George Dantzig
at RAND, Berkeley, and Stanford

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October 14, 2008
Overview
Overview

1. At RAND
Overview

1. At RAND
2. At Berkeley
Overview

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2. At Berkeley
3. At Stanford
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2. At Berkeley
3. At Stanford
4. At Rest
1952–1960: The RAND Corporation

In 1952, George Dantzig left the Pentagon to become a Research Mathematician at the RAND Corporation in Santa Monica, California.
1952–1960: The RAND Corporation

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RAND was established in 1945 as the Air Force’s Project RAND through a special contract with the Douglas Aircraft Company reporting to Air Force Major General Curtis LeMay.
1952–1960: The RAND Corporation

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In 1948 RAND became an independent, nonprofit organization, but with a reputation as an Air Force think tank.
The Rand Corporation Building
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A major influence: The Berlin Airlift

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Supplying West Berlin by air presented an enormous logistical challenge to military and civilian planners.
At RAND, Dantzig enjoyed the company of brilliant colleagues under the benevolent leadership of John D. Williams.
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The in-house staff was augmented by a steady stream of stimulating visitors.
Among Dantzig's RAND colleagues were:

- Richard Bellman
- Lester Ford
- Ray Fulkerson
- Murray Geisler
- Selmer Johnson
- Harry Markowitz
- Lloyd Shapley
- Philip Wolfe
RAND Colleagues

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RAND visitors & consultants

K.J. Arrow          J. von Neumann
L. Hurwicz         A.W. Tucker
T.C. Koopmans      D. Blackwell
J.F. Nash, Jr.     R. Dorfman
P.A. Samuelson     M. Dresher
H.A. Simon         A.S. Manne
R.M. Solow         M. Flood
T.S. Motzkin       M. Shubik
Dantzig’s research at RAND

Major research directions
Dantzig’s research at RAND

Major research directions

- LP and variants of the Simplex Method
Dantzig’s research at RAND

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- LP and variants of the Simplex Method
- Large-scale LP
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  - Decomposition Principle
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- Large-scale LP
  - Compact basis methodology
  - Block structures
  - Decomposition Principle
- Linear programming under uncertainty
Dantzig’s research at RAND

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- Network optimization
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  - Network flows
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  - Network flows
  - Shortest path problem
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  - Traveling salesman problem
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- Network optimization
  - Network flows
  - Shortest path problem
  - Traveling salesman problem

- Integer programming
Dantzig’s research at RAND

Major research directions

- Network optimization
  - Network flows
  - Shortest path problem
  - Traveling salesman problem
- Integer programming
- Nonlinear optimization
Dantzig’s other activities at RAND include:

- Second Symposium in Linear Programming (1955)
- Third Symposium in Linear Programming (1959)
- Linear Programming and Extensions
Dantzig’s other activities at RAND include

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Dantzig’s other activities

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- *Linear Programming and Extensions*
Dantzig’s beliefs

- Mathematical programming could be used to improve mankind’s lot.
Dantzig’s beliefs

- Mathematical programming could be used to improve mankind’s lot.
- The availability of good software is essential to the widespread adoption of mathematical programming methodology.
1960–1966: UC Berkeley

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In so doing, Dantzig fulfilled an ambition dating back to his graduate student days at Cal.
On leaving RAND

My leaving [RAND] had to do with the way we teamed up to do research. In the beginning I was part of a team with Ray Fulkerson and Selmer Johnson. For a time we did great things together. Then after a while, although we remained good friends, each of us got busy doing his own thing. ... There were no new people being hired to work with us as disciples.

From an interview with D. Albers (1986)
Building O.R. at Berkeley

In his 6 years at Berkeley, Dantzig
Building O.R. at Berkeley

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- Taught Linear Programming and Network Flow Theory courses.
Building O.R. at Berkeley

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- Supervised 11 doctoral students.
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- Taught Linear Programming and Network Flow Theory courses.
- Supervised 11 doctoral students.
- Completed *Linear Programming & Extensions*.
- Diversified his research interests.
- Established the University of California’s Operations Research Center.
Operations Research Center early 1960s
Operations Research Center early 1960s

- Note barbed wire
- Note chain-link fence
The final test of a theory is its capacity to solve the problems which originated it.
Real world problems come first.
1. Real world problems come first.
2. Mathematical modeling comes next.
1. Real world problems come first.
2. Mathematical modeling comes next.
3. Theory and algorithms follow as needed.
Modeling as a metaphor

In teaching Linear Programming, George Dantzig emphasized the column approach wherein the right-hand side is expressed as a linear combination of columns with each column corresponding to an activity.
Modeling as a metaphor

In teaching Linear Programming, George Dantzig emphasized the column approach wherein the right-hand side is expressed as a linear combination of columns with each column corresponding to an activity.

This is in contrast to the row approach which views the feasible region as the intersection of hyperplanes or halfspaces.
Modeling as a metaphor

The difference can be thought of as an emphasis on activities versus constraints.
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George attached more importance to activities than to rules.
Modeling as a metaphor

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George attached more importance to activities than to rules.

He also tended to use single activities to achieve multiple goals.
In 1966, Dantzig accepted an offer to join the Operations Research Program (and Computer Science Department) at Stanford University.
1966–2005: Stanford University

In 1966, Dantzig accepted an offer to join the Operations Research Program (and Computer Science Department) at Stanford University.

The following academic year, the O.R. Program became the O.R. Department.
Stanford O.R. Department Faculty 1967

Dantzig, Manne, Hillier, Iglehart, Veinott, Kalman, Lieberman, Arrow, Cottle
O.R. House at Stanford, circa 1967
Dantzig’s early initiatives at Stanford

- Presidency of TIMS
Dantzig’s early initiatives at Stanford

- Presidency of TIMS
- Joint seminar with Berkeley
Dantzig’s early initiatives at Stanford

- Presidency of TIMS
- Joint seminar with Berkeley
- Mathematical Programming Language
Dantzig’s early initiatives at Stanford

- Presidency of TIMS
- Joint seminar with Berkeley
- Mathematical Programming Language
- Model Development Laboratory
Dantzig’s early initiatives at Stanford

- Presidency of TIMS
- Joint seminar with Berkeley
- Mathematical Programming Language
- Model Development Laboratory
- Systems Optimization Laboratory
Dantzig’s later initiatives at Stanford

- Mathematical Programming Society
Dantzig’s later initiatives at Stanford

- Mathematical Programming Society
- International Symposium on Math. Prog.
Dantzig’s later initiatives at Stanford

- Mathematical Programming Society
- International Symposium on Math. Prog.
- The PILOT Project
Dantzig’s later initiatives at Stanford

- Mathematical Programming Society
- International Symposium on Math. Prog.
- The PILOT Project
- Involvement with IIASA
Dantzig’s later initiatives at Stanford

- Mathematical Programming Society
- International Symposium on Math. Prog.
- The PILOT Project
- Involvement with IIASA
- Compact City (with T.L. Saaty)
Dantzig’s final initiatives at Stanford

- Response to the interior-point challenge
Dantzig’s final initiatives at Stanford

- Response to the interior-point challenge
- Programming under uncertainty (with G. Infanger)
Dantzig’s final initiatives at Stanford

- Response to the interior-point challenge
- Programming under uncertainty
  (with G. Infanger)
- *Linear Programming 1: Introduction*
  (published 1997 with M.N. Thapa)
Dantzig’s final initiatives at Stanford

- Response to the interior-point challenge
- Programming under uncertainty
  (with G. Infanger)
- *Linear Programming 1: Introduction*
  (published 1997 with M.N. Thapa)
- *Linear Programming 2: Theory and Extensions*
  (published 2003 with M.N. Thapa)
Dantzig’s final initiatives at Stanford

- Response to the interior-point challenge
- Programming under uncertainty (with G. Infanger)
- *Linear Programming 1: Introduction* (published 1997 with M.N. Thapa)
- *In His Own Image*  
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<thead>
<tr>
<th>Name</th>
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<tr>
<td>P. Abrahamson</td>
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<td>P. Jackson</td>
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<td>D. Morton</td>
<td>C. Yu</td>
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<td>H. Hu</td>
<td>V. Nicholson</td>
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National Medal of Science 1975
Other Major Honors and Awards

1971 National Academy of Sciences
1975 National Medal of Science
1975 American Academy of Arts & Sciences
1975 von Neumann Prize (ORSA & TIMS)
1985 National Academy of Engineering
1985 Harvey Prize (Technion, Israel)
1986 Silver Medal (O.R. Soc. of U.K.)
1989 American Ingenuity Award (Coors)
Is he just saying cheese?
<table>
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<th>Institution</th>
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<tr>
<td>Technion</td>
<td>1973</td>
<td>Columbia</td>
<td>1983</td>
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<td>Linköping</td>
<td>1975</td>
<td>Univ. Louvain</td>
<td>1983</td>
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<td>Univ. Maryland</td>
<td>1976</td>
<td>Zürich</td>
<td>1983</td>
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Dantzig Prizes, etc.

- Dantzig Prize (MPS & SIAM)
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- Dantzig Prize (INFORMS)
Dantzig Prizes, etc.

- Dantzig Prize (MPS & SIAM)
- Dantzig Prize (INFORMS)
- Dantzig-Lieberman Fellowship (Stanford)
Dantzig active to the end

- Formally retired in AY 1980 at age 65
Dantzig active to the end

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- Recalled to duty till AY 1996 at age 81
Dantzig active to the end

- Formally retired in AY 1980 at age 65
- Recalled to duty till AY 1996 at age 81
- 70th, 75th, 80th, 85th, & 90th birthday parties and conferences held in his honor
Celebrating George Dantzig’s 90th birthday
George Dantzig at his 90th birthday party
Summing up

George Dantzig made seminal contributions to many branches of mathematical programming.
Summing up

George Dantzig’s endearing qualities included
Summing up

George Dantzig’s endearing qualities included

- Warmth
Summing up

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- Warmth
- Generosity
Summing up

George Dantzig’s endearing qualities included

- Warmth
- Generosity
- Wit
Summing up

George Dantzig’s endearing qualities included

- Warmth
- Generosity
- Wit
- Dedication
Summing up

George Dantzig’s endearing qualities included

- Warmth
- Generosity
- Wit
- Dedication
- Courage
George B. Dantzig (1985)