance*, P. M. Morse
- 1958 *Linear Programming and Economic Analysis*, R. Dorfman, P. A. Samuelson, R. Solow
- 1958 *Scientific Programming in Business and Industry*, A. Vazsonyi
- 1959 *Mathematical Methods and Theory in Games*, Programming and Economics, I, II, S. Karlin
- 1959 Chance-Constrained Programming, A. Charnes, W. Cooper
- 1959 Dantzig-Wolfe Decomposition, G. B. Dantzig, P. Wolfe
- 1959 *Mathematical Methods of Operations Research*, T. Saaty
- 1959 Shortest Route Problem, E. Dijkstra
- 1959 International Federation of Operational Research Societies (IFORS)
- 1960 Branch and Bound, A. Land, A. Doig, R. Dakin, J. Little, K. Murty, D. Sweeney, C. Karel
- 1960 Facility Location
- 1960 Cost Effectiveness Analysis
- 1960 Value Theory, P. Fishburn
- 1960 Planning, Programming and Budgeting (PPB)
- 1960 Artificial Intelligence and OR
- 1960 Airline Group of the International Federation of Operations Research Societies (AGIFORS)
- 1960 Decision Trees
- 1960 Vehicle Traffic Science, R. Herman, D. Gazis, G. Newell, R. Oliver, I. Prigogine
- 1960 Cost Effectiveness Analysis
- 1960 *Stochastic Processes*, L. Takács
- 1960 *Finite Markov Chains*, J. G. Kemeny, J. Laurie Snell
- 1960 *Dynamic Programming and Markov Processes*, R. A. Howard
- 1960 *Planning Production, Inventories, and Work Force*, C. Holt, F. Modigliani, J. Muth, H. Simon
- 1961 International Abstracts in Operations Research (IAOR) established
- 1961 GPSS/Simulation Language, G. Gordon
- 1961 *Elements of Queueing Theory*, T. L. Saaty
- 1961 *Queues*, D. Cox and W. Smith
- 1961 Research Analysis Corporation (RAC)
- 1961 *Industrial Dynamics*, J. Forrester
- 1961 Little's Law, J. Little
- 1961 Packet Switching Theory, L. Kleinrock
- 1961 Geometric Programming, C. Zener
- 1962 Benders Partitioning Method, J. Benders
- 1962 Chinese Postman's Problem, M.-K. Kwan
- 1962 *Renewal Theory*, D. Cox
- 1962 *Flows in Networks*, L. Ford, Jr., D. Fulkerson
- 1962 *Smoothing, Forecasting and Prediction of Discrete Time Series*, R. Brown
- 1962 Fuzzy Set Theory, L. Zadeh
- 1962 Center for Naval Analyses
- 1963 *Analysis of Inventory Systems*, G. Hadley and T. Whitin

- 1963 *Linear Programming and Extensions*, G. Dantzig
- 1963 Delphi Method, N. Dalkey and O. Helmer
- 1963 Implicit Enumeration/Additive Algorithm, E. Balas, A. Geoffrion
- 1964 Social Welfare Function, Impossibility Theorem, K. Arrow
- 1964 *Analysis for Military Decisions*, E. S. Quade (ed.)
- 1964 Vehicle Routing Savings Algorithm, Clarke and Wright
- 1965 *Management Models and Industrial Applications of Linear Programming*, A. Charnes, W. W. Cooper
- 1965 Complexity Theory; NP-Complete, J. Edmonds, R. Karp
- 1965 Goal Programming, A. Charnes, W. Cooper
- 1965 The Knapsack Problem, G. B. Dantzig
- 1965 Political Redistricting, S. Hess, J. Weaver, H. Seigfeldt, J. Whelan, P. Zitlau
- 1966 *A First Course in Stochastic Processes*, S. Karlin
- 1967 *Introduction to Operations Research*, F. Hillier, G. Lieberman
- 1967 *Theory of Scheduling*, R. Conway, W. Maxwell, L. Miller
- 1967 Criminal Justice: President's Crime Commission Science and Technology Task Force, A. Blumstein, S. I. Gass, R. C. Larson
- 1967 *Geometric Programming*, R. Duffin, E. Peterson, C. Zener
- 1968 Surrogate constraints, F. Glover
- 1968 *Nonlinear Programming: Sequential Unconstrained Minimization Techniques*, A. Fiacco, G. McCormick
- 1968 Metric (Multi-Echelon Technique for Recoverable Item Control), C. Sherbrooke
- 1968 Decision Analysis, R. Howard
- 1968 Outranking Procedure (ELECTRE) for Multi-Attribute Decision Making, B. Roy
- 1969 Advertising, J. Little, L. Lodish
- 1969 *Principles of Operations Research*, H. Wagner
- 1969 *System Simulation*, G. Gordon
- 1969 New York City RAND Institute
- 1969 First ARPANET/INTERNET site at UCLA, L. Kleinrock
- 1970 *Time Series Analysis*, G. Box, G. Jenkins
- 1971 *Marketing Decision Making: A Model Building Approach*, P. Kotler
- 1971 ORSA's journal *OR/SA Today* established
- 1971 *World Dynamics*, J. Forrester
- 1971 Computational Complexity, S. A. Cook, R. Karp
- 1972 *Limits to Growth*, D. Meadows et al.
- 1972 International Institute for Applied Systems Analysis (IIASA)
- 1972 Soft Systems Methodologies, P. Checkland
- 1972 Sweep Algorithm for Vehicle Routing, B. Gillett, L. Miller
- 1972 First Franz Edelman Award for Management Science Achievement presented to The Pillsbury Company
- 1972 Klee-Minty problem showed that the simplex method is not a polynomial-time algorithm, V. Klee and G. J. Minty
- 1973 Decision Support Systems, P. Keen, S. Morton
- 1974 *Computers and Operations Research* established
- 1974 Hypercube Queueing Model, R. C. Larson
- 1974 OR established in Federal Express

1974 First joint ORSA and TIMS meeting
 1974 *OR/MS Today* established (first joint ORSA/TIMS publication)
 1974 TIMS's *Interfaces* becomes joint publication of TIMS and ORSA
 1974 SLAM, GASP/Simulation Languages, A. Pritsker
 1974 "*A Guide to Models in Governmental Planning and Operations*, S. I. Gass, R. Sisson (eds.)
 1974 "*Fundamentals of Queueing Theory*," D. Gross, C. Harris
 1975 Multicriteria Decision Making, M. Zeleny, S. Zionts, J. Wallenius, W. Edwards, B. Roy
 1975 First von Neumann Prize (ORSA) to George B. Dantzig
 1975 Analysis for Public Decisions, E. Quade
 1975 *Queueing Systems, Vol. I: Theory*, L. Kleinrock
 1976 *Queueing Systems, Vol. II: Computer Applications*, L. Kleinrock
 1976 *Decisions with Multiple Objectives: Preferences and Value Tradeoffs*, R. Keeney, H. Raiffa
 1976 *Models in the Public Policy*, M. Greenberger, M. Crenson, B. Crissey
 1976 Quality Control, G. Taguchi
 1977 *Models for Public Systems Analysis*, E. Beltrami
 1977 Anti-Cycling Rules for Linear-Programming Problem, R. Bland
 1977 *Manpower Planning*, R. Grinold, K. Marshall
 1978 Data Envelopment Analysis (DEA), A. Charnes, W. Cooper, E. Rhodes
 1978 Lagrangian Relaxation, A. Geoffrion
 1979 Ellipsoid Method, L. Khachian
 1979 "Airline Safety: An Empirical Study," A. Barnett, M. Abraham, V. Schimmel
 1980 Spreadsheet OR add-in software
 1980 Constraint Programming
 1980 *The Analytic Hierarchy Process*, T. Saaty
 1980 Parallel Computing
 1980 LINDO, L. Schrage
 1980 Conflict Analysis
 1980 Revenue (Yield) Management, American Airlines, T. Cook
 1981 *Urban Operations Research*, R. C. Larson, A. Odoni
 1982 Expert systems, A. Barr, E. Fiegenbaum
 1982 Simulated Annealing, W. Metropolis
 1982 Average Running Time of Simplex Method Shown to be Polynomially Bounded,
 K.-H. Borgwardt
 1984 Neural Networks, J. Hopfield
 1984 Interior Point Methods, N. Karmarkar
 1984 *What's Best*, S. Savage, K. Cunnigham, G. Link
 1984 PROMETHE Method for Multi-Attribute Decision Making, J.-P. Brans, B. Mareschal,
 P. Vinke
 1985 Flexible Manufacturing Systems
 1985 Airline Crew and Aircraft Scheduling
 1985 *Handbook of Systems Analysis: Craft Issues and Procedural Choices*, H. Miser, E. Quade
 1986 Burger King receives OR practice award
 1988 American Airlines Decision Technologies, T. Cook
 1988 General Algebraic Modeling System/GAMS, A. Meeraus
 1989 Tabu Search, F. Glover
 1990 Desert Shield military airlift

- 1990 Supply Chain Management
- 1990 Financial Engineering, W. Ziemba, S. Zenios, J. Mulvey
- 1990 Geographical Information Systems
- 1990 Evolutionary Algorithms
- 1991 American Airlines and Federal Express receive the INFORMS Prize
- 1991 OR and Persian Gulf War
- 1992 San Miguel Corporation receives the INFORMS Prize
- 1993 NYC's Office of Management and Budget and United Airlines receive the INFORMS Prize
- 1994 Network-Enabled Optimization System (NEOS)
- 1994 AT&T and US West Technologies receive the INFORMS Prize
- 1995 Data Mining
- 1995 INFORMS formed by merger of ORSA and TIMS
- 1995 Bellcore receives the INFORMS Prize
- 1995 Online Analytical Processing (OLAP)
- 1995 Enterprise Resource Planning (ERP)
- 1995 INFORMS OnLine
- 1996 *Encyclopedia of Operations Research and Management Science*, S. Gass, C. Harris
- 1996 e-Commerce
- 1996 Center for Excellence in Aviation Operations Research (Berkeley, MIT, U of MD, VPI&SU)
- 1996 Pfizer, Inc. receives the INFORMS Prize
- 1997 Merrill Lynch Private Client Group receives the INFORMS Prize
- 1998 Lucent Technologies receives the INFORMS Prize
- 1999 IBM receives the INFORMS Prize
- 2000 50th anniversary of the publication of the *Journal of Operational Research*
- 2001 50th anniversary of the OR program at the Naval Post Graduate School
- 2002 50th anniversary of the founding of ORSA
- 2002 50th anniversary of the publication of *Operations Research*