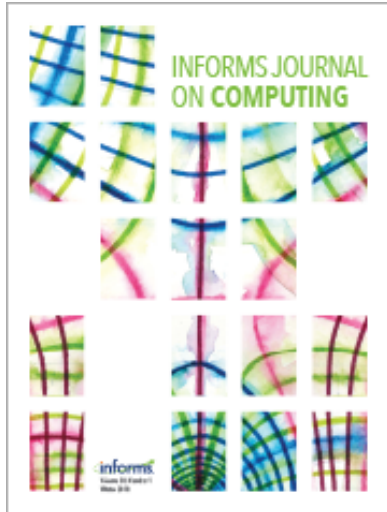




INFORMS Journal on Computing

Publication details, including instructions for authors and subscription information:
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To cite this article:

Allen Holder Fred MurphyWilliam Pierskalla (2018) A Memorial to Harvey J. Greenberg, Founding Editor of the INFORMS Journal on Computing. INFORMS Journal on Computing 30(3):421-423. <https://doi.org/10.1287/ijoc.2018.0843>

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A Memorial to Harvey J. Greenberg, Founding Editor of the *INFORMS Journal on Computing*

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Received: July 11, 2018

History: Accepted by David Woodruff.

Accepted: July 11, 2018

Published Online: July 30, 2018

<https://doi.org/10.1287/ijoc.2018.0843>

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Harvey J. Greenberg died on June 29, 2018, after a long and distinguished career in operations research (OR). His profound impact on OR continues to flourish, and his contributions to the Institute for Operations Research and the Management Sciences (INFORMS), and in particular to the INFORMS Computing Society (ICS), are inimitable.

Harvey earned a BS in industrial engineering from the University of Miami in 1962 and a PhD in OR from the Johns Hopkins University in 1968. He later held a postdoctoral position at Stanford University in 1971 and 1972. He had academic positions in the Department of Computer Science and Operations Research at Southern Methodist University, as a graduate program director of computer science at Virginia Tech, and in the Department of Mathematics at the University of Colorado at Denver. Outside of academia, he was a division chief, office director, then senior OR analyst, for the Energy Information Administration; he was also a senior analyst for management systems. He was named an INFORMS Fellow in 2011, and he won the Harold Larnder Prize in 1999.

Academic Contributions

Harvey advanced OR through his numerous publications that spanned a wide range of topics, from assessing computational studies, to research in sensitivity analysis, software development, and applications in computational biology. One of Harvey's initial research interests was the study of generalized Lagrange multipliers, a topic that fascinated him throughout his career. His subsequent engagement in Washington, DC, taught him that practitioners spent most of their time building and analyzing models instead of designing algorithms to solve them, and he thereupon became one of the research progenitors investigating

model management and analysis. One of the products of this research was the software package ANALYZE, which was used by several industrial partners to study and improve their optimization models.

Harvey spearheaded the Intelligent Mathematical Programming System research consortium in the 1980s and 1990s, which was a group of talented and diverse researchers from academia and industry. The goal was to advance the contemporary diagnostic and interpretive capabilities associated with the ever larger problems of the day. Harvey's keen and precocious awareness of the application of mathematical programming foreshadowed innovative software tools that could better leverage the utility and efficacy of mathematical models in practice. Although Harvey was fond of saying, "We can solve far larger problems than we can analyze," he was determined to extract as much analysis as possible from the sizable models of his era.

Harvey returned to his research stalwarts of sensitivity analysis and parametric programming in the mid-1990s. Here, he made several original contributions that were motivated by the new mathematical perspectives provided by interior-point algorithms. Yet another addition to Harvey's repertoire came at the turn of the 21st century when he presaged the critical role that OR would play within the burgeoning field of computational biology. He dedicated himself to becoming current in the sister field of biology, a daunting task even for a trained biologist, let alone for someone nearing the end of his career in OR. Harvey quickly accomplished novel publication fluency and made several contributions to computational biology. He also broadcast and promoted applications in computational biology to the OR community, almost uniquely fulfilling the important role of bridging the two research communities.

Harvey's passions for research and investigation were obvious, and those who were fortunate to work with him found an energetic and creative virtuoso. He was simply a powerhouse of contemplation as his ever-present mind quickly chased a seemingly endless stream of possibilities. Attempting to keep up was half the fun. He fancied the undisturbed hours after twilight, and he often wanted to share his excitement of a breakthrough during one of his renowned all-nighters. His adoring wife, Ellie, regularly mandated compassion by suggesting that he inform his colleagues in the morning. Even more astonishing than his prodigious ability to conjecture was the substantial volume of his postulates that turned out to be meritorious, although he was quick to concede when they were not. Indeed, Harvey rejoiced, celebrated, and applauded those who bested his conjectures. In the end, science and math would win the day, and regardless of how zealous and heated a conversation had become, there would be jubilation once the truth was known.

Impacts on National Policy

The United States found itself in a pernicious energy crisis in the 1970s. The national concern was so grave that President Jimmy Carter labeled it the "moral equivalent of war," a moniker intended to draw the country into a unified effort to overcome its dependency on imported energy. The country desperately needed more efficient use of its resources, and Harvey joined the newly formed Federal Energy Administration (the precursor to the Department of Energy) to assist the effort. He ran the forecasting systems and worked closely with President Carter's White House Energy Policy Office to estimate the impacts of alternative policies on the energy markets and the U.S. economy. The outcome of the interactions between the White House and the modelers was President Carter's National Energy Plan, which resulted in the passing of legislation after the usual back and forth with Congress. The nation consequently restructured its energy markets, and the gasoline and natural gas shortages disappeared.

Harvey approached his service at the Federal Energy Administration with the same fervor, alacrity, and creativeness that he brought to his other endeavors. He often reminisced about having "Potomac fever," especially as he chuckled about seeing his afternoon's presentation discussed on the evening news later that day. He was notorious for sidestepping bureaucracy to facilitate his team's headway, once commandeering office furniture intended for a press conference to better furnish his staff's offices. Harvey was proud of his participation in navigating the country through the energy crisis, and he extolled the role played by OR in averting further harm.

A Career of Service

Many of Harvey's most lasting impacts will be the products of his tireless service to our profession. Harvey was never shy about dedicating himself to enterprises that he knew were meritorious, independent of any professional credit that he might receive. He was the founding editor of the *INFORMS Journal on Computing* (then the *ORSA Journal on Computing*), he helped develop two PhD programs, he cochaired several meetings of the Operations Research Society of America (ORSA) and ORSA/TIMS (The Institute of Management Sciences), and he was a cofounder and the second chairman of the Computer Science Special Interest Group within ORSA (the forerunner to the ICS). He further served as an associate editor for *Operations Research* and was on the editorial boards of 15 other publications. He helped guide OR activities within the Society for Industrial and Applied Mathematics (SIAM), the Mathematical Programming Society, and the Association for Computing Machinery (ACM). He was also a U.S. member of three NATO committees. The ICS created the Harvey J. Greenberg Award for Service to the ICS in 2007 in recognition of his longstanding commitment to service.

Educational Significance

Harvey's educational legacy is commensurate with his aptness for identifying the needs of a community and then working toward meeting those needs with clever solutions. One example is the *Mathematical Programming Glossary*, which he created to help students learn the language of mathematical programming. He developed this online resource prior to the banality of graphical browsers, but he intuited the educational benefit of interlinking terms to facilitate learning. The glossary, which is now hosted by the ICS, contains over 800 terms and enjoys substantial Internet traffic as a premier information service within OR and management science (MS). This effort was an altruistic labor of love that stemmed from Harvey's desire to give to the OR community, and he received no financial reward from this remarkable undertaking.

Another of Harvey's educational projects was his authorship of *Myths & Counterexamples in Mathematical Programming*, which was motivated by the fact that we learn much from well-crafted examples and counterexamples. Indeed, mathematical truth is often identified by a well-designed example or counterexample that pinpoints the delineation between what is correct and what is incorrect. This volume contains over 200 myths and counterexamples spread over linear and nonlinear programming, integer programming, dynamic programming, and multiple-objective optimization.

Harvey authored other educational resources as well, such as his free text *A Simplified Introduction to LaTeX* and an early online course *A Short Course in Linear Programming*. Beyond authorship, he initiated both the Math Clinic and the Center for Computational and Mathematical Biology at the University of Colorado at Denver.

Personal Conviction

Harvey held strong convictions for the greater good, and he lived by the ideals expressed by his heroes: Abraham Lincoln, John F. Kennedy, and Albert Einstein. He was a lifelong supporter of civil rights and equal rights, and he ignored outdated gender models as he helped his female colleagues excel. Harvey further prompted his graduate students to do what was right for science and math and not to be overly concerned about the many trappings that might accompany their careers.

A Friend to Many

Harvey was an affable and gracious friend to many, and while he targeted magnanimous pursuits in knowledge, education, and service, he cherished the camaraderie of the quest. Working or studying with Harvey could be exhilarating, tense, friendly, fun, tiring, and acute. He had a gregarious personality and a witty sense of humor, and he especially enjoyed puns (the cornier the better). He was also quick to support young talent and to welcome them into the fold.

Harvey made indelible and lasting impacts on OR, its supporting organizations, and his numerous friends and colleagues. Our community will miss his pervasive nudging to do something new, to see around the corner, and to enjoy our discipline's many possibilities.

The authors drafted this memorial with the help of many who sent comments following Harvey's death, and we author this memorial as representatives of everyone who assisted.