50 Years of Computer Science at Indiana University
Front cover: Student and part-time employee Marta Proe (left), chief programmer Dale J. Hall (middle), and graduate student and research assistant Richard D. Smith (right) work on an IBM Tape 650 computer in the Research Computing Center, IU's early technology center.

Inside front cover: Early computers at IU took up a massive amount of space and often broke down, but they helped set the course of computing at IU.
From the Chair

It’s so easy to forget about the past. We get so caught up in our everyday lives and being focused on innovation that the past can quickly fade. Even in my own life, the work that meant everything to me just five or 10 years ago can lose some luster in the light the next project or the next advancement.

But the foundation of everything around us is built on what has come before, and the 50th anniversary of the establishment of computer science at Indiana University presents us the perfect opportunity to celebrate our surprising roots. We are fortunate that some of the key players in our history are still with us to share their perspective, to wave away the fog of time and take us back to the moments that helped make the Department of Computer Science the thriving and exciting place it is today.

No one could have predicted the size, scope, and diversity of the current CS department, but the wildest dreams of those pioneers have been realized.

The faculty of the computer science department is fortunate to be here as we celebrate our first half century, and we cherish the amazing history of the department even as we look toward an exciting future. Just as nobody could have predicted in 1967 what computer science would look like in 2017, it’s nearly as mind-boggling to envision what the world will look like when we reach our centennial in 2067.

Do we even dare to dream?

Computer science, however, is about stretching the boundaries of the imagination, and in that spirit, I would like to make a few far-flung predictions.

I see a world in which the principles of computing converge with the foundations of physics, biology, and other physical sciences. The science of computing will learn more and more from nature, which could lead to amazing results. Will we see programmable human cells? Will we see programmable photons? Will we get closer to understanding information flow in the universe? Will machine intelligence match—or even exceed—human intelligence?

Computer science will underpin all of these developments and so much more, and the work being conducted at IU will help lead the technological revolution to places we haven’t yet thought of. As we continue to pursue those developments every day, join us as we look back on our first 50 years that set the table for what is to come.

Amr Sabry
Computing at Indiana University began in 1940 when the Central Statistical Bureau was established and charged with providing statistical services for faculty research. The setup was simple—one keypunch, one electromechanical IBM 405 tabulator, and one IBM 75 counting card sorter—made up the entire bureau, and the equipment was provided to IU as a grant from IBM in exchange for the University teaching courses about its use.

The Central Statistical Bureau was absorbed into the registrar’s office in the late 1940s, but in late 1949, computing at IU got a new life.

Dr. Lynne Merritt, a chemistry professor, returned from a sabbatical at the California Institute of Technology raving about the usefulness of an IBM 604 calculating machine. He lobbied chemistry Chair Frank Gucker—who would later become the dean of the College of Arts and Sciences—to secure one for IU. Although his initial effort fell short, he did receive a grant from the Office of Naval Research to fully fund the rental ($3,072 per year) of an IBM 602A Calculating Punch.

Merritt, Gucker, and astronomy professor Marshal Wrubel were allowed to use the computer from 5 p.m.-8 a.m.—the registrar’s office used it during the day—and IU President Herman B Wells would often stop by to talk to the professors about the machine.

Those visits made an impact.

During his State of the University address in the fall of 1953, Wells called for the addition of computing equipment to aid research at IU.

“Many complicated problems in the physical, biological, and social sciences, in business, and in education require the employment of modern high-speed computing machines for practical solutions,” Wells said. “We should expand our facilities to supply an adequate research computing center coordinated with our present setup which serves primarily administrative and bookkeeping functions. Much of the expense of the additional equipment can be reclaimed from contract research.”

By 1954, the Research Computing Center was established, and Merritt was the unofficial director of the first computing resources effort at IU. Wrubel became the first official director when Merritt returned to Cal Tech on a Guggenheim Fellowship in 1955, and in the fall of 1956, it was Wrubel who oversaw the arrival of the first “real” computer on the Bloomington campus.

The IBM 650 was a significant upgrade to IU’s computing power, but it ran hot. It used roughly 1,000 vacuum tubes, which generated heat. Air conditioning was installed, but the machine broke down often. Still, by 1959, nearly 30 departments were regularly using the machine, which was housed in the basement of Swain East.
Harrison Shull, a professor in the chemistry department, took over as director of the RCC in 1959, and he presided over the move of the RCC in late 1961 and early 1962 to a specially constructed basement space in the Health, Physical Education, and Recreation Building, now part of the Wildermuth Intramural Center.

In conjunction with the move into the new facility, an IBM 709 and three auxiliary machines were installed thanks to a grant from the National Science Foundation and the Indiana University Foundation. The IBM 709 featured roughly 6,000 vacuum tubes, and it, too, was subject to a lot of breakdowns—so many, in fact, that graduate students quickly learned how to change the tubes, much to the consternation of IBM engineers.

The IBM 709, however, was IU’s first computer capable of compiling the FORTRAN programming language, although the process was slow. To speed the process, three IU professors, Stanley Hagstrom and Franklin Prosser, both of the chemistry department, and future RCC Director Stephen Young, developed a new compiler they called FASTRAN.

As the use of computers grew at Indiana University, across the United States, and around the world, the field of computer science began to take shape. The University of Cambridge in England had established the first computer science program in 1953. It wasn’t long before other universities followed suit.

Hagstrom, Shull, and Prosser, three of IU’s most prolific programmers, were about to play a central role in leading the University into the computer revolution.

The IBM 75 Counter (top left) was one of IU’s original computing devices. It worked in conjunction with the IBM 405 tabulator (top right), and together, they comprised the University’s early computing power. The addition of an IBM 602A (bottom) in the late 1940s boosted IU’s capabilities.
The Beginning

When Harrison Shull sat down in the office of Franklin Prosser, the director of education for the Research Computing Center at IU, in mid-1964, he believed he had an idea whose time had come.

"Harrison came into my office and said, 'I think it’s about time we made a proposal for a program in computer science. Will you draw up a program?' " said Shull, a professor in the chemistry department.

Prosser agreed, and he drafted a proposal to present to the Department of Mathematics. That department wasn’t quite ready to take the step into computer science, and the math department countered with a plan to create a statistics and tabulation program—tabulation being the computer science portion of the program.

That plan wasn’t approved, either, but the idea never went away.

Three years passed, and when George Springer took over as chairman of the math department, computer science suddenly found someone in power who had an understanding of the importance of the field. Springer committed to a computer science program, and Shull was more than happy to move the process forward.

1967 1968 1969

Looking to expand the program into a self-sufficient department with full-time faculty, Shull pushes for the creation of the Department of Computer Science. Despite some initial resistance, the proposal was brought before the Board of Trustees. On Oct. 29, the IU Board of Trustees unanimously approved the formal separation of computer science from the math department, creating the Department of Computer Science. Associate Director of the Research Computing Center and Associate Professor of Computer Science Franklin Prosser is named the first chair of the department.

The department features three full-time and four part-time faculty, 22 undergraduate majors, and one graduate student.

1967
Chemistry professor Harrison Shull and George Springer, chair of the math department, create a computer science program within the math department. Funding for the endeavor came partially from the National Science Foundation’s Science Development program.

1968
The computer science program, which had yet to offer a class, is assigned some office space at Lindley Hall.

1969
The computer science program begins offering classes at the sophomore level, building the program from an undergraduate level instead of starting at the master’s level, which was the more traditional method of starting a program at the time. Franklin Prosser, a professor of chemistry, designs and teaches the first eight courses of the curriculum that established the program.

1971
Springer hires Paul Purdom from the California Institute of Technology as the first full-time faculty member. One of the stipulations of his hiring is that computer science become its own department. Purdom’s willingness to come accelerates the decision to create a department.
The first computer science classes, and later the department, were housed at Ernest H. Lindley Hall.

1972
The Department of Computer Science awards its first degrees. Two men and three women—George Cohn III, Linda M. Felter, Fred R. Haver, Sarah M. Porter, and Mary C. Trauner—were awarded Bachelor of Arts degrees.

1973
Computer science establishes a Master’s of Science program, which is quickly approved by the state.

The first Master of Science degree in computer science is awarded to Ming-Lun Li.

1975
Enrollment in computer science includes 93 undergraduate students and 49 master’s students.

1976
Dan Friedman and David Wise publish the paper “Cons should not evaluate its arguments,” an influential piece that pushed for the exploration of a programming style with potentially infinite data structures. It inspired the Haskell programming language, which continues to grow in popularity to this day.
Growing Up

As the department found its footing through the late 1970s and early 1980s, it started to make its presence felt.

The department established a Ph.D. program in 1977 that signified a step forward in its academic development, and professor Douglas Hofstadter earned a Pulitzer Prize for his book “Gödel, Escher, Bach: An Eternal Golden Braid,” which is still influencing researchers nearly four decades after its publication.

The program acquired its first large machine, the DEC Vax 11/780, in 1980, to bring its computing power into the future, but it was the department’s can-do attitude that helped set it apart. Researchers and students in computer science were forced to work out hardware issues on their own due to the lack of an engineering program at IU, which gave IU’s computer scientists an edge in the marketplace where they arrived with more skills in their toolbox than graduates of other programs.

Computer science awarded its first two Ph.D. degrees to Steven Johnson and Donald Byrd in 1983, and as the 1980s progressed, the department’s work in programming languages, hardware design, and algorithms moved to the forefront. The department grew quickly, and a $2.8 million grant from the NSF helped bolster the technical staff.

### 1977

A Ph.D. program in computer science is created with an interdisciplinary focus. That characteristic was designed to distinguish the program from others being offered in the state.

Paul Purdom takes over as chair of the department from Franklin Prosser.

### 1979

Douglas Hofstadter, a professor in computer science and cognitive science, publishes “Gödel, Escher, Bach: An Eternal Golden Braid.” The book would go on to win the 1980 Pulitzer Prize for general nonfiction.

### 1980

The computer science department acquires its first large machine, a DEC Vax 11/780. The computer was the first commercially available 32-bit computer and the first machine to handle one million instructions per second.

A Bachelor of Science degree aimed at business-minded students is approved by the Indiana Commission for Higher Education and is offered by the computer science department for the first time.

### 1981

The computer science department awards its first Bachelor of Science degrees to four students—Hussain Abdullah Abu-Romman, Jeffrey A. Hathaway, Pik Chu Lee, and Wayne C. Ostler.

Ed Robertson named chair of the computer science department, replacing Paul Purdom.

Dan Friedman and David Wise establish the LISP and Functional Programming (LFP) conference.
Faculty Spotlight: Doug Hofstadter

It’s every researcher’s dream to write a definitive book that will resonate with readers and echo through the ages. Not many reach that goal.

Douglas Hofstadter is one of the few.

Hofstadter’s book “Godel, Escher, Bach: An Eternal Golden Braid” illustrated the links between formal systems by interweaving narratives of themes in the lives of logician Kurt Godel, artist M.C. Escher, and composer Johan Sebastian Bach. It also helped illustrate mathematical topics and explored computers and artificial intelligence’s ability to someday mimic human thought, all done through narratives between fictional characters in the vein of Lewis Carroll.

Hofstadter, who was then an assistant professor of computer science, was awarded the 1980 Pulitzer Prize for general non-fiction and the National Book Award for science, an honor that came as a surprise. It was his first book, but it has been enthralling readers for nearly 40 years and still appears on best seller lists. Hofstadter, now the College of Arts and Sciences distinguished professor of cognitive science and computer science, is still researching computational models of human thought and the philosophy of mind and of consciousness at IU.

1983

The computer science department awards its first two doctoral degrees to Steven D. Johnson and Donald A. Byrd. Johnson used computer language to specify a computer circuit, which made it possible to apply mathematical techniques, and Byrd focused on programming computers to recognize and print sheet music. Both would go on to teach in the department at IU.

Computer science receives its second research equipment grant, allowing it to augment its mainframe computers and establish a digital lab.

1986

The department receives a National Science Foundation Coordinated Experimental Research Grant. Funding allows the acquisition of a VAX 8800 and a substantial increase in the number of technical staff. The NSF grant is for $2.8 million, and IU contributes $1.7 million as a matching effort.

Dan Friedman helps invent hygienic macros in programming languages.

The Revised (3) Report on the Scheme programming language is published and includes IU co-authors Dan Friedman, Kent Dybvig, and C.T. Haynes.
Maturing

The 1980s saw the computer science department become a power house in programming languages. The work of David Wise and Dan Friedman was influential to creating a new generation of programmers, and Mitchell Wand, who arrived in the department in the late 1970s, brought a confidence to the program and helped develop more connections to hardware.

Thanks to the work of the programming languages group—not to mention research being conducted in artificial intelligence, hardware design, and algorithms—the computer science department began to establish itself as a hotbed of critical research.

A wealth of quality faculty, such as Wise, Friedman, Prosser, and Dave Winkle, helped the program build a reputation as one that produced technically sound students who enjoyed a deep understanding of not only the theories but also the practical working of computing.

The late 1980s also saw the department begin to stretch its legs. The hallways at Lindley Hall, the home of the department since its establishment, were packed with students, and it was clear that the program’s facilities needed some renovations to reach its potential.

1988

Franklin Prosser, who chaired the department from 1971-77, returns as chair, taking over for Ed Robertson.

The technical staff of the computer science department designs a computer system to track the timing of IU’s famous Little 500 bicycle race.

1990

Lindley Hall renovations require the computer science department to temporarily relocate to nearby Memorial Hall and five houses. The department stays in those accommodations for roughly a year.
Building for the Future

As the calendar turned to 1990, the computer science department found itself at the center of a renovation—literally.

Lindley Hall, the home of the department since its founding, was in need of serious renovations, and that meant computer science would be on the move, at least temporarily. The decision was made to place the department into one and a half floors of Memorial Hall with the rest of the department taking residence in five houses on Third Street and Atwater Ave., half a mile away.

The move was the first large-scale move of a high technology unit in IU’s history, and thanks to a lot of hard work, the transition was relatively seamless with just 12 hours of computer downtime.

The computer science department made an impact on one key aspect of the redesign of Lindley’s 90-year-old interior that would allow it to rapidly adapt with the times. The CS department worked with architects to install free-standing cable trays along the walls of the hallways instead of running wire in the ceiling. It was unique on campus, but it also allowed the department to quickly pivot from twisted pair wiring to coax and fiber optic wires, providing flexibility and efficiency.

1992
The computer science department moves back into Lindley Hall boasting 210 undergraduate students, 168 master’s students, and 60 doctoral students, and offers 69 courses.

1993
Steve Johnson, one of the first recipients of a Ph.D. in computer science from IU, is named chair of the department, replacing Franklin Prosser.

1995
Steve Johnson steps down as chair of the department and is replaced by Daniel Leivant.

The early 1990s renovation of Lindley Hall showcased CS’s innovative spirit.
The Internet Age

When the computer science department was founded, it was staffed by young, hungry researchers who were relatively close in age to the students, and most everyone was learning how to build their careers and a department.

But as time went on and the department grew, that esprit de corps that was such a driving force during the early days began to fall victim to the weight of expansion. New faculty members became more specialized, and a renewed focus on research became the order of the day.

Still, the program continued to conduct groundbreaking work that would shape the field in significant ways.

Research from Andrew Hanson, a professor of computer science and later the chair of the department, pushed graphics and visualization into new territory. He helped make video and images for conferences possible, and the department’s work in the area helped usher in an era of better communication.

The rise of the Internet also created new interest in the field. As the general public became more comfortable with computers, IU’s computer science department took an active role as a leader in distributed systems and scientific and parallel computing.

1997

Daniel Leivant steps down as chair of the department and is replaced by Dennis Gannon.

Future IU president Michael McRobbie assumes the post of vice president of information technology at IU and also serves as a professor of computer science.

2001

The Pervasive Technology Lab is launched in August backed by a five-year, $30 million grant from the Lilly Endowment to research the diverse aspects of pervasive computing. It also is designed to act as a catalyst in building Indiana’s IT sector.
Faculty Spotlight: Dennis Gannon

Chances are the work of Dennis Gannon, a professor emeritus of computer science at Indiana University, has touched your life in some way.

Gannon came to IU in the summer of 1985 after earning a Ph.D. in mathematics from UC Davis and a Ph.D. in computer science from the University of Illinois. During his 24 years as a professor, he focused on a range of interests including programming systems and tools, parallel programming, large-scale cyberinfrastructure, and data analytics. But it was his work in cloud computing that sets him apart.

Gannon envisioned the power of cloud computing and the impact it could have on the world, and he helped make the idea a reality. The former science director for the Pervasive Technology Lab at IU led the DARPA HPC++ project that set the groundwork for cloud computing, and he left Indiana in 2009 to work on the Microsoft Azure project that helped bring it to the masses.

Gannon, who was chair of computer science from 1998-2004, also was critical in the founding of IU’s School of Informatics, which would later merge with the computer science department to form the School of Informatics and Computing, the predecessor of the School of Informatics, Computing, and Engineering.

2002
The department enjoys tremendous growth as the impact of advances in computing begin to take hold. Graduate students number more than 200, and enrollment is limited only by class space and available faculty.

2004
Department chair Dennis Gannon, who had headed the department since 1999, steps down and is replaced by Andrew Hanson.

2005
Following months of discussions and planning, the computer science department officially merges with the School of Informatics.

The Cyberinfrastructure for Network Science Center (CNets) is established in December.
The 21st Century

The 21st century brought with it an explosion in technology. Computers and the expansion of the internet changed the way we communicate, interact with one another, and how we live.

Computer science saw an explosion of its own, with enrollment increases once again filling the hallways of Lindley Hall. Roughly 50 percent of the enrollment boom came from Ph.D. students, showing a renewed interest in the field.

Under the leadership of chair Dennis Gannon, the department embraced the nascent idea of cloud computing, allowing IU to set the trend toward distributed systems. Software that powers such systems was developed in Bloomington, and faculty such as Beth Plale, Geoffrey Fox, and Kay Connelly, helped lead the way.

As the world underwent a seismic change when it comes to technology, the computer science program saw its own major changes. Andrew Hanson, department chair from 2004-09, presided over the program as it merged with the School of Informatics, a process that was both complicated and contentious. Ultimately, the two entities came together to form the School of Informatics and Computing, marking the next evolution in the program’s history.

The department also was quick to embrace newer areas of computer science, such as security, bioinformatics and intelligent systems, establishing itself as a major player in the respective fields. A new wave of young faculty members injected new life into the department, which continued to grow both in size and importance.

Professor of Computer Science Andrew Lumsdaine made an impact by helping lead the Pervasive Technology Institute, and he created the Center for Research in Extreme Scale Technologies (CREST) in 2011. Lumsdaine made contributions to the Message Passing Interface (MPI), which is the standard for parallel computing, and led the implementation of LAM/MPI and its successor, the Open MPI Project.

2008
The Pervasive Technology Institute is established thanks to a $15 million in funding from the Lilly Endowment.

2009
The School of Informatics is renamed the School of Informatics and Computing.
Andrew Hanson steps down as chair of the department after five years on the job, and Andrew Lumsdaine takes over.

2010
Professor Andrew Lumsdaine receives the Best Paper award at Supercomputing 2010 in New Orleans.
Paul Purdom named a distinguished scientist by the Association for Computing Machinery for his contributions to significant advances in computing technology.

2011
The Center for Research in Extreme Scale Technologies (CREST) is founded.
Luddy Hall, shown here in a rendering, is scheduled to open in 2018 and will become the new home of computer science at Indiana University.

2012
Andrew Lumsdaine steps down as chair of the department. He had served since 2009. Chris Raphael becomes the next chair of the department.

2014
After two years as chair of computer science, Chris Raphael steps down from the job. Amr Sabry takes on the position, one he holds through the present day.

2015
The construction of Luddy Hall, a $42 million, 124,000-square-foot facility off Woodlawn Ave., breaks ground. The building will become the new home of the computer science program after 50 years in Lindley Hall.

2016
Computer science faculty are part of the Precision Health Initiative group that was named the first recipient of funding in IU’s Grand Challenges Program. PHI aims to cure disease using patient-centered strategies.
The computer science department founded a half-century ago at Indiana University was little more than a vision, an idea that couldn’t have possibly imagined the way computers would drastically change our lives.

Envisioning the future is just as difficult, but only because the possibilities are endless. Whereas once it was inconceivable that people would someday carry a miniature computer in their pockets or that their automobiles would become rolling technological wonders, modern computing has created a world in which the only limit is your imagination.

But that doesn’t mean we’re flying blind into the future. We have a good idea of what areas hold a lot of potential.

For instance, bioinformatics has the potential to change the way we approach the human body.

Researchers in the computer science department are on the cutting edge of research in comparative genomics, protein bioinformatics, proteomics, and sequence analysis, and their work on human disease will create improved healthcare and better outcomes for patients in the near future.

The department already is a critical part of one of the most ambitious projects in IU history: the Grand Challenges program.

Faculty from the School are part of the Precision Health Initiative, the first recipient of funding from the Grand Challenges program. The PHI is a $120 million initiative with a goal of curing at least one form of cancer and one childhood disease, as well as finding a preventative solution to one chronic illness and one neurodegenerative disease.

The plan is to use precision medicine to battle disease at a genomic level. Precision medicine focuses on the treatment of disease by taking into account patients’ individual differences in environment, genes, and lifestyle. Using those factors, treatments could be developed to attack disease at a much more precise level than in the past.

Such research requires the input of researchers in bioinformatics, security, high-performance computing, and a host of other fields to reach the ultimate goal. Analysis of patients’ health records and genomes, plus the use of wearable devices, will create a wealth of data that can help computer scientists identify trends in treatments.

But it’s more than that. The potential for bioinformatics to change the way we live and how we receive care is nearly boundless. As diseases are fought on a genomic level, and the illnesses that were once a scourge of human life will become a lot less threatening. The data generated by wearable smart devices will be accessible to a wider range of researchers, and the result will be information that could create policy changes that will help people avoid health issues before they arise.

Medications, meanwhile, will continue to be developed to work with more precision, allowing doctors to attack diseases head-on without the crippling side effects that can make treatments of illness nearly as bad as the illness itself.

Bioinformatics at IU is led by researchers such as Cenk Sahinalp, Predrag Radivojac, and Yuzhen Ye, among others.
As the department continues to add young faculty from a multitude of disciplines, IU is uniquely positioned to take a leadership role in the groundbreaking work being conducted in medicine. Thanks to the long-standing excellence of IU’s biology department, computer scientists in Bloomington will have the opportunity to work with world-class researchers to help pursue the latest breakthrough that will change lives.

Another area poised to push computer science at IU comes in the realm of security. The explosion of data in nearly every facet of life has led to technological advances that couldn’t be imagined even 10 years ago. Those advances will not only continue but accelerate as the world becomes more and more connected, but with those advances comes risk. Hackers already dominate the headlines thanks to cyberattacks, and criminals from halfway around the world have already used their technological skills to hijack hospitals while holding key information for ransom, all without ever leaving their keyboard. That’s where experts in security come in.

Researchers in security are at the vanguard of protecting the sensitive data that flows wirelessly all around us. The challenge comes in staying a step ahead of the criminals or people who aim to harm society through attacks or by creating inconvenience. It’s a never-ending battle that will require researchers to anticipate weaknesses in every new technology that is developed.

Researchers in security at IU Bloomington already are considered among the best in the world. XiaoFeng Wang, a professor of informatics and computer science as well as the co-director of the Center for Security and Privacy in Informatics, Computing, and Engineering, is one of the most-cited security researchers in the field.

By developing security protocols and mechanisms for wired and wireless infrastructures, as well as working in privacy
Innovation will continue to drive computer science.

protection in human genome research and cloud and web security, faculty in security will stand at the point of the spear in keeping cyberattackers at bay. They also will create new methods and techniques to identify when cyberattacks are underway, creating a better opportunity for people, businesses, and governments to react to minimize damage.

The security area will also include work from L. Jean Camp, Minaxi Gupta, Ryan Henry, Raquel Hill, Yan Huang, Apu Kapadia, and Steven Myers.

Historically, the computer science department has been highly regarded for its programming languages group, and it has a bright future as well. Programming with probabilistic languages will be led by Assistant Professor Chung-chieh Shan and will serve as the foundational technology for machine learning. Professor of Informatics and Computing Amr Sabry will lead the way in quantum computing, and Associate Professor of Computer Science Ryan Newton continues to be a leader in parallel computing. Meanwhile, Associate Professors Jeremy Siek and Sam Tobin-Hochstadt are on the forefront of research in gradual typing, which allows parts of a program to be dynamically typed and other parts to be statically typed. Their work is already making an impact in web programming.

For instance, Microsoft (TypeScript) and Facebook (Hack) are both using languages that include gradual typing, bringing the work at IU to the masses.

Data science also will shape the future of computer science at IU. With an ever-growing wealth of data at our disposal, it’s critical to develop tools that can analyze, visualize, and mine the data to be properly navigated, which could lead to life-changing discoveries that will make an impact around the world. Data science is also one of the fastest growing areas in technology, and faculty such as Johan Bollen, Funda Ergun, David Leake, Fil Menczer, Beth Plale, Haixu Tang, Dirk Van Gucht, and David Wild will lead the way.

The establishment of the intelligent systems engineering program at IU will also provide computer science with more resources to push the boundaries of artificial intelligence and data mining, and the intelligent systems group will help create intelligent user interfaces and knowledge management systems. Designing and optimizing both hardware and software to more efficiently operate on a large scale is also going to be critical for the parallel systems group. They will work on faster and more efficient use of cloud computing and big data to accelerate computations while minimizing bugs and maximizing reliability.

The importance of intelligent systems engineering was underlined when the School of Informatics and Computing became the School of Informatics, Computing, and Engineering in summer 2017.

All of this will be underpinned by a strong educational focus on the core of computer science.

The focal point in today’s classrooms is less about the delivery of content, which is easily accessible, and more about actively engaging with computer science concepts and theories. Using data-driven strategies to design targeted learning tasks, teaching in modern collaborative learning spaces, and incorporating socially relevant and innovative projects into our courses results in increased enrollment, improved student learning outcomes, and higher student retention and satisfaction.

As technology develops, educating students on the key tenants of computer science will produce graduates who can become leaders both in industry and academia. These innovators will carry the field forward, and computer science at Indiana University will continue its role as the birthplace of technological advances for the next half century and beyond.
Faculty Spotlights
**J. Michael Dunn**

Mike Dunn began his career at IU in the philosophy department in 1969, but his multidisciplinary interests allowed him to branch out into a number of different areas.

Dunn, who did his undergraduate work at Oberlin College and earned a Ph.D. in philosophy from the University of Pittsburgh in 1966, was a founding faculty member in the cognitive science program at IU, and he became a professor of computer science in 1989. As a visitor at the Australian National University, he served as an examiner on the Ph.D. dissertation of future IU president Michael McRobbie, and he chaired the University Information Technology Committee arranged by McRobbie at IU that set out the University’s strategic plan in 1999.

Dunn was charged with organizing and establishing the School of Informatics, and in 2000 it became the first new school on campus in more than a quarter century. He served as the dean of the School of Informatics until his retirement in June 2007.

Dunn was made a Sagamore of the Wabash, the highest honor paid to a citizen of the state of Indiana, by the Governor of Indiana in 2007, and he was elected a Fellow of the American Academy of Arts and Sciences in 2010.

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**Dan Friedman**

Dan Friedman wanted one thing out of his career. He wanted to teach.

Friedman, a professor of computer science, managed to do just that, but he also influenced a generation of programmers who feel his impact to this day.

Friedman, who earned a Ph.D. from the University of Texas at Austin in 1973, became enamored with the challenge and beauty of programming languages early in his career, and his ability to connect with students drove him. He found a wider audience starting in 1974 with the publication of “The Little LISPer,” a book on the LISP programming language that explained the complexities of language in an easy-to-understand format.

The 1976 publication of the influential paper “Cons should not evaluate its arguments,” written with research partner David Wise, cemented Friedman’s place as an expert in his field. In the decades since, Friedman has added a pile of programming books to his resume, including “The Little Schemer,” “The Little MLeer,” and “Essentials of Programming Languages.”

Friedman also focuses on theoretical foundations of computer science and is a member of the editorial board of *Higher-Order and Symbolic Computation.*
Andrew Hanson

Andrew Hanson already had a long career under his belt before he joined the faculty at IU. Hanson earned a B.S. in chemistry and physics from Harvard in 1966 and a Ph.D. in theoretical physics in 1971 from MIT. He then went on work at Princeton, Cornell, and Stanford, and he spent nearly a decade as a senior computer scientist in the Artificial Intelligence Center at SRI International.

But he truly found a home in Bloomington.

His research in computer graphics and mathematical modeling methods led him to breakthroughs in the visualization of scientific problems, especially those in four dimensions, and his 2006 book “Visualizing Quaternions” continues to be highly influential. Hanson also focused on machine vision and artificial intelligence, including computer-based automated research assistants to aid in the conceptualization and solution of scientific research problems.

He served as the director of graduate studies in computer science from 1996-2002 and was chair of the department from 2004-09. He retired in 2012 and is currently a professor emeritus of computer science at IU.

Steven Johnson

Few people have experienced the half-century of computer science at IU quite like Steven Johnson.

Johnson came to IU in the early 1970s and earned a master’s degree in mathematics before pursuing a master’s in computer science. After leaving for a few years to work at Bell Laboratories, he returned to pursue a Ph.D. in computer science in the early 1980s. Johnson became one of the first two students to earn his Ph.D. in computer science from IU, and he immediately joined the faculty.

“What Dan Friedman and David Wise were doing in programming languages made the most sense to me mathematically,” Johnson says. “They were looking at programming from a mathematical perspective and less in a machine perspective.”

Johnson’s work on processors in the 1980s was groundbreaking, as was his research in the line of formal synthesis during the 1990s.

Johnson became the chair of the department in 1993, and he filled that role for two years as the department was in the midst of rapid change. He later took on the role of CS program director in 2010 and became professor emeritus of computer science in 2013.
There might not be a computer science department at IU without Paul Purdom. That’s not a stretch. When Purdom was contemplating coming to IU while on leave from the University of Wisconsin in 1971, he told the dean of the College of Arts and Sciences that he could be swayed to join the faculty if the computer science program was made into an autonomous department. That may have been enough to tilt the scales in favor of the program moving from being part of the Department of Mathematics to its own department, and Purdom has been at IU ever since.

After earning his bachelor’s, master’s, and Ph.D. in physics from the California Institute of Technology, Purdom embarked on a career that saw him focus on the analysis of algorithms. He became a world leader in the area, and he is the co-author of the book *The Analysis of Algorithms*.

He served as the second chair of the computer science department from 1977-81, and he has been named a distinguished scientist by the Association for Computing Machinery. Purdom has been involved in research in bioinformatics, data mining, database theory and systems, rewriting systems, and the theoretical foundations of computer science. The Purdom Fellowship for graduate study is named in his honor.

Ed Robertson played a critical role in the development of the computer science department not just as chair of the program from 1982-88 but also as a critical researcher in the area of databases. His interest in the problems developing countries face when adopting computing technology helped spread the reputation of computer science at IU around the world.

Robertson earned his B.S. in mathematics from the California Institute of Technology in 1965, and he received a Ph.D. in computer science from the University of Wisconsin. He also was a Fulbright Scholar at the University of Nairobi in Africa. But it was his work in database systems theory, information modeling, software engineering, and systems engineering and modeling that set him apart in Bloomington.

His research in conceptualizing, designing, and implementing database tools helped bring computing to the masses, and he was honored with IU’s Teaching Excellence Award in 1999, 2000, and 2007, and the IU Trustees Teaching Award for Faculty in 2004. He was also given the School of Informatics and Computing Distinguished Service Award in 2009.