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History of the Computer Sciences Department at Purdue University

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1. INTRODUCTION

The article by Rosen and Rice [1990] relates how the first department of computer sciences in the United States was established at Purdue University in October 1962. The present article describes how the department found its identity and matured into one of the strong departments at Purdue and in the nation. There are three natural phases to this development. In the 1960's the effort was to define the courses, the degree programs, and, indirectly, the field itself. The 1970's saw the department's maturation and growth into a typical university department. The 1980's started with a series of crises, some nationwide and some internal to Purdue, which eventually gave the department a considerably different character than it had in the 1970's. This paper is organized around these three periods.

Figure 1 presents a chronology of the principal events and milestones for the period 1962–1989.

1962	–	Department formation, M.S. and Ph.D. programs started
1964	–	First M.S. degrees awarded (3)
1966	–	First Ph.D. degrees awarded (2)
1967	–	Move to Math Sciences Building
1968	–	Undergraduate program started
		First B.S. degrees awarded
		100th M.S. degree awarded
		Regular faculty size reaches 10
		Department and Computing Center completely separated
1970	–	200th M.S. degree awarded
1972	–	Regular faculty size reaches 20
1973	–	200th B.S. degree awarded
1977	–	500th M.S. degree awarded
1978	–	500th B.S. degree awarded
		Department acquires first computer facility (VAX 11/780)
1979	–	Conte retires as head, Denning appointed
1981	–	Crisis: Enrollment explosion arrives
1982	–	100th Ph.D. degree awarded
1983	–	Denning leaves, Rice appointed head
		Crisis: Large loss of key faculty
1984	–	Crisis: Major growth in facilities and laboratories
		Crisis: No space for faculty, students or staff
1985	–	Move to new building
1986	–	Regular faculty size reaches 30
1987	–	1,000th M.S. degree awarded
1989	–	2,000th B.S. degree awarded

Figure 1. Milestones and principal events in the history of the Computer Sciences Department at Purdue University, 1962–1989.

2. THE 1960'S: ESTABLISHING THE CURRICULUM

The first task of Samuel Conte as new department head was to hire some faculty and define a graduate program. The course offerings planned were not large, enough graduate courses for the M.S. and Ph.D. degrees and an undergraduate service course in programming. In the very first year there were seven teaching faculty, including Conte, a numerical analyst. Four were already at Purdue: Richard Kenyon, an EE Ph.D. and Assistant Professor; L. Duane Pyle, a Math Ph.D. and Assistant Professor; Don Novotny, an Ind. Engr. Ph.D. candidate and full time instructor, and Rosemary Stemmler, a full time instructor. Two new faculty were hired, Robert Korphage in theory and Saul Rosen in programming systems. While not all of these were teaching full time, this staff could offer over 20 courses a year, which was ample to support the planned program.

In 1963 there were three new faculty: Richard Buchi in theory, Walter Gautschi in numerical analysis, and John Steele in programming systems. Steele primarily worked in the Computer Sciences Center and has taught rarely over the years. The following year John Rice in numerical analysis was hired, and this completed the initial phase of hiring.

No new faculty were hired in 1965 and only one, Carl de Boor in numerical analysis, was hired in 1966. He was the first of a number of young Ph.D.'s hired who became influential members of the department. Robert Lynch in numerical analysis and Paul Young in theory were hired in 1967, Jay Nunamaker in business applications was hired in 1968, and Victor Schneider and Vincent Shen, both in systems, were hired in 1969. Also hired during this period was Maurice Halstead, a senior person in programming systems who later worked in what is now called software engineering.

The new Mathematical Sciences building was completed in 1967 and the department (along with Statistics) moved there from the Engineering Administration building. The Computer Sciences Center occupied the two floors below ground. The department occupied the fourth floor which was substantially larger than the previous space and also much nicer. In the beginning, space was so ample that some graduate students were given faculty offices (with windows!). Fifteen years later, even with space on other floors, people were jammed packed together.

In 1966 Saul Rosen went to SUNY Stony Brook for a year. He returned in 1967 and soon was part of a major management change. Conte had been both Director of the Computer Sciences Center, a computing services organization, and Head of the Computer Sciences Department. Both of these were growing rapidly, and in 1968 Saul Rosen was appointed Director of the Computer Sciences Center which was renamed the Purdue University Computing Center (PUCC) in January, 1970. Very close ties were established between the computer center and the department while Conte was head of both; this friendly cooperation continued under Rosen's direction and still persists today.

As recounted in Rosen and Rice [1990], the Department of Computer Sciences was as part of the Division of Mathematical Sciences along with the Departments of Mathematics and Statistics. Felix Haas was head of the Division and also Head of the Mathematics Department. Initially, the three departments were only partially independent within the Division. They set degree requirements separately, but there was only

one graduate committee and one Ph.D. qualifying exam system. They had separate personnel committees, but not separate budgets. This arrangement was appropriate in view of the small sizes of the Computer Sciences and Statistics departments, their youth as departments, and the administrative skill of Felix Haas. This arrangement was, of course, also a continual source of friction and the three departments gradually became truly independent during the next five or six years. The final step was the complete separation of budgets in 1968.

2.A. The Graduate Program

The M.S. degree was designed as a program to train computer scientists for industry. Students with degrees in other fields (of course, there were no B.S. graduates in computer science at that time) were given a broad introduction to numerical methods, programming systems and theoretical computer science. Ten courses were required for the M.S. degree, with wide flexibility given in selecting them. The only requirement was that one course must be taken from each of the three main areas. Students usually took a few related courses from engineering, applied mathematics or statistics. This program attracted students immediately, including some programmers who came from California with Conte. The first three M.S. degrees were awarded in the Spring of 1964. The number of M.S. graduates per year rose rapidly, reaching 31 in 1965–66, and has been in the 30–60 range (occasionally higher) ever since.

Defining the Ph.D. was not difficult in the areas of numerical analysis and theory as there were already well-established research subdisciplines in these areas. Further, the qualifying exam system was reasonably compatible with these two areas. The Ph.D. qualifying exams within the Division of Mathematical Sciences were uniform and, naturally, very mathematical in nature.

Defining the Ph.D. in programming systems was not so simple. Most of the research was in industry, not academia. There were no standard research journals and, indeed, many important ideas and results were published in ad hoc ways – or even not at all. There were no textbooks and very few research monographs. Defining the course work and evaluating theses was difficult, but at least there was an experienced faculty member, Saul Rosen, for these tasks. The qualifying exam was a particular challenge for students in this area. The "standard body of knowledge" for this exam was missing, yet the existing mathematics exams (even the one in applied mathematics) were far removed from the students' needs and interests. Students were asked to become expert in these outside areas; they viewed this both as a very difficult task and as a waste of their time.

The first two Ph.D. graduates were in 1966: Karl Usow, a student of John Rice and Kenneth Brown, a student of Samuel Conte. The following year there were five Ph.D. graduates. The first Ph.D.'s in programming systems were not until 1969; Larry Axsom and Edouard Desautels, both students of Saul Rosen. A complete list of the Ph.D. students is given in Section 5. It is not always easy to decide whether some Ph.D. students in the early days were in mathematics or computer science. All the senior computer science faculty also had appointments in mathematics, the qualifying exams were the same and there was a single graduate committee. Ph.D. requirements, unlike those of the M.S., were essentially the same for all departments, and Ph.D.

degrees are not officially labeled by department. Thus there are four Ph.D.'s in computer science whose advisors were not on the computer science faculty, and several computer science faculty (e.g., Buchi, Gautschi, Lynch, Rice, Young) had Ph.D. students not in the computer science list of Section 5.

2.B. The Undergraduate Program

The undergraduate program evolved from initial, very sparse offerings of courses in programming to a computer science option in the mathematics department to a separate B.S. degree approved in 1967. Conte was an active member of the Association for Computing Machinery committee to study and recommend a model B.S. degree program. The result, known as *Curriculum '68*, was very close to the degree program at Purdue which was one of the test beds for developing *Curriculum '68*. There were B.S. degrees awarded immediately because many students could and did transfer from the CS option of mathematics and met the new degree requirements within a year.

The similarities between these B.S. degree curricula are illustrated in Figure 2 where a comparison is given of the course requirements for (1) the B.S. degree in computer science (CS Major), (2) the B.S. degree in mathematics within the computer science option (CS Option in Math), and (3) the model Curriculum '68. The principal difference between the CS major and Curriculum '68 was the increased emphasis on theory and the fact that programming languages material was covered in several courses rather than being collected into a single course. The CS option in Math simply had lower requirements, consistent with the requirements of the other mathematics options.

Course	*CS Major*	*CS Option in Math*	*Curriculum '68*
Calculus	3	3	3
Advanced Calculus	1	1	1
Linear Algebra	1	1	1
Programming 1 & 2	2	2	2
Numerical Methods	1	1	1
Theory	3	2	1
Computer Systems	2	0	2
Programming Languages	0	0	1
Electives - CS	2	2	2
Statistics	1	0	0
Electives - Math/CS/Stat	0	0	2
Total Courses	16	12	16

Figure 2. Comparison of the requirements for B.S. in computer science (CS Major), the B.S. in mathematics with the computer science option (CS Option in Math), and the Curriculum '68 model B.S. program.

Although a B.S. degree was offered starting in 1967, the department did not have a full range of appropriate undergraduate courses by then. The B.S. program relied heavily on the graduate courses and a typical B.S. degree would include 3–5 courses at

the dual graduate/undergraduate level. Some of the required B.S. courses were graduate courses or dual level courses designed for graduate students and special undergraduates. This situation reflected two facts. First, the faculty was still not large enough to offer a full range of courses for the B.S., M.S. and Ph.D. degrees plus a substantial service program. Second, material known to be appropriate for undergraduates had to be offered in graduate courses because entering graduate students rarely had a B.S. in computer science.

The above situation was well recognized by the department and there was a steady migration of material from the graduate level downward as soon as the faculty levels and student backgrounds allowed it. It was not until well into the 1980's that the undergraduate computer science program included the variety of offerings that was common in the other sciences.

There were many lessons learned about the computer science curriculum in these formative years. Perhaps the most important was that *the rapid evolution of the field makes courses at all levels become out-of-date in a few years.* It was the hope in the early days that we would soon define courses CS101, CS102, CS103 which would become semi-permanent fixtures analogous to Math 101–103 or Physics 101–103. That has not yet happened and does not seem likely for the near future. Among the other lessons learned were: (1) It is completely unrealistic to teach programming to a mixed class of science, engineering and business students. The business students do not have the background to compete. (2) It is a hard struggle to keep the students, teaching assistants, and even some faculty focused on the principles of computer science as opposed to the mechanics. (3) There is never enough money to provide the level of computing facilities that the students deserve. (4) Programming assignments open new arrays of possibilities for students to cheat. As soon as one cheating technique is counteracted, another is invented.

3. THE 1970's: MATURATION

At the start of the 1970's, the department was through its pioneering years. The degree programs were established, there was a faculty of 15, there were dozens of computer science departments at other universities, and the department was fully independent. The 1970's were to be a decade of consolidation and maturation.

There were still serious challenges; perhaps the most difficult was hiring faculty. By 1970 there was a significant production of computer science Ph.D.'s but it did not come close to meeting the demand. Computer science departments were being established rapidly, the computing industry was expanding steadily, and several other industries (oil, aerospace, banking) began to hire significant numbers of Ph.D.'s. Throughout the 1970's almost every computer science department had unfilled positions for computer science Ph.D.'s, as did many major industries. The growth in Ph.D. production was slow, almost zero in the latter part of the decade.

The regular faculty at Purdue increased from 15 in 1970–71 to 22 in 1979–80, the result of relentless recruiting. Young faculty that were hired who later became important figures in the department include:

1972 – Peter Denning, Michael Machtey, Herbert Schwetman

1976 – Douglas Comer, Christoph Hoffmann
1977 – Michael O'Donnell
1978 – Buster Dunsmore

These gains were offset by losses of key faculty. Four went to other positions: Duane Pyle, Carl de Boor, Jay Nunamaker, and Victor Schneider. Maurice Halstead and Michael Machtey died suddenly in 1979.

The shortage of faculty was compounded by another trend that became widespread in the 1970's. That was the change from a mathematics-like discipline (pushing only paper and punched cards) to a science-like discipline with a significant experimental science component. Some computer science departments originated in engineering and had the experimental component from the beginning. By the end of the 1970's, most departments, including Purdue's (which originated in mathematics) had started to establish a significant experimental component. As the discipline moved in this direction, it adopted some of the practices of the experimental sciences. In particular, teaching loads had to be reduced to compensate for the increased effort needed to operate teaching laboratories and experimental research facilities. The fierce competition for faculty, of course, accelerated the reduction of teaching loads and the offering of equipment to attract faculty. While the faculty in 1979 had the same teaching load as in 1970, this would not be so for long.

A significant effect of the lack of faculty was the heavy reliance on graduate teaching assistants. While recognizing that it was educationally unsound, the department sometimes had graduate students teaching other graduate students in the 1960's and had graduate students commonly teaching upper division courses in the 1970's. There seemed to be no alternative except not to offer the courses.

A second serious challenge of the 1970's for computer science departments everywhere was to establish their scientific respectability. Many science and engineering faculty only knew about computing through contact with Fortran programming, and they assumed that was all there was to computer science. It was almost like believing that mathematics consisted of arithmetic using *really big* numbers, or physics consisted of analyzing structures with *really lots* of levers and pulleys. Even though the Purdue Department of Computer Sciences was consistently rated in the top 10, it had to continually reaffirm its permanence and value to other parts of the university. While there is still a residual of these feelings even today, by the end of the 1970's the bulk of the university administrators and faculty believed computer science was a serious scientific discipline that was here to stay.

The third serious challenge was the evolution of the courses. In spite of repeated reorganizations of courses and the expansion of offerings, it seemed there was always some course that needed complete restructuring. The department simply did not have enough faculty to keep all the courses up-to-date at all times. This situation persists today.

The educational programs were fairly stable in size during the 1970's. From 1970 to 1979 the number of Ph.D.'s awarded annually was unchanged at 6 and the number of M.S. degrees increased by 1 from 53 to 54. The number of B.S. degrees awarded annually grew from 33 to 92, but 71 were already awarded in 1973–74.

The quality of the degree programs improved significantly during this decade. At the graduate level, by the end of the decade the department insisted that all entering students have the equivalent of a B.S. in computer science or make up the deficiency. At the undergraduate level, the number of courses offered was increased significantly, and better text books became available.

The decade ended with Conte stepping down as Department Head in 1979. In his 17 years as head, he had guided the department from its pioneering infancy to a strong department both nationally and within the university. It was a major achievement. The department also benefited greatly from the foresight and support of Felix Haas. He became Dean of Science soon after the department was formed and later became Provost. Already in the early 1960's he foresaw that computer science would become one of the major scientific disciplines, and he supported Conte's efforts to keep Purdue's department growing and to become one of the best. Conte's successor was Peter Denning who led the department into the 1980's.

4. THE 1980's: DECADE OF CRISES

The growth and maturation of the 1970's held the seeds for the crises that hit in the first half of the 1980's. There were too many major needs and a lack of resources to meet them.

4.A. Crisis #1: The student enrollment explosion

The number of entering freshmen majoring in computer science during the 1970's did grow some. There were about 80 to 100 entering in 1970–1974. It then increased to 150 a year in 1975–1977. In 1978 and 1979 the numbers increased to 200, then 300 and the crisis was upon us (see Figure 3). This growth was nationwide. One year in the early 1980's, one survey showed that 9% of the high school graduates wanted to study computer science. If this percentage had continued, computer science would have had as many students as all of engineering! By the fall of 1981 there were over 500 freshmen starting out in computer science. The earlier groups of students were advancing through the curriculum and the undergraduate courses overflowed, were divided, and then overflowed again.

The administration at Purdue was very reluctant to limit the entering freshmen class in computer science. There was strong pressure to increase the size of the student body. Finally, in 1982, a mechanism was agreed upon to limit the freshmen class in computer science. Higher SAT scores and class rank were required in computer science than in the rest of the School of Science. The number of freshmen majors dropped to about 350 in 1982 and stayed there until 1985. Even that number was beyond the capacity of the department.

Sometime after the limit mechanism was put in place, the faculty realized that the administration had quietly created a new category of students, the *pre-computer-science* classification. Essentially all the students who met the School of Science requirements, but not the computer science requirements, were admitted into this classification. Thus there was no reduction in the students in the courses, even though the number of official majors decreased. The students in this new classification who made acceptable grades were admitted as official computer science majors when they became upper division

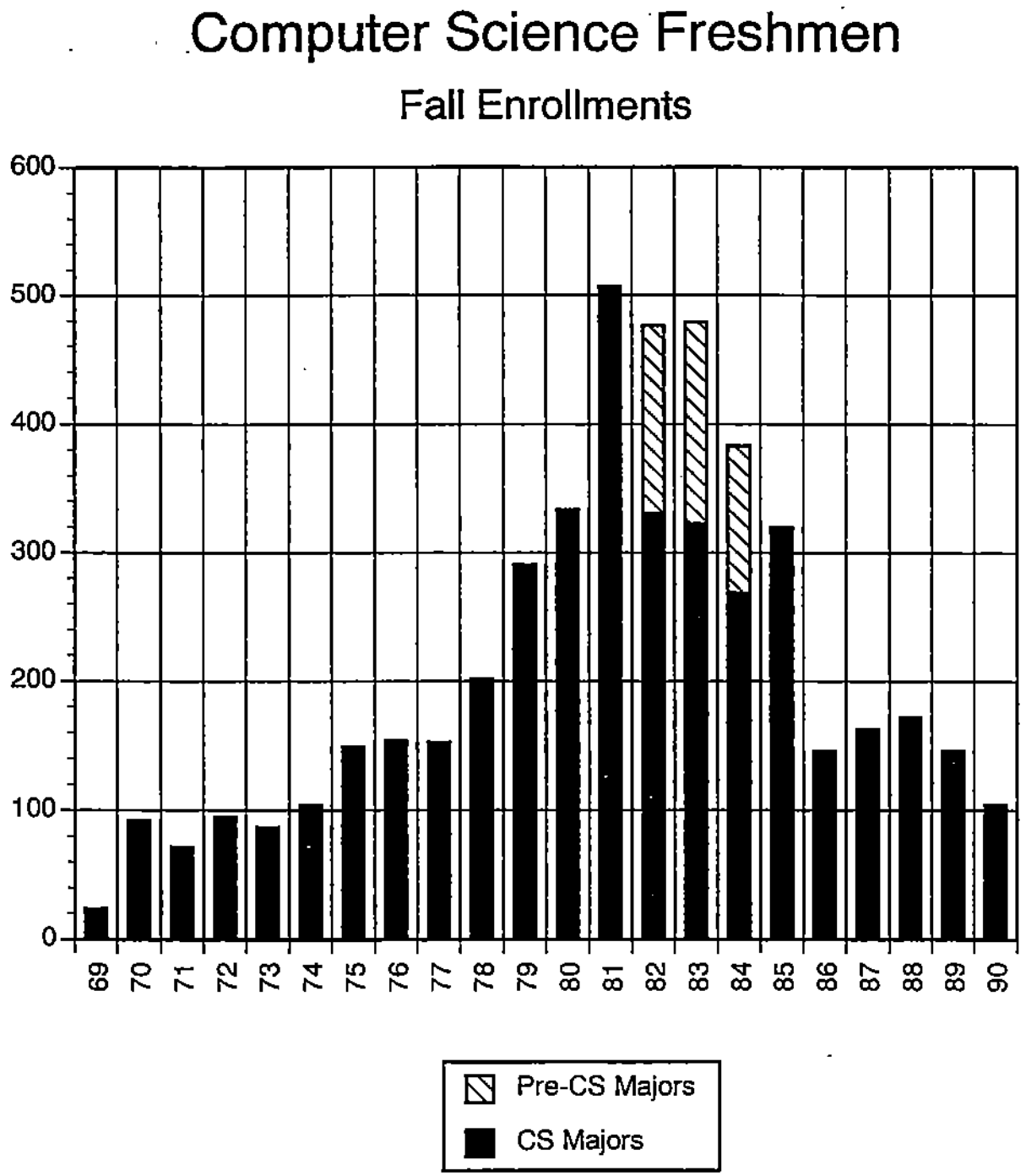

Figure 3. Entering freshmen declaring computer science as their major for 1969 to 1989. In 1982 to 1984, the classification of "pre-computer science" major is shown on top of the officially declared majors.

students. Such actions are the source of mistrust between faculties and administrations. In this case, this action helped precipitate the 1983 crisis.

The administration did offer to increase the number of positions in the department, but that was completely safe. The department already had unfilled positions and having more of them would not increase the number of faculty. The explosion was handled primarily by increasing class sizes. Examples of extreme situations during that period were: (1) The senior level course in numerical analysis was taught in a single lecture section with about 150 students – and a half-time TA grader, (2) The first year graduate course in compilers had over 80 students and no grading assistant, (3) Teaching assistants had classes of 160 to 180 students in lower division courses.

There was a corresponding lack of computing facilities to support the courses. Many courses used VAX 11/780 timesharing systems and examples of the poor service includes: (1) The terminals reserved for "quick fixes" were limited to 10 minutes use. Response was so slow that one could not log on in 10 minutes. (2) Many terminals would automatically disconnect because they would not receive an echo of characters sent to the VAX within 15 seconds. They assumed the computer was down rather than merely swamped. (3) Load averages on the VAXes were commonly up to 30, and 60 was sometimes reached. Load averages measure how busy computers are and, to calibrate this, most users find the VAX satisfactory with a load average of 1, frustratingly slow with a load average of 4, and unusable with a load average of 10.

4.B. Crisis #2: The Space Crunch

Computer science started the 1980's in the Mathematical Sciences Building where it had been since 1967. The growth of the 1970's had gradually taken up the spare space in the building for all its occupants (mathematics, statistics, the computing center, School of Science administration, and computer science). Yet in the 1980's computer science started changing toward an experimental, laboratory oriented discipline. This means space was needed for departmental computing, for teaching labs, and for research labs. The department was severely constrained by the lack of space, even though a few offices were converted to labs for research projects. The result was a tighter and tighter packing of people. Research projects needing space involved very tedious negotiations even to get inadequate space. Most faculty simply could not engage in laboratory work.

Two examples illustrate the extent of the problem. In 1983, a faculty member came to the department head to ask for a new secretary to help support his work. Heads usually reply "I don't have any money for that", but in this case the department head said instead, "I understand, let's do it. Tell me where you want the secretary to be and I'll hire one". This offer was safe because the head knew that there was no place in the department to put even one more desk. In 1984, the Dean of Science arranged a loan of space from Chemistry while the new computer science building was being renovated. The plan was to move 20 teaching assistants into a miserable, temporarily abandoned chemistry lab complete with lab bench, sinks, gas, etc. The graduate students were so appalled that they found a packing scheme whereby one could place five graduate students into a 150 square-foot office, each with his own desk, chair and some book case space. These offices had been already overcrowded with four

students in them.

In response to Crisis #3, discussed next, in January 1984 a building was selected for renovation to house the computer science department. The renovation was completed in quick time and the building was occupied in the fall of 1985. The space was of excellent quality and for a few years the department enjoyed ample space. However, the need for labs, supporting staff, and research assistants grew rapidly, and by 1989 the packing process was being repeated again. Fortunately, it had not yet reached the extreme situation of 1984.

4.C. Crisis #3: Establishing Departmental Computing Facilities

The department acquired its first general purpose computer, a VAX 11/780 in 1978. It was the first VAX to be running VAX UNIX outside the developer's sites (Berkeley and Bell Labs). The particular motivation for this move was the need for computer scientists to have an interactive, time shared computing environment. It was not practical for PUCC to provide this service on a widespread basis, and they were unwilling to do so for just one department. It was, however, inevitable that the department set up its own facilities as its needs were becoming too specialized and too diverse to be satisfied by a centralized service center. This move was part of the nationwide trend of computer science becoming more experimental, more laboratory oriented.

This crisis was very real but was handled much more smoothly than the others because of the university administration's willingness to support this growth. The extent of the changes required is illustrated by Table 1, which gives the values for operations budget, facilities staff and installed equipment. In a ten year period a major new operation was established within the department. The operating budget shown is entirely from university funds, in recent years about 20% more has been received from research grants. A large proportion of the equipment was purchased through government research grants.

Table 1. Growth of the computing facilities from 1979 to 1989. The operating budget is that supported by the university, the people are full time, and equipment value indicates their current worth, not original cost.

	1979	*1984*	*1989*
Operating budget	$20,000	$150,000	$500,000
Facilities staff	0	3	9
Equipment value	$250,000	$2,000,000	$3,500,000

While this crisis was handled smoothly, it did have its trying moments. The department, like many others, initially did not realize the necessity of a professional staff to operate the facilities. The early staff (Douglas Comer and his students, then Herbert Schwetman) were regular faculty and students who took on this extra challenge. They did a superb job, but this was not their only job. More than once there were scenes of the following nature:

(1) Professor X has a paper that must go out today and it is being revised on the computer.

(2) The computer crashes.

(3) Professor X rushes to the office of Professor Y who is in charge of the facilities and demands that the computer be brought back up at once.

(4) Professor Y replies that he has two classes to teach, he has not finished preparing for them and maybe he can work on the problem late in the afternoon.

(5) All the students who might be able to bring the system back up are gone to classes, the library or someplace.

(6) There is then a heated discussion between Professor X and Professor Y about who is irresponsible, unreasonable, incompetent, etc.

A trying moment for the department head related to this crisis occurred in 1985. The Dean of Science was discussing the department's new budget and emphasizing how important the administration felt it was to stay within the allocated budget categories. The head pointed out that, for the year just ending, the department's supplies and expenses budget was going to be overspent by about 100% due to the computing facilities. Further, this budget item had been increased only 5.5% in the new budget. There ensued a discussion about who was being serious about what.

These growing pains were, on the whole, minor and the department did obtain excellent computing facilities. This growth did, however, contribute to the space crunch crisis. Fortunately, computers were getting smaller all the time or it would have been even worse. The professional staff required space that was in very short supply in the mid 1980's, and this group was of significant size by 1989 – and continued to grow.

4.D. Crisis #4: Loss of Key Faculty

The crises already discussed began in the early 1980's to create concern and then alarm among the faculty. They could see that in order to remain among the top 10 departments, Purdue would have to make major investments to create the "experimental science" facilities needed. That meant more space for laboratories, more support for staff, and more computing facilities. Instead of addressing this challenge, some faculty perceived that the administration was letting them drown in a flood of students. The faculty realized that it was impractical to hire 10 new professors as they were not available. They did hope, however, that the administration would help in other ways (more teaching assistants, more lab space, better computing facilities) while the faculty coped with the student flood. Faculty morale dropped steadily as it appeared that little help would be forthcoming.

This crisis should be placed in the context of the national situation. Enrollments were ballooning wherever they were not strictly limited. There was national awareness that heavy investments were needed for experimental computer science facilities. Many universities were responding with major programs in computer science; it seemed that all the leading departments were getting a $15 million or $30 million new building plus 20 new positions. Of course, only some were, but the Purdue faculty felt it was going

to be left behind.

In the summer of 1981 a group (Peter Denning, John Rice, Larry Snyder and Paul Young) from computer science met with Provost Felix Haas to discuss the situation. They had prepared a plan [Denning, et al., 1981] to maintain the excellence of the department. The faculty's sense of unease was expressed and the Provost responded by saying that Purdue strongly supported the department and would not let it fall apart. The Provost noted that Purdue could not let people like those present become so unhappy that they left Purdue; it would ruin the department. A year and a half later Denning and Young had resigned and a third (Snyder) resigned about a year after that.

The plan prepared by this group was realistic in that the faculty would get less than they wanted and the administration would give more than it wanted. The plan was agreed to in principle but not as an itemized list of commitments. The plan and resulting actions did not fully disspell the belief that Purdue was willing to settle for a second tier computer science department. In the Fall of 1983 the faculty was systematically surveyed about the problems and priorities for the department. Of 22 items, the following were judged as having the highest priority (in the order listed).

1. Class sizes were too large,
2. Number of Ph.D. students was too low,
3. Lack of laboratory space,
4. University's commitment to maintaining a top tier department.

The overall ratings by the faculty of the department's and/or university's performance in attending to these items were, respectively, D+, C-, D and B-.

In 1983 and 1984 the department lost 10 faculty, including many of its key people, namely

	Person	*Rank*	*New Position*
1983:	Fran Berman	Assistant Professor	UC at San Diego
	Jan Cuny	Assistant Professor	University of Massachusetts
	Dorothy Denning	Associate Professor	Stanford Research Institute
	Peter Denning	Professor and Head	NASA: RIACS
	Mike O'Donnell	Associate Professor	Johns Hopkins
	Paul Young	Professor	University of Washington
1984:	Richard Buchi	Professor	Died
	Dennis Gannon	Associate Professor	Indiana University
	Herbert Schwetman	Professor	MCC
	Larry Snyder	Professor	University of Washington

This set of faculty would have constituted one of the better departments in the country and their loss was clearly a major blow to Purdue. While the departmental crisis was the reason for some of the departures, there was also a certain coincidence. For four of these people the principal reason for leaving was their spouse's situation and this was a contributing factor for several others. See Figure 4 for data on faculty size from 1962 to 1989.

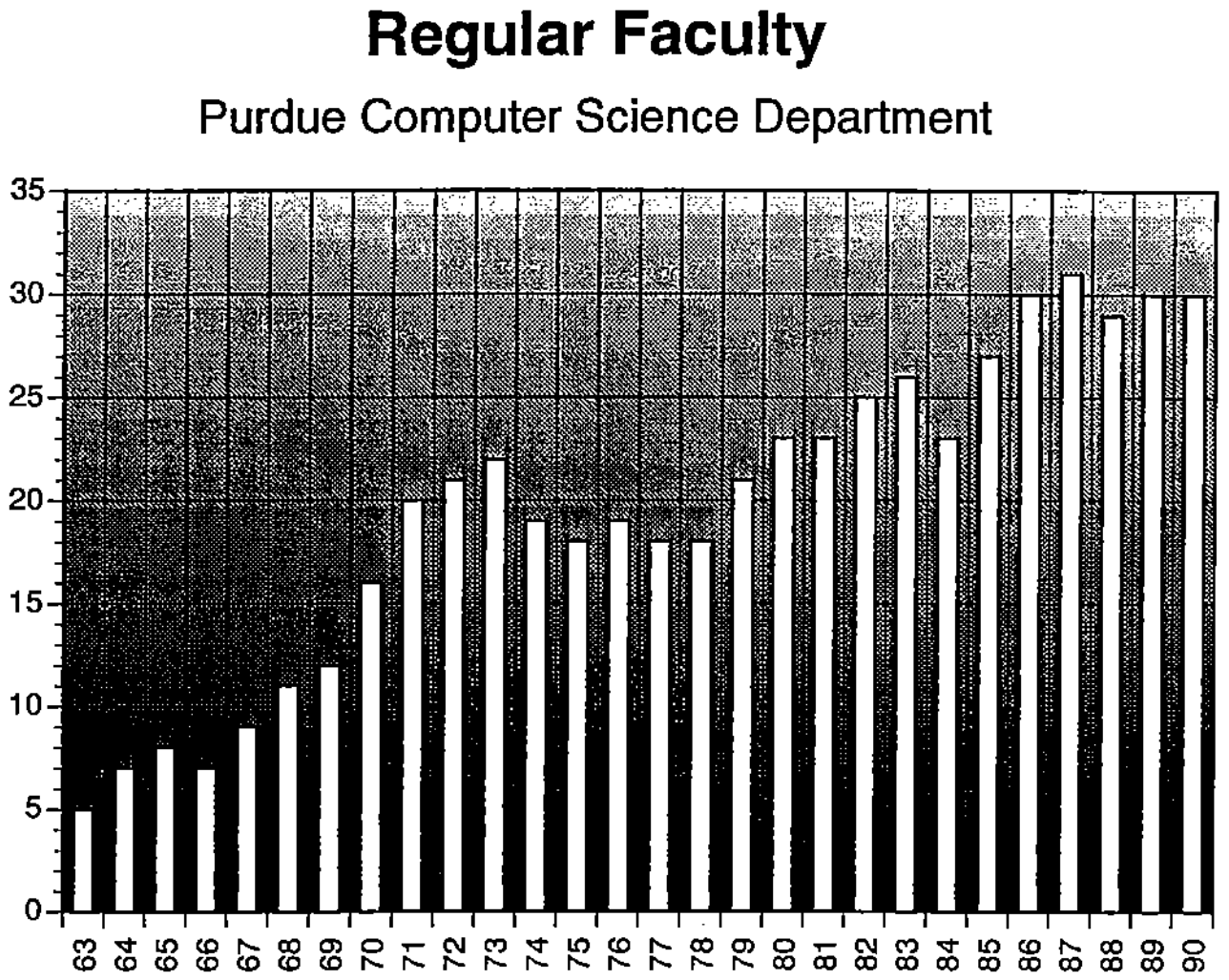

Figure 4. Growth of the regular faculty in the Department of Computer Sciences from 1962 to 1989. Regular means tenured or tenure-track with principal appointment in Computer Sciences.

The search for a replacement of Peter Denning as department head was educational. John Rice was appointed Acting Head and a vigorous search for a new head started. The Dean outlined how the candidates would be winnowed out; the department opined that Purdue would be lucky to have any serious candidates to winnow. A year later only three candidates had been found who were both interested and interesting enough to be interviewed. Two were offered the position and turned it down, the third said it would be a waste of effort to make an offer.

As the crisis deepened, the administration became more convinced that it was real and that efforts should be made to "save" the department. On January 1, 1983 the entire computer science faculty was given a 1% midyear raise as a sign of commitment by the university. Purdue salaries at that time were near average on a national basis. In January 1984, it was decided to completely renovate the Memorial Gymnasium and make it into the Computer Science Building. Only three months later the architects were finished and the bids sent out requesting a completion date of August 1985.

New faculty were hired in 1983 and 1984 but three associate professors (Apostolico, Marinescu and Wagstaff) and five assistant professors (Bajaj, Dyksen, Mehrotra, Melhem and Schnyder) did not adequately replace four professors, three associate professors and two assistant professors. Furthermore, Apostolico and Marinescu came from Europe and were not as well established in the U.S. as typical associate professors, and Wagstaff's research area borders on mathematics.

4.E. The Recovery

The recovery from these crises really in 1985. The move into the newly renovated Computer Science Building made a dramatic improvement in morale. Not only was the environment greatly improved, but there was clear opportunity to start teaching and research laboratories of all kinds; the computing facilities had the high quality space (if not yet all the equipment) needed to provide first class facilities. This was accompanied by initial solid evidence that the flood of students was receding; the entering class of freshmen had only a little over 300 declaring themselves to be computer science majors.

Even though severe damage was caused by some of these crises, there had been other real success in meeting some of them. The department's budget was increased steadily, well above the inflation rate in the early 1980's, and this continued into the mid 1980's. From 1980 to 1989 it increased from $1.1 million to $3.0 million, at least a million dollars more than the inflation rate. The increases in the early 1980's seemed to be instantly consumed by the crises at hand, but they were building a base for the recovery in the second half of the decade.

The first priority after the exodus of people in 1983-84 was to rebuild the faculty. The nationwide shortage of computer scientists made this a difficult challenge, but one that had to be met. New hiring really began in earnest in 1984 with six new regular faculty. By 1989 the regular faculty had grown to 30, of which 18 were hired in 1983 or later. Not one remained of the 19 regular faculty hired in the eight year period 1968-1975, there were five "old timers" (Conte, Gautschi, Lynch, Rice and Rosen) and seven "middle-aged" faculty. Most of the new faculty hired were, of course, young, even though the losses had been heaviest among the more senior faculty. Five associate

professors were hired but most of these were relatively new to the rank.

Three full professors were hired. Rao Kosaraju was appointed the Loveless Distinguished Professor of Computer Science in 1986 and the department was thrilled to have acquired such a distinguished theoretician. Unfortunately, he returned to Johns Hopkins after one year because of family reasons. The other full professors appointed were Richard DeMillo and Elias Houstis. DeMillo came as Director of the Software Engineering Research Center (SERC).

A second high priority was to expand the experimental research activities now that space was available. By 1989 the department had eleven substantial research activities, ten with operational laboratories. The two largest projects were SERC and CAPO, discussed below. The others were Computational Combinatorics (Atallah, Frederickson, and Hambrusch – theory), Cypress (Doug Comer – networking), ELLPACK (Dyksen and Rice – scientific computing), Graphics (Dyksen), Interbase (Elmagarmid – databases), RAID (Bhargava – databases), Scientific Visualization (Bajaj and Hoffmann), Shadow Editing (Comer – operating systems), Xinu (Comer – operating systems).

SERC is part of the National Science Foundation's Industry-University Cooperative Research program. It is joint with the University of Florida and has 15 industry affiliates, including many of the leading computing companies. SERC was established at Purdue primarily through the efforts of Sam Conte who had taken up research in software engineering after being department head. He saw the opportunity to create an important center in the department and, after two years of hard work, it became operational in 1985. DeMillo came as the permanent director and substantial laboratory space and equipment was provided for SERC's use. By 1989 SERC involved 12 faculty and 14 graduate students at Purdue.

A second major research activity started in 1987, the Computing About Physical Objects (CAPO) project. Its principal support is from the National Science Foundation's Coordinated Experimental Research program but it has substantial support from other agencies and from Purdue. This project originated in 1986 from discussions between Hoffmann, Houstis and Rice. The eventual proposal included many other faculty and by 1989 the project involved seven faculty, three postdocs, and over 20 research assistants and staff personnel.

The growth in research in general, and experimental research in particular, is perhaps best illustrated by the increase of research funding from $447 thousand in 1980 to $3.6 million in 1989. Not surprisingly, there was also a substantial increase in the number of Ph.D. students during this period and some decrease in the number of M.S. students.

The new space acquired upon moving into the Computer Science Building also allowed the department to establish teaching laboratories. In the first year, 1985, there were four of them, two for CS 110 (an elementary PC-based service course), one for CS 230 (now CS 180, the first course for CS majors) and one for graduate courses in operating systems and networking. By 1989 this number had doubled. Operating laboratories is considerably more expensive in manpower (never mind maintaining equipment) than ordinary lecture courses; one must have laboratory assistants and supervisors of various kinds. The funding for this expansion came primarily from the reduced number of majors in computer science; as fewer sections of certain courses

were needed, the assistants were reassigned to help in labs.

5. HISTORICAL DATA

Some historical data was given earlier, namely in the following figures:

1. Departmental milestones and events,
3. Entering freshmen in computer science,
4. Size of regular faculty.

Here we give four more data sets. Figure 5 shows the number of degrees awarded at all levels from 1964 to 1989. Figure 6 lists all the full time faculty from 1962 to 1989 and shows the years they were in the department. Full time refers to appointment in all capacities at Purdue, several of these people were only part time in computer science. Faculty part time in other departments or PUCC include Abhyankar, Anderson, Bonczek, Christian, French, Gautschi, Lucier, Lynch, Rice (until 1983), Rosen, Schwetman, Steele, and Whinston. The "regular" faculty are those that are tenured or tenure-track and whose principal appointment is in Computer Sciences. Figure 7 lists all the professional staff since the first, William Gorman, was appointed in 1975. Their positions are also given. Figure 8 lists all the Ph.D. graduates, with their advisors, from 1966 to 1989.

6. ACKNOWLEDGEMENTS

We acknowledge valuable discussion and input from Samuel Conte, Walter Gautschi, William Gorman, Felix Haas, Robert Lynch, and L. Duane Pyle.

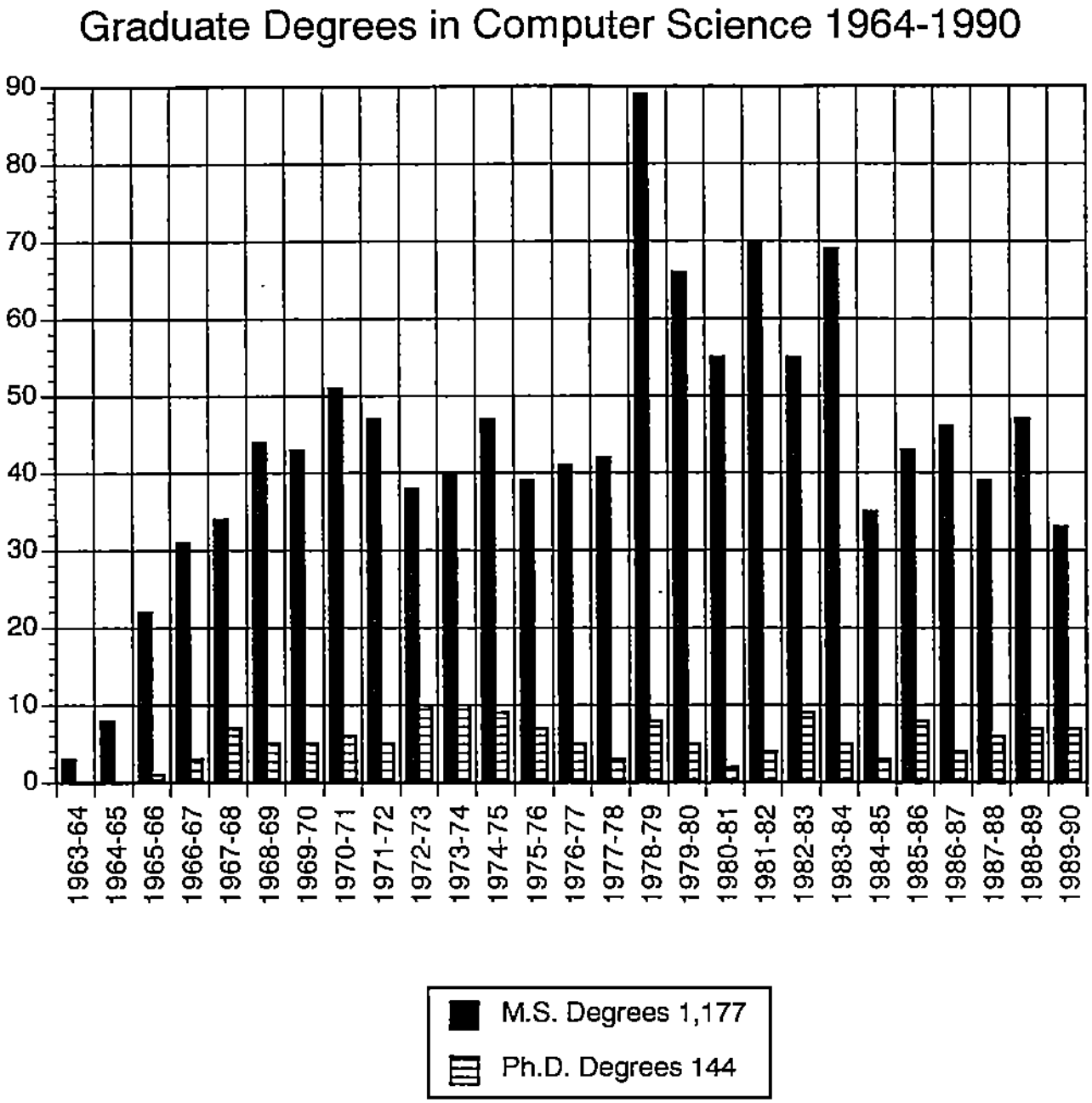

Figure 5-A. Number of graduate computer science degrees awarded from 1964 to 1990.

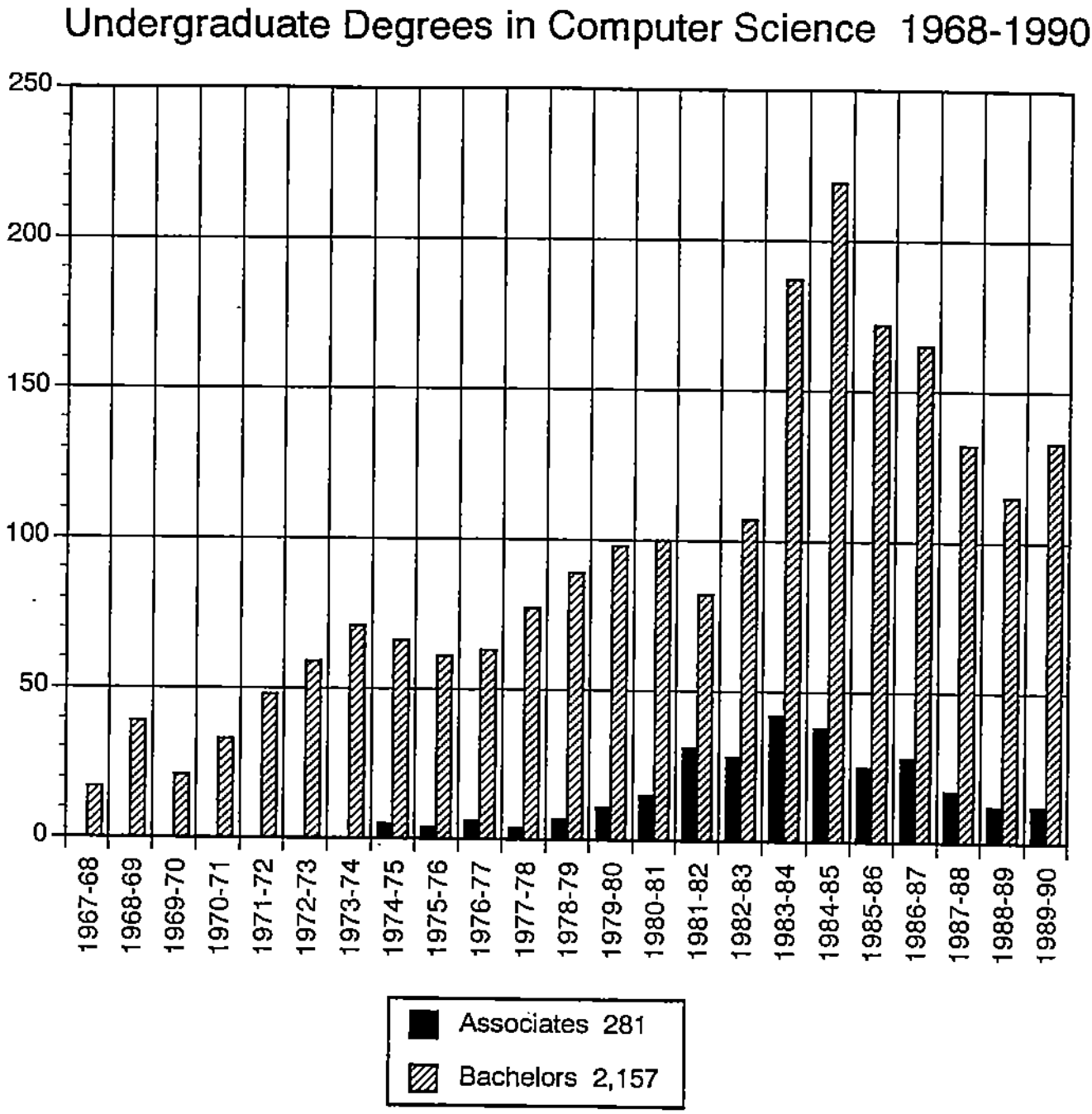

Figure 5-B. Number of undergraduate computer science degrees awarded from 1968 to 1990.

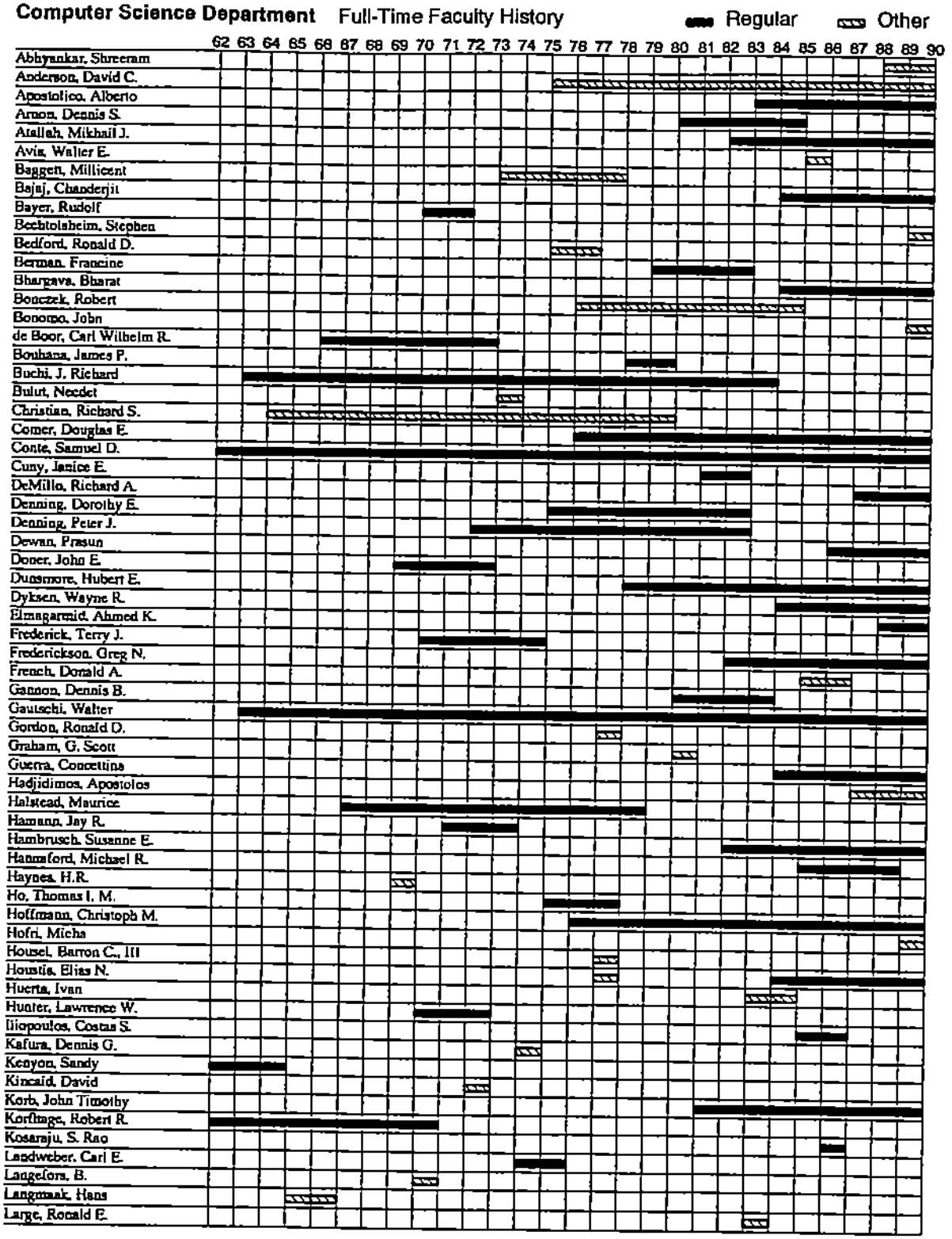

Figure 6. Full time faculty in computer science. The year marks indicate the summer, so Bayer was on the faculty in the 1970-71 and 1971-72 academic years.

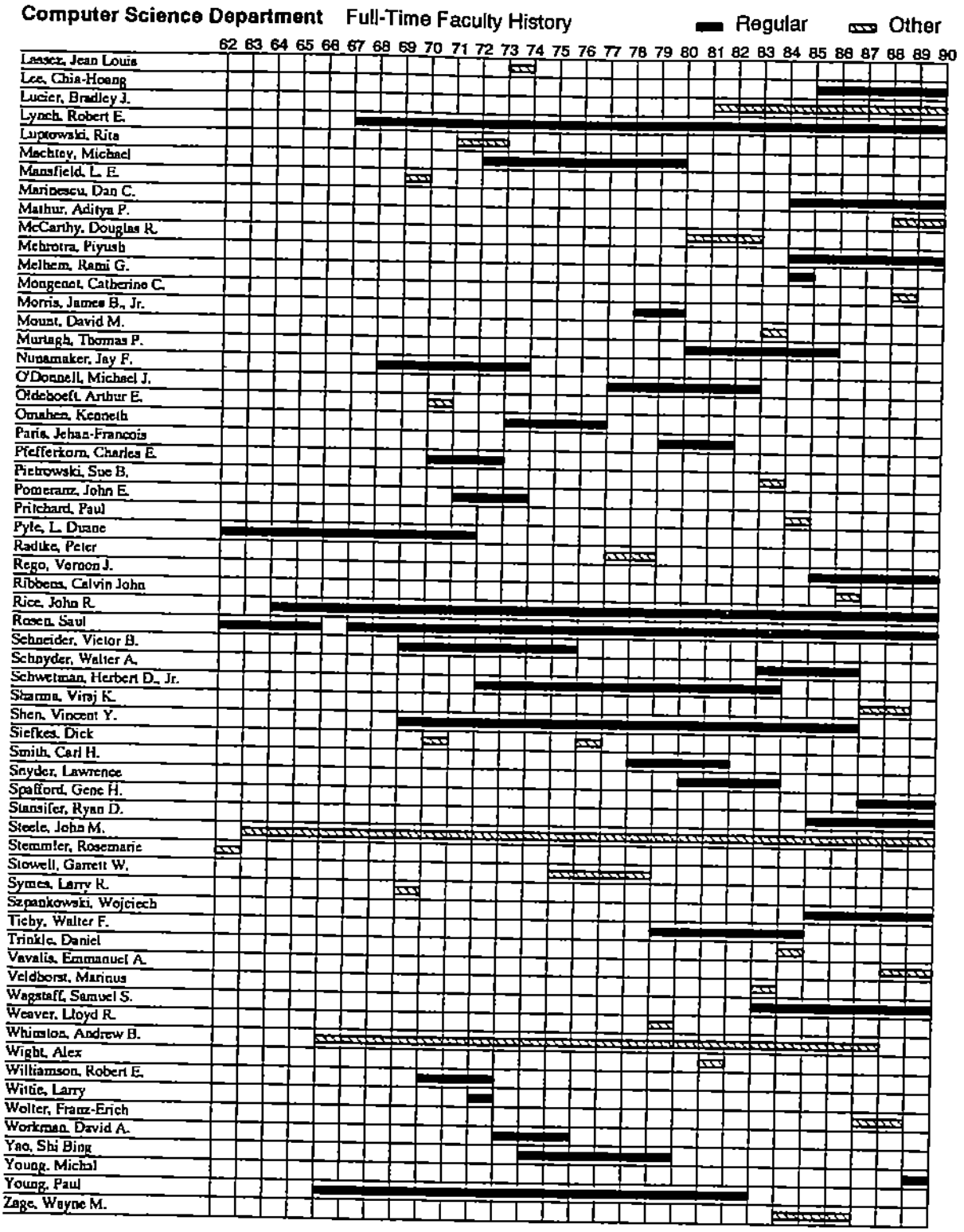

Figure 6. Continued.

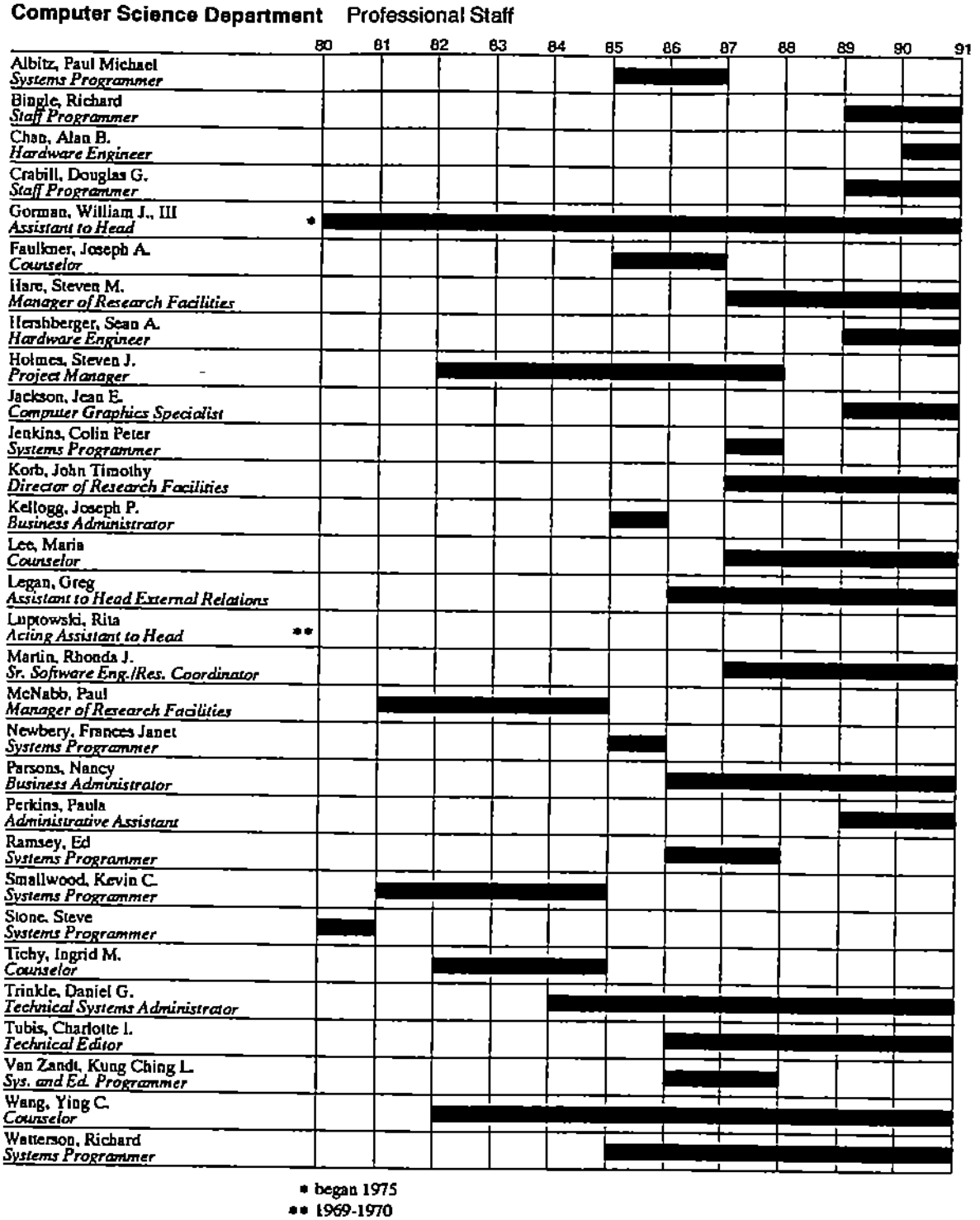

Figure 7. Professional staff in computer sciences from 1975 to 1990. The year indicates the academic year in which they came, left or were appointed from non-professional staff positions at Purdue. Position titles are the most recent if more than one position was held.

Ph.D. Graduate	Major Professor
1966	
June	
Usow, Karl H.	J. R. Rice
August	
Brown, Kenneth M.	S. D. Conte
1967	
June	
Brainerd, Walter Scott	J. R. Buchi
Kalan, James E.	J. S. Maybee
August	
Evans, Bernard B.	S. D. Conte
Kerr, Douglas S.	S. D. Conte
Landweber, Lawrence H.	J. R. Buchi
Sweet, Roland A.	J. S. Maybee
1968	
January	
Hosken, William H.	J. R. Buchi
Zahar, Ramsay V. M.	W. Gautschi
June	
Hoff, John C.	J. R. Rice
August	
Burchard, Hermann G.	J. R. Rice
1969	
June	
Axsom, Larry E.	S. Rosen
Desautels, Edouard J.	S. Rosen
Gibbs, Norman E.	R. E. Korfhage
Symes, Lawrence R.	J. R. Rice
August	
Dershem, Herbert L.	R. E. Lynch
Phillips, James L.	W. Gautschi
Smith, Douglas K.	L. D. Pyle
1970	
June	
Oldehoeft, Arthur E.	S. D. Conte
Pruess, Steven A.	C. deBoor
August	
Bass, Leonard J.	P. R. Young
Silverston, Stefan M.	S. D. Conte

Ph.D. Graduate	Major Professor
1971	
January	
Frailey, Dennis J.	M. H. Halstead
Mei, Peng-Siu	J. R. Buchi
June	
Blair, James C.	S. Rosen
Noonan, Robert E.	M. H. Halstead
1972	
June	
Boyce, Raymond F.	M. H. Halstead
DeLutis, Thomas Gregory	M. H. Halstead
Hochgesang, Guy T.	M. H. Halstead
Nylin, William C., Jr.	M. H. Halstead
Shapiro, Michael D.	M. H. Halstead
August	
Berk, Toby S.	M. H. Halstead
Dodson, David S.	C. deBoor
December	
Lancaster, Ronald Leo	V. B. Schneider
Pekarek, Edward G., Jr.	R. E. Lynch
1973	
May	
Aird, Thomas J.	J. R. Rice
Arsenault, James R.	J. F. Nunamaker, Jr.
Conti, Dennis M.	T. J. Frederick
Lassez, Jean-Louis	J. R. Buchi
Mickunas, Marshall D.	V. B. Schneider
Roman, Roger V.	S. D. Conte
August	
Bulut, Necdet	M. H. Halstead
Housel, Barron C., III	M. H. Halstead
Iverson, James A., Jr.	J. F. Nunamaker, Jr.
Oldehoeft, Rodney R.	J. R. Rice
December	
Buten, Richard E.	V. Y. Shen
Krause, Kenneth Leroy	V. Y. Shen
Swenson, Donald E.	A. B. Whinston

Figure 8. Ph.D. graduates in computer science showing time of graduation and thesis advisor.

Ph.D. Graduate	Major Professor
1974	
May	
Collins, William J.	P. R. Young
Schutte, Lawrence J.	M. H. Halstead
Zweben, Stuart H.	M. H. Halstead
August	
Anderson, Larry A.	W. Gautschi
Dahl, William J.	J. F. Nunamaker, Jr.
Friedman, Frank L.	V. B. Schneider
Zislis, Paul M.	M. H. Halstead
December	
Heiman, David I.	M. F. Neuts
Ho, Thomas I. M.	J. F. Nunamaker, Jr.
Kafura, Dennis G.	V. Y. Shen
Verbrugge, William G.	J. F. Nunamaker, Jr.
1975	
May	
Denning, Dorothy E.	H. D. Schwetman
December	
Cox, George W.	V. B. Schneider
Elci, Atilla	M. H. Halstead
MacLennan, Bruce J.	V. B. Schneider
1976	
May	
Blosser, Patrick A.	J. F. Nunamaker, Jr.
Lemme, James M.	J. R. Rice
Puk, Richard F.	R. Garrett
Wade, Bradford W.	V. B. Schneider
August	
Bonczek, Robert H.	A. B. Whinston
Fletcher, Sharon K.	H. D. Schwetman
Kahn, Kevin C.	P. J. Denning
December	
Graham, Gordon S.	P. J. Denning
Konsynski, Ben R.	J. F. Nunamaker, Jr.
1977	
August	
Gordon, Ronald D.	M. H. Halstead
Schwartz, Mayer D.	P. J. Denning
Winklmann, Karl A.	P. R. Young

Ph.D. Graduate	Major Professor
1978	
August	
Long, Timothy J.	P. R. Young
Ottenstein, Karl J.	M. H. Halstead
Ottenstein, Linda M.	M. H. Halstead
Poplawski, David A.	C. M. Hoffmann
December	
Bruell, Steven C.	H. D. Schwetman
Mead, Robert L., Jr.	H. D. Schwetman
1979	
May	
Gehringer, Edward F.	H. D. Schwetman
Simon, Richard T.	P. J. Denning
August	
Boisvert, Ronald F.	J. R. Rice
December	
Balbo, Gianfranco	P. J. Denning
Hevner, Alan R.	S. B. Yao
Miller, James R.	D. C. Anderson
1980	
May	
Dennis, T. Donald	P. J. Denning
August	
Fasel, Joseph H., III	P. J. Denning
December	
Woodfield, Scott N.	V. Y. Shen
1981	
August	
Joseph, Deborah A.	P. R. Young
Tolopka, Stephen J.	H. D. Schwetman
December	
Chew, Leslie Paul	M. J. O'Donnell
1982	
May	
Ward, William A., Jr.	J. R. Rice
August	
Waddle, Vance E.	A. B. Whinston
December	
Brumfield, Jeffrey A.	P. J. Denning
Dittert, Eric R.	M. J. O'Donnell
Hedlund, Kye Sherrick	L. Snyder
Hsiao, Ching-Chih	L. Snyder

Figure 8. Continued.

Ph.D. Graduate	Major Professor
1983	
May	
Mount, David	C. M. Hoffmann
Reed, Danny A.	H. D. Schwetman
Schrader, David K.	P. J. Denning
Thebaut, Stephen	V. Y. Shen
August	
Agrawal, Subhash C.	P. J. Denning
Arthur, James D.	D. E. Comer
December	
Capka, David M.	P. R. Young
1984	
May	
Bishop, Matthew	D. E. Denning
Bondi, Andre B.	P. J. Denning
August	
Wang, Andrew	H. E. Dunsmore
December	
Li, Kuo-Cheng	H. D. Schwetman
1985	
May	
Peterson, Larry Lee	D. E. Comer
August	
Bechtolsheim, Stephan V.	D. B. Gannon
Hwang, Yeou-Huei	D. B. Gannon
Kerola, Teemu Tapani	H. D. Schwetman
December	
Kapauan, Alejandro A.	D. B. Gannon
Panetta, Jairo	D. B. Gannon
Yu, Tze-Jie	H. E. Dunsmore
1986	
May	
Kortekangas, Atte Juhani	A. B. Whinston
Pan, Shuh-Shen James	A. B. Whinston
August	
Droms, Ralph E.	D. E. Comer
Kent, Christopher A.	D. E. Comer
Ribbens, Calvin J.	J. R. Rice
Ruan, Zuwang	W. F. Tichy

Ph.D. Graduate	Major Professor
1987	
August	
Goodrich, Michael T.	M. J. Atallah
Janardan, Ravi	G. N. Frederickson
Ruggieri, Cristina	T. P. Murtagh
December	
Krishnamurthy, Balachander	J. T. Korb
1988	
May	
Brown, Robert L.	D. E. Comer and P. J. Denning
Wills, Craig E.	J. T. Korb
August	
Bhasker, Parthasarathy	A. B. Whinston
Christara, Christina C.	E. N. Houstis
Rathi, Mahesh Kumar	S. D. Conte
Shannon, Gregory E.	G. N. Frederickson
December	
Kim, Myung-Soo	C. Bajaj
Leu, Pei-Jyun	B. Bhargava
Narten, Thomas	D. E. Comer
1989	
August	
Bonomo, John Paul	W. R. Dyksen
Guan, Dah Jyh	G. N. Frederickson
Gupta, Ajay Kumar	S. E. Hambrusch
Yavatkar, Rajendra Shivaram	D. E. Comer
December	
Rodger, Susan Hatcher	G. N. Frederickson
1990	
May	
Browne, Shirley Victoria	B. Bhargava
Riedl, John Thomas	B. Bhargava
August	
Chuang, Jung-Hong	C. M. Hoffmann
Tsay, Jyh-Jong	M. J. Atallah

Figure 8. Continued.

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