THE WANG INSTITUTE OF GRADUATE STUDIES:
A HISTORICAL PERSPECTIVE

DISSERTATION

Presented to the Graduate Council of the
North Texas State University in Partial
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By

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The Wang Institute of Graduate Studies was an independent, non-profit corporate college located Tyngsboro, Massachusetts originated through the benevolence of An Wang. This study focuses on the problems in education and industry that acted as the impetus for this institute and develops a historical perspective of Wang Institute from its inception in 1979 until its end in August, 1987. The study describes the philosophy, organizational structure, curriculum, faculty, and students of Wang Institute. Wang Institute of Graduate Studies no longer exists. The facility used by Wang Institute of Graduate Studies is now known as Wang Institute of Boston University.
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CHAPTER I

INTRODUCTION

Advances in the highly technical computer society of today have opened many new job opportunities for software specialists. The job market in this field has grown so rapidly that educational institutions are having a difficult time meeting industry demands for highly skilled software specialists.

The Wang Institute of Graduate Studies was an independent, non-profit corporate college located in Tyngsboro, Massachusetts, approximately thirty-five miles northwest of Boston. It was founded in 1979 by An Wang who revolutionized the computer industry with his inventions related to core memory. The main building, built in 1925, was once a home for the Marist Brothers and St. Joseph’s Juniorate Seminary. Since the purchase of the building and surrounding property, the facility was completely renovated to accommodate classrooms, offices, computer laboratory space, library, and lunchroom. At the beginning of 1987, plans were well under way for additions to the current facility (11, p. 1). The surrounding property was landscaped for recreation facilities.
The stated mission of the institute was a dual one: "to provide the professional graduate education that software engineers require to meet the demands of industrial software development and management, and to help alleviate the acute nationwide shortage of highly skilled software specialists" (10, p. 4).

Strict admission requirements seemed to be a trademark of the institute. The requirements included "a Bachelor's degree from an accredited institution of higher learning with a minimum grade point average of 3.0, at least one year of full-time software development work experience, and specific expertise in computer science and mathematics" in addition to others (11, p. 6). High academic standards remained in the forefront. A student was required to maintain an average of 80 to higher to avoid scholastic probation (11, p. 9). Team work was emphasized and study groups were encouraged.

The Wang Institute of Graduate Studies was accredited by the New England Association of Schools and Colleges, Inc. It received its degree granting authority from the Board of Regents of Higher Education of the Commonwealth of Massachusetts, while its original charter was obtained in April, 1979, from the Commonwealth of Massachusetts (11, p. 23).

The degree awarded by this school was the Master of Software Engineering which was designed to enable students
to master both the technical and managerial aspects of software development and maintenance (11, p. 4). An important aspect of this education program was "the combination of formal academic methods and industrial practice in this area of computer and information technology" (11, p. 4).

The Wang Institute was forced to close its doors with its last graduating class on August 9, 1987, when its major source of funding was terminated.

Purposes of the Study

The major purpose of the study was the development of a historical perspective of the Wang Institute of Graduate Studies. Other purposes were (1) to identify the significant events in the development of the Wang Institute, the characteristics of the institute, and the contributions of the organization to higher education, (2) to describe the philosophy, the organizational structure, curriculum and administrative policies, (3) to analyze the effects of the current trends in computer science and computer information systems on the institute, and (4) to predict trends, if any, that may have an effect on the Wang Institute and computer science and computer information systems in general.
Questions for Study

To achieve the purposes of this study, the following questions were formulated.

1. What problems within post-secondary education prompted those initiating the Wang Institute of Graduate Studies to begin this school?

2. How did the Wang Institute differ from traditional institutions of higher education with programs in computer science?

3. What mistakes were made in its formulation and development to this date?

4. What types of students were attracted to the institute?

5. What are the future plans for the Wang Institute?

Background and Significance of the Study

This study presents a history of the Wang Institute from its beginning in 1979 to the present. Nothing of an educational historical nature has been written about this young institute since 1982. By providing organized information about the past—both discoveries and mistakes—revealing the needs for reform and perhaps by predicting trends, histories of educational institutions are valuable to research in education (1, p. 799). This research was to learn something new about the Wang Institute, the impact it
has on education, and the place it has in higher education for the future.

Little has been written about this relatively little-known institute and its influence or impact on traditional computer science or business information systems education. An indication of these influences and impacts should be revealed through this study. In addition, this study should provide useful information to those individuals, both administrators and instructors responsible for setting up curricula in the area of computer study. It is useful to those individuals studying higher education, and may help to predict trends in computer-related education, as well as corporate professional education, particularly those trends at the Wang Institute. For these reasons, the Wang Institute of Graduate Studies is a significant area of research.

The Setting

Corporate Colleges in American Higher Education

For two centuries the college was the dominant form of institution for American higher education. Early in the history of higher education in the United States, a few medical, law and ministry schools were founded, typified by Harvard, Princeton and Yale. The preferred education in many professions during early times was the apprenticeship which remained outside the realm of higher education. After
1825 a few engineering schools such as Rensselaer School, now called Rensselaer Polytechnic Institute, began to appear. After the Civil War, state universities began to evolve. Land grant colleges were established as a result of generous opportunities opened by the Morrill Land Grant Act in 1862. This legislation granted huge tracts of federal land to states for establishing colleges to train students in scientific farming, engineering and military science (4, p. 33). Professional schools began to establish entrance requirements of a high school education and later evolved to require some, if not completion, of college coursework.

Graduate schools became the professional schools for college teachers. Women's colleges such as Elmira, Wells, Vassar, Wellesley, and later Radcliff were established and coeducation in existing schools evolved. Diversity among institutions became one of the major characteristics of American higher education (5, p. 478). Professional education became an essential feature of the graduate institute.

Early in the history of American higher education, several special driving forces helped foster the diversity found in graduate and professional education. These forces were a dynamic environment coupled with changing desires and needs of the population (5, p. 508), early reformers who opened the door to change, and the influence of the German university as a model of change (5, p. 491). The German
universities were "world famous for their success in joining teaching and research and the ambitious goal of producing not just the practitioner, but the creative scholar in every field of professional endeavor" (3, p. 175). Those persons attending the German schools returned to the United States to become leaders in higher education, many as presidents of many important and influential universities. This leadership serves as an important example of successful establishment of implementing innovative ideas in higher education such as the Wang Institute of Graduate Studies (WIGS).

Professional graduate education has not always been performed in a traditional manner. It progressed from the formal classroom to the practical hands-on laboratory. Innovative ideas and philosophies have met the forever growing need to provide specialists in the business and professional world. When the university has not been able to fulfill the need, businesses have taken the initiative to train individuals within their own confines. "Education and training within large private sector corporations of the United States has become a booming industry" (4, p. 1). Some of these training programs have developed into degree-granting institutions that are recognized by the same state agencies and regional agencies that accredit traditional higher education.
An important and practical social benefit that flows from professional training is the presence of a corps of competent professional persons that may directly improve social conditions as they exist today (2, p. 288). For example, the presence of computer information specialists may facilitate the expansion, dissemination and storage of data, and advance the educational process and facilitate the decision making process. "The most commonly expressed concern about higher education over the last several years is that it may not graduate enough engineers and computer scientists to meet the demands of the new high technology economy" (9, p. 43). The increased use of computers has produced a definite demand for "highly trained specialists who can integrate technical skill and managerial ability" (8, p. 1). In the October, 1980, report prepared by National Science Foundation in conjunction with the Department of Education entitled "Science and Engineering Education for the 1980's and Beyond," the authors express concern about the ability of educational institutions to alleviate the problem of the ever increasing shortage of computer science professionals of all kinds (11). To further substantiate the problem, the Massachusetts High Technology Council conducted a similar study of the needs within the state of Massachusetts and discovered comparable conclusions (8, p. 6).
Corporate colleges of today have grown to attempt to meet this need. Each institution has its own mission, its own strengths and weaknesses, its own clientele, and its own circumstances (6, p. 6). The Wang Institute of Graduate Studies is an example of such an education institution.

One of the problems of traditional universities in trying to meet industry demands for engineers and computer scientists is inflexibility when it comes to new ventures, according to Professor Thomas Cheatam, Chairman of the Computer Sciences Department at Harvard and a former member of the Wang Institute of Graduate Studies National Academic Advisory Committee (10, p. 1). Another problem, according to Cheatam and Edmund Cranch, former president of Worchester Polytechnic Institute and the Wang Institute of Graduate Studies, is that many universities are geared for research and are not professionally oriented to equip people to work in a practical way in industry. Very often, in a traditional computer science program, the projects and theses are strongly mathematical, without the constraints and limitations of the real world. One can make assumptions, one can make equations, but to actually put the components in place and build a machine is different (10, p. 1).
CHAPTER BIBLIOGRAPHY


CHAPTER II

THE STORY OF WANG INSTITUTE OF GRADUATE STUDIES

Origin of Wang Institute of Graduate Studies

An Wang, one of the twelve naturalized Americans who received the Medal of Liberty in 1986, was born in Shanghai and educated at Harvard. He started Wang Laboratories in his garage in 1951 after he invented magnetic core memory in 1948 which was a primary source of computer memory for many years. In 1951, working out of his garage and with virtually no business background, he founded Wang Laboratories which produced magnetic cores and won various research contracts. In the 1960s Wang Laboratories became well known for their calculators. The small garage operation eventually grew to become the world’s most well known word processor manufacturer of the 1970s and early 1980s. In 1976 he moved the headquarters of Wang Laboratories to Lowell, Massachusetts.

Wang believes "both personal and national success depend on a highly trained, highly educated workforce" (27, p. 233). In response to this belief he served as a member of the Massachusetts Board of Higher Education, Massachusetts Board of Regents, trustee of Northeastern University and Boston College and an overseer of Harvard
University. Being familiar with the problems in higher education and feeling he had a debt of gratitude of his own successes to repay, he wondered whether there was a need in higher education he could help fill. Wang looked for a way to make a profound contribution to the study of computer science. He decided software engineering was a promising place to begin because he felt those people that had a particular gift for programming would be the ones who would benefit the most from studies in software engineering (27, p. 234). The Wang Institute of Graduate Studies grew out of this seed planted in the mind of Wang.

While on a cruise in February, 1979, Wang drew up the basic outline he wanted to start. By April, 1979, organized the institution board and by June, 1979, acquired state approval to grant a master's degree in software engineering (27, p. 235). The Wang Institute of Graduate Studies was founded as an independent, non-profit corporate college located in Tyngsboro, Massachusetts. It was funded initially by a $3 million grant from Wang. In his own words Wang called the Wang Institute "a hundred-year project" with the hope that it will one day rank with MIT or Cal Tech (15, p. 106).

The educational purpose of the Wang Institute School of Information Technology, the first school of the venture, was to address the problem of training leaders in the field of
software engineering. According to Wang the Institute served "Massachusetts, and the high technology industries, and aid[ed] our search in finding new methods and ways of applying high technology to advance society... a non-competitive brotherhood of computer scientists" (30, p. 1). The Institute declared its purpose to answer the "most significant industry need for the first-line supervisors, project leaders and software architects by offering a professional master's degree program" (30, p. 1).

Although the alternative to affiliate with another school existed, Wang chose to initiate the Wang Institute because he wanted the potential students to be trained as project managers, not as theoreticians. He doubted the ability of existing schools of higher education to accommodate theory to practice in this relatively new field. He explained, "Harvard, for example, wants to train Ph.D's who are only interested in relatively unknown theses" (8, p. 150). Wang opened his own institute in order to maintain control of the structure and direction of advanced technological education.

At the time of its inception, there was no other school that offered a degree in software engineering in the New England area. For three years, Harvard had tried a similar program but encountered "conflicts between traditional academic requirements and the multidisciplinary studies essential to the new field" (7, p. 1). This program was
unable to accommodate the marriage between theory and practice necessary to achieve the goals of software engineers.

The degree awarded by this school was the Master of Software Engineering which was designed to enable students to master both the technical and managerial aspects of software development and maintenance (33, p. 4). An important aspect of this educational program was "the combination of formal academic methods and industrial practice in this area of computer and information technology" (33, p. 4). This type of training more closely responds to the needs of industry as the student was ready to go to work immediately upon graduation instead of requiring further training.

The site chosen for the Wang Institute, just a few miles from the home office of Wang Laboratories, was on 200 wooded acres located in Tyngsboro, Massachusetts, approximately 35 miles northwest of Boston. The renovated facility accommodated classrooms, offices, computer laboratory space, library, and lounge.

Steps in Early Development

The initial idea for the Wang Institute of Graduate Studies was that of An Wang, but he could not originate this school alone. Subsequent planning involved an association of people representing academic, industrial, and
institutional constituents. The union of ideas and support these people contributed to the credibility of the infant institution. This marriage of the minds also diminished "potential resistance or misunderstanding from the academic and industrial community" (2, p. 195).

Early in the process Wang discussed his ideas with reputable authorities in both education and industry. These discussions led to the formulation of two advisory committees, The Institute Advisory Committee (IAC) and the National Academic Advisory Committee (NAAC). The IAC, formed in the summer of 1979, consisted of four university presidents and one university chancellor representing universities in the area with which Wang was associated. The members were Asa S. Knowles of Northeastern University, Edmund T. Cranch then of Worchester Polytechnic Institute, John B. Duff representing neighboring Lowell University, Jean Mayer of Tufts University, and Rev. J. Donald Monan, S.J. of Boston College. This committee was formed under the advisement of Duff in order to profit from the academic experience in the area. It was after this Wang announced his intention to form the institute and began searching for a dean.

The Institute Advisory Committee was charged with providing the President of the Board of Trustees, then Wang, with advice on institute governance and procedures.
Its early role was to advise on the general requirements and aspects of establishing institutions of higher education, such as initial administrative procedures, governance issues, and cooperation with surrounding academic community (2, p. 198). Regular meetings of the IAC continued until about January, 1980, when the Institute's first administrators were appointed.

Wang formed the NAAC to guide curriculum development, faculty and dean selection and hardware procurement. Edmund Cranch was asked to serve as a liaison between the IAC and the NAAC. The composition of the NAAC was balanced between recognized experts in the computer industry and prominent members of the academic community consisting of Alan Merten, University of Michigan, chairman of the NAAC; Bruce Arden, Princeton University; Robert M. Bozeman, Allied Stores Corporation; Professor Thomas Cheatham, Harvard University; Richard Fairley, Colorado State University; Ugo Gagliardi, General Systems Group, Inc.; William McKeeman, Palo Alto Research Center, Xerox Corporation; J. William Poduska, Prime Computer Inc.; and Carl Swartz, Wang Laboratories (14, p. 3-9).

As it developed, the task of the NAAC was to advise the President, Board of Trustees and the Academic deans on the matters of proposed degree programs, proposed curriculum and courses, potential faculty members, faculty evaluation procedures, and curriculum evaluation procedures (14, p. 3-9).
Richard Fairley, who was invited to be on the NAAC due to his work on curriculum in the 1970s for the Institute of Electrical and Electronics Engineers, Inc. and the Society of IEEE, was chairman of the curriculum subcommittee. He came with a plan for curriculum for the software engineer master’s degree (9).

In order to receive degree-granting status, it was vital to have a plan in place. The NAAC designed a degree program and curriculum consisting of a twelve month, thirty-three hour course of study leading to a master’s degree in software engineering. The NAAC decided the school would not offer any classes in the evening so that it would not have the appearance of a metropolitan college. Part-time students were offered the option to take two classes each semester to complete the degree requirements in either a twenty-four month period or a thirty-six month period. For the total plan of theory and practice in software engineering to take place, it was necessary to procure computer systems. The NAAC members canvassed local industry for recommendations settling on three state of the art computers: a Digital Vax 11/780, a Prime 750, and a Wang VS 80. An IBM 3033 was available for student use through remote access communications. All students had individual study areas with video display terminals (32).

The Trustees Incorporated of Wang Institute of Graduate
Studies was established in April, 1979. The members consisted of Wang, serving as president, his wife Lorraine Wang, his two sons Courtney and Frederick, and corporate employees and legal advisors with whom Dr. Wang had a long-time relationship. The lawyers, Charles E. Goodhue III and William J. Pechulis, were instrumental in setting up the corporation. Earlier were able to expedited the acquisition of the Marist facility in Tyngsboro, Massachusetts for the site of the institute. The Massachusetts Education and Health Act fund defrayed part of the cost of this property. Pechulis and Goodhue executed the legal activities that were necessary and helped shape the governance policies which led to degree-granting authority (2, p. 203).

The search to find the appropriate person as dean of the new school continued. Wang had set the opening date for the Institute for fall of 1980 so time was of the essence. Finally in January, 1980, Ugo Gagliardi arranged a leave from Harvard University to became part-time Academic Dean. Gagliardi was experienced in industry and President of General Systems Group, Inc. and the Gordon McKay Professor of the Practice of Engineering at Harvard. Negotiating a leave from Boston University, Caroline Wardle joined forces with the Wang Institute to lend her expertise in program design as full-time Associate Dean. Her background included founding the Metropolitan College of Boston University computer science department and initiation of the bachelor’s
degree programs in computer science and information systems. When Gagliardi and Wardle came, the responsibilities of the IAC were terminated and the NAAC resumed as the advisory board which met three times a year (2, p. 204).

Four major tasks immediately confronted the administrators acquiring degree-granting authority, recruiting faculty and staff, recruiting students, and preparing the facilities for opening. These tasks had to be accomplished almost immediately in order to retain the ambitious opening date of the fall of 1980.

Wardle performed most of the degree-granting preparation, writing the necessary documents along with Jack Bohlen, hired as Administrative Vice President in January, 1980, and Barbara Adler who was hired as Assistant to the Dean in March, 1980. Bohlen and Wardle had joint responsibility to secure outside support and work toward obtaining degree-granting authority. For the duration of Bohlen's administration at Wang Institute from January, 1980 until December, 1982, his office was not at the Institute but at Wang Laboratories in Lowell. He reported directly to Wang while Wardle was responsible for day-to-day operations at the Institute (2, p. 203).

The accomplishments of Wardle and Gagliardi during the first few months of existence were tremendous. They were able to define the initial academic policies and educational
objectives and prepare the initial philosophy and curriculum documents for the degree-granting review to be held on May 15, 1980. Adler's contribution to the initial institutional self-study were the library, student services and physical facility sections. She also served as affirmative action officer. Walter Saxe, CPA and an auditor for Wang Laboratories, was appointed as Vice-President for Finance in June, 1980. The deans and NAAC members continued to interview candidates for faculty positions, for without faculty members, the main purpose could not be accomplished (36, p. 4).

The young institute had strict criteria for the faculty positions of assistant professor and associate professor: the appropriate terminal degree or equivalent professional experience, must have held a faculty appointment at another academic institution and a record of achievement in the field of academic specialization (14, p. 5-4). Faculty recruitment was additionally hampered by the lack of accreditation of the institute. Early appointments to the faculty were Nancy Martin, Associate Professor in April, 1980, and James P. Bouhana, Assistant Professor in May, 1980, but they were not able to start until later in the year. By the time the visiting committee of the Massachusetts Board of Higher Education completed its work on August 19, 1980, a librarian and computer operations supervisor were appointed. Prior to this time, the
administrative staff was working out of Wang Labs. In August, 1980, the offices were moved into the partially refurbished building on Tyng Road in Tyngsboro.

During the infancy of Wang Institute, there was so much to do in such a very short period of time in order to meet the ambitious opening date. There were recruitment publications to get out and students to recruit. The equipment facilities the staff were used to using at their offices at Wang Laboratories were not yet available in the new quarters. It was obvious everything would not be completed to enter the first class in the fall, 1980 so the entering class date was extended to January, 1981. In a status report dated August 15, 1980 to the NAAC, Wardle stated they "started to work on a recruitment plan to attract the entering class of January, 1981" (38, p. 1). With the help of Ted Leonis, Corporate Publicity/Public Relations Manager of Wang Laboratories, the plan included a new bulletin and flyer, contacting initial companies for providing students for the beginning class, an open house scheduled for October 20 and 21 along with several seminars running parallel to the open house. People from the surrounding high technology industry and universities were extended a general invitation to attend. This report also defined the scheduled delivery date of computer equipment for use at the new school (38, p. 1).
The infant institute was not without its internal problems. Gagliardi's resignation in August, 1980, led to a major administrative change. Wang appointed Wardle as temporary dean. She agreed to stay until her temporary leave from Boston University was expired on July 1, 1981. Once again the search committee of the NAAC had to recruit a new dean. In the interim, Wardle continued to administer the duties necessary to accomplish the perceived goals of the institute.

Plans progressed for the opening of the school quicker than earlier anticipated. The School of Information Technology was officially dedicated on October 4, 1980. Among the audience present for the ceremony were Massachusetts Senator Paul Tsongas, Massachusetts Governor Edward King, and President of Dartmouth College, John G. Kemeny. In Kemeny's keynote address he cited "the Wang Institute's program as a uniquely important contribution to the critical task of refining our nation's technological innovations" (35, p. 1).

Degree-Granting Review

The Visiting Committee of the Massachusetts Board of Higher Education visited the site in May, 1980, but did not complete its report until August 19, 1980. The delay was explained by the processess of reorganization which the Board was undergoing at the time (2, p. 210). Dean Wardle
responded to the visiting committee report stating most of the recommendations made had been carried out since the visit in May. Degree granting authority was cited as being likely but, as yet, premature because too little was in existence to be evaluated (36, p. 6).

The report of the Visiting Committee consisted of three major sections: curriculum development and faculty for the School of Information Technology, master's degree of Software Engineering, and the overall governance of the institute.

In a memo to the faculty, Wardle clarified faculty members had the option of a twelve-month or nine-month industrial style contract or a twelve-month or nine-month academic style contract. The academic style contract covered four working days a week, "the fifth day may be used for paid consulting work" (37, p. 1). The industrial style contract covered five working days, with no paid consulting work. In either case the nine-month contract included three weeks of vacation and the twelve-month contract included four weeks of vacation (37, p. 1).

The Visiting Committee expressed reservations about the curriculum development. "It was not clear at present with whom the ultimate responsibility for shaping the curriculum resides" (22, p. 1). The role of the NAAC, the dean, and faculty needed clearer definition in relation to curricular responsibilities. The visiting committee questioned the
situation of the temporary dean whose expertise was in software engineering, as it was "unclear how the emphasis might shift if the future dean had slightly different interests" (22, p. 1). The committee further criticized the little role the faculty had in curriculum development. The goals promised in the curriculum were to deal with human factors and societal aspects of computer science. How and where was this to be accomplished (22)?

To clarify and refine the mission Wardle identified two areas of curricular specialization, first line supervisors of software development projects, and software architects. She distinguished the program at Wang Institute from the traditional computer science programs as follows:

...it is our intent to evolve an educational institution which will include important aspects of professional schools of engineering, medicine, law and business. The professional school stresses the proper balance of education in technical subjects of the professions, emphasizes professional responsibility and ethics, and provides an opportunity for extensive practical professional training in the work environment such as an internship in medicine or as in our case, extensive laboratory exposure to actual computer projects (38, p. 3).

Wardle further clarified the characteristics of the proposed curriculum by comparing the core of the traditional computer science curriculum to that of the software engineering core. Courses in the traditional computer science core include operating system design, database management, and other specialized courses. The program
offered at the Wang Institute had as its core management concepts, programming methodology, computing systems architecture, applications of formal methods, project management and software engineering. Courses in the traditional computer science core would be offered as electives.

The standards of quality faculty being recruited were praised as were efforts to help faculty remain "astute in the practice of software engineering" (22, p. 1). In the report the visiting committee recommended the institute's need to

1. acquire faculty with a unique blend of academic and industrial experience and management,

2. require that the faculty give a minimum time commitment to the institute, and

3. evaluate the teaching load of 2 courses/semester for full-time faculty since the additional demand of developing a new curriculum was extremely time consuming (22, p. 1-2).

According to the institute self-study, the governance of the Wang Institute included majority of the standards of the Association of American University Professors with the exception of sabbatical leave and tenure. The committee did note the multi-faceted position Wang held as President, Chairman of the Board and Chief Executive Officer of the Institute which was adequate for the infant institute, but a full-time president would be necessary for the long term. The role of the IAC was clear in the self-study according to
the visiting committee, but the role of the NAAC needed further clarification. The committee suggested authority of curriculum development should be given to the faculty while interfacing between academic and industrial areas with the NAAC. The visiting committee recommended "as the institute develops, particular attention should be given to the development of board membership and definition of its broadened responsibilities" (22, p. 5). The visiting committee further warned, as the institute developed, that there might be the danger of overlap between the NAAC, IAC and trustees. The committee further emphasized the need for a permanent dean and associate dean and the stability and consistency that these permanent position would lend.

The visiting committee credited Dean Wardle's "leadership and persistence in the development of this presentation [for degree-granting authority]" (22, p. 5). The importance of the mission, direction and progress of the Wang Institute was assured but the degree-granting authority was premature. Anticipating these problems, Wardle made the guidelines clear for the deans and faculty searches. In her "Response to the Report of the Visiting Committee to the Wang Institute of Graduate Studies (October, 1980)", Wardle addressed every issue expressed by the visiting committee and guaranteed the change of administrative roles as necessary. By this time Bouhana and Martin joined the staff as full-time faculty members and became active in the
development of the curriculum and institute policies. The response was efficacious enough to schedule a degree-granting authority meeting on October 28, 1980.

Those present at the hearing representing Wang Institute were Dean Caroline Wardle, faculty members Nancy Martin and James Bouhana, and Vice President for Finance and Administration, Walter Saxe. Others present speaking on behalf of the institute were Professor Thomas Cheatham of Harvard University, John William Poduska, President and Chief Executive Officer of Apollo Computer, Inc., and John Duff, President of the University of Lowell. The final decision was announced on November 21, 1980. The Wang Institute of Graduate Studies was now authorized to grant the Master’s Degree in Software Engineering. This decision made it possible to seek accreditation with the New England Association of Schools and Colleges (31, p. 3).

Reorganization

By this time, many applications for admission were received and the educational goal Wang had established was about to begin. It was indeed a time of excitement. Twenty part-time students entered the Wang Institute of Graduate Studies charter class in January, 1981.

It was obvious that the tuition of twenty part-time students would not offset the enormous expense incurred to this date, much less sustain the school on an ongoing basis.
Walter Saxe estimated beginning costs of $50,000 per student while student tuition and fees were approximately $8,000 per student (2, p. 217). Although these initial costs were high, expense was not a problem. Wang's grant was sizable and the spirit of the institute was progressive and excited about the prospects that lay ahead. As of December 31, 1980, seventeen individuals and thirty-eight businesses were recognized as founding sponsors of the Wang Institute of Graduate Studies. Even with this impressive following, the institute would eventually need more funding. This objective was a priority with members of the NAAC. In a letter to Wang from Robert Gordon, NAAC member, he stated,

> Finally what is clear to me is that the institute will need continuing support in the early years from both you, the surrounding industry, and the cadre of interested professionals who recognize the overriding importance of software. This means a continuing infusion of ideas, the latest hardware and software technology and fresh young minds. The attraction for the academic professional is a release from the legacy of the established institution with its dogmas and bureaucracy, and the chance to strive for the high goals previously mentioned by innovating in both the teaching arena as well as the research arena. This atmosphere should be fostered at the Institute and closely monitored, else the main attraction of the venture might disappear. I think the current situation has some of the elements in place, but may be lacking in research support and freedom from bureaucracy. Excellence will require both the practice of the craft, and the time for the introspection of that practice to proceed forward (10, p. 1).

The first semester served as a basis of operation upon which assessment of future growth and development could be evaluated. Students contributed their experience out of
dedication to seeing the institute succeed. The addition of
graduate assistants facilitated academic staffing. The
Distinguished Lecture Series and guest lecturers contributed
greatly to WIGS and its program.

Searching for a new dean and additional faculty for
1981-1982 proved to be a difficult task. Those meeting the
criteria for position of dean of WIGS were scarce. In light
of this, Wang decided to discontinue the search for a dean
and established an administrative team consisting of an
executive vice president and faculty chairman. Paul Guzzi,
former Massachusetts Secretary of State and Chief
Administrative Officer of the State Board of Higher
Education, was appointed to the dual position of executive
vice president of Wang Institute while serving at Vice
President for Administrative Services at Wang Labs. William
McKeeman, a former member of the NAAC was named faculty
chairman. Her sabbatical drawing to a close, Wardle
returned to Boston University with the feeling of
accomplishment since she had carried out everything she had
set out to do (2, p. 218). "Administrative coordination was
facilitated by an executive committee consisting of Nancy
Martin, William McKeeman, Walter Saxe, Paul Guzzi, and Lynn
Wonneberger. McKeeman met every week with Wang" (2, p.
220). Delegation of authority went from Wang to Paul Guzzi
to McKeeman (2, p. 220).
The responsibility of student recruitment activities fell on the shoulders of the faculty until August, 1981, when a Corporate Liaison was hired to perform this task. By July, 1982, this position was fully incorporated into the administrative framework of WIGS by reporting to the Vice President for Finance. "This reorganization resulted in more effective student recruiting planning and operations" (23, p. 20).

Beginning in August, 1981, attracting corporate support became the primary recruiting emphasis rather than responding to individual basis to inquiries (23, p. 21). In doing this, the Corporate Associate Program became the responsibility of the Corporate Liaison, in addition to familiarizing technical managers and trainers with the MSE program through verbal and written correspondence.

Beginning in July, 1982, the Vice President for Finance; the Director of Communications, Diane Osen; and the Corporate Liaison began working together as a more closely knit recruitment team. WIGS hired an additional recruitment staff member in September, 1982. "A recruitment consultant was retained to help define priority areas of attention and identify appropriate approaches to addressing them" (23, p. 21). These additions allowed a greater variety of recruiting techniques to supplement enrollment. The recruitment team, under the leadership of Diane Osen, developed publications such as a viewbook and an institute
newsletter that aided in the recruitment process. Also, the team met with students to solicit support for recruitment activities (23, p. 22).

During this time of development, the library was continually growing under the direction of librarian Robin Adams. This quickly became a job for more than one person. The students requested twenty-four hour service. Adams arranged for interlibrary loan privileges with surrounding libraries. She soon found it necessary to develop a policy handbook. A temporary space problem was alleviated with the completion of building renovations (2, p. 224).

The young Wang Institute, having proved it could execute its goals, turned to the objective of achieving accreditation of the New England Association of Schools and Colleges (NEASC). Although Barbara Adler held primary responsibility for the accreditation self-study (see appendix A for NEASC guidelines), appropriate faculty and staff gave input into the self-study document. Students were also encouraged to make comments (2, p. 224, 225).

NEASC Accreditation

The Initial Visit

Barbara Adler arranged for a NEASC visitation date in April before leaving the institute in January, 1982. Diane Osen assumed responsibility for the self-study and worked closely with the NEASC (2, p. 225).
The NEASC Visiting Committee evaluated the institute’s educational program in April, 1982. The report following the visit contained praise for several aspects of the program. Seon Cho, newly appointed WIGS Vice President for Administration, summarized their comments to the NAAC.

1. **The Quality of Faculty**

   The Committee noted that students benefit from "extensive, easy, frequent contact with faculty...(who) actively engage students in discussion and are very conversant with the records and progress of each student." They added that "knowledge of each student’s work by faculty is outstanding."

2. **The Quality of Learning Resources**

   According to the Committee, the Library and Computer Center are "outstanding" learning resources for MSE students. Library services are "well-managed by professional...personal needs and interests are met promptly and efficiently." Similarly, the Computer Center is "well-staffed to served users and the attitude of personnel is to assist students."

3. **Quality of the National Academic Advisory Committee**

   The committee asserted that the institute has been well-served by the academic and industrial experts who comprise the NAAC, noting that the MSE program has been "shaped by extensive consultation with recognized national leaders in computing." The NAAC is "an active force...and a means of guiding major decisions and planning assumptions." Moreover, they said, the NAAC is a "potent source of ideas for the institute clearly separate from interests of Wang Laboratories." (4, p. 2)

The Visiting Committee also made several recommendations:

1. expansion of the Board of Trustees to include additional persons who are knowledgeable about computing, who are part of the regional higher
education community, and who understand long-term personnel demands of the computing industry;

2. shared administrative leadership has hampered efforts in recruiting, fund raising and internal assignments of duties;

3. the institute needs to be viewed as an independent organization...to promote fund raising and recruiting efforts; and

4. student recruiting and placement practices should be strengthened. (4, p. 3)

The institute staff wasted no time in responding to these problems. In July, 1982, the recruitment team was activated along with a fund raising campaign. The administrative structure was reorganized during that summer. In August, the Board of Trustees elected Edmund Cranch, then President of Worchester Polytechnic Institute, and Paul Guzzi as board members. Every effort was made "to emphasize the independence of the institute through public relations and publications" (4, p. 3).

On September 20, 1982, the Commission for Higher Education of the NEASC voted unanimously to grant accreditation candidacy status to the Wang Institute. They were now ready to pursue full accreditation status.

Occurring parallel to the accreditation activities, the first graduating class of WIGS proudly received MSE degrees. On Sunday, August 8, 1982, five men received the first degrees conferred by WIGS. Harvard President, Derek Bok, addressed the graduates, welcoming Wang Institute into the family of state colleges (5, p. 2). Wang stated, "When we
founded this school we created a graduate curriculum to satisfy the demands of a rapidly growing and ever changing industry. This first commencement reaffirms our commitment to this goal" (5, p. 2).

In September, 1982, eighteen new students were admitted. (See Appendix C) Twenty students returned to continue studies making the total enrolled thirty-eight. With these numbers it was obvious to WIGS administration and faculty that additional instructional staff had to be acquired soon. Richard Fairley and Richard Lauer joined the faculty at WIGS in January, 1983. Fairley was a member of the NAAC at the time of his appointment and had been a driving force in the MSE core curriculum.

The Second Visit

The accreditation process continued. The faculty and staff prepared for the second Visiting Committee of the NEASC in April, 1983.

The Visiting Committee arrived at WIGS on April 17, 1983, to find Wang, trustees, NAAC members, faculty, staff and students ready to meet with its members. After three days of intensive study, the NEASC Visiting Committee cited the strengths in the activity and commitment of the founder, sense of educational creativity, positive progress towards fulfilling its purpose, dedication of the faculty, openness of communication and strong sense of working together,
excellent support staff, high standards, exceptional physical facilities and soundness of finances (20, p. 9, 10).

Concerns defined by the Visiting Committee included the challenge of student recruitment, difficulty of faculty recruitment, non-existent multi-year plan, dependence on one source of funding and "faculty member's research is rewarded only as it relates to teaching excellence" (20, p. 10). The Committee recommended addressing the implications of a majority student population of part-time students, "a proposed process to select a President for Wang Institute," expanding library holdings, reassigning remaining administrative responsibilities held by the faculty, developing a multi-year plan and continued broadening of the composition of the Board of Trustees (20, p. 11). Suggestions included development of an expanded fund-raising plan, consideration of revolving admissions, encouragement of faculty interaction with industry, development of an endowment spending policy (20, p. 11).

The personnel at Wang Institute went to work immediately to try to rectify the problems, thus expediting full accreditation certification. The institute staff felt accreditation would help student recruitment, especially from corporations that offered scholarships to their employees (16, p. 2).
In February of 1983, WIGS made a significant change to student entrance requirements. Instead of requiring two years of work experience, software engineers who had approximately one year of full-time software development experience could be admitted to the program. Part-time students could enroll in only one course per semester if they chose, full-time students had the option of completing the program in three or four semesters, and GRE scores were required from applicants (34, p. 40). These modifications were made in order to enable more software engineers to enroll at WIGS.

According to minutes of the NAAC, the faculty was concerned about the lack of faculty professional development having an effect on recruiting additional faculty members. It seems that faculty time dedicated to administrative problems cut into professional development time substantially. Placing administrative responsibility in the hands of administrative staff solved the problems and alleviated the lack of professional development situation (16, p. 1, 2).

Addition of a New Program

In May of 1983, WIGS established a fellowship program designed to support a year of full-time post-doctoral academic research in any area of East Asian studies in the humanities and social sciences. This Chinese Studies
Program was added as an additional dimension to the mission of WIGS (3, p. 1). "The primary function of the program [was] to advance scholarship, foster quality research, and enhance scholarly communication in the multidisciplinary field of Chinese Studies through fellowship programs" (3, p. 1). A separate advisory committee was established for this purpose. The Wang Institute Chinese Studies Advisory Committee consisted of internationally recognized Chinese Studies scholars Samuel C. Chu, Professor of History, Ohio State University; John K. Fairbank, Francis Lee Higginson Professor of History, Emeritus, Harvard University; Michael Ying-mao Kau, professor of Political Science, Brown University; and C. Martin Wilbur, George Sansom Professor of Chinese History, Emeritus, Columbia University (3, p. 13).

Competition for fellowships of up to $25,000 was announced in October, 1983.

During the June 10, 1983, meeting, the NAAC reassessed its role over the last four years and the future. "During the last four years, the committee has been involved with academic and curricular matters" (16, p. 1). The new role adopted was to advise, review, and oversee after meeting with separate groups or a combination of groups on academic, administrative, students or policy matters (16, p. 1).

The second graduating class of WIGS received MSE degrees on August 7, 1983. Fourteen men, including some of the first part-time students to enroll, were formally
invested with academic hoods by faculty members McKeeman and Fairley (13, p. 1, 3).

Enrollment increased to forty-one students in September, 1983. To help alleviate the teaching load, Mark Ardis joined the faculty beginning with this semester (6, p. 2). Also, to encourage the students, the institute became authorized under Federal law to enroll non-immigrant alien students and could participate in the Exchange Visitor Program (25, p. 5). WIGS became eligible to participate in the federal Guaranteed Student Loan Program allowing MSE students who met the requirements to borrow $5,000 per year to cover educational expenses (25, p. 5). Wang made another contribution to help students by establishing a revolving student loan program to provide graduating non-company sponsored students with funds for travel and other job-related expenses (25, p. 5).

During 1983 and 1984, the faculty strengthened the curriculum evaluation process. The Faculty Chair and Curriculum Committee, consisting of full-time faculty members and student representatives, [were] responsible for curriculum evaluation" (21, p. 3). The first level evaluation process involved preparation of course notebooks following a prescribed format prepared by the instructors and evaluations prepared by the students. The second level evaluation process involved uniformity and continuity of
topics across courses (21, p. 3). This effort was made in response to a recommendation made by the Visiting Committee in relation to curriculum integration.

Under the direction of Nancy Martin, the Wang Institute Software Environment (WINSE) was established. This grew from a definition study performed by students Carl Werowinski and Eric Rustici conducted as part of the Software Engineering course during the spring of 1982. WINSE was established to "enable MSE students to find appropriate software tools, and to learn how to use them quickly and easily," according to Daniel Liggett, software engineer, who served as administrator for WINSE and who was responsible for developing the new service (24, p. 6). The magnitude of this effort became clearer by the fall of 1983. WINSE benefited the students by providing "documentation for every software package in the environment, including tutorials which explain[ed] the uses of each package and sample terminal sessions and examples" (24, p. 6). Students, faculty and staff were invited to make new software recommendations to the Environment Board composed of Martin; Liggett; Susan Gerhart, professor of information technology; Seon Cho; and Rae Burns, graduate assistant. The board was responsible for acceptance of only the highest quality software into the environment and for preparing a tutorial for each package (24, p. 6).
"On December 21, 1983, the institute's trustees voted to initiate a search for the selection and appointment of a full-time President" (21, p. 1). The Executive Committee was authorized as the search committee to coordinate and oversee the recruitment and selection process. They concluded the primary qualification of the person selected should include "substantial experience in a senior administrative position" (21, p. 1). The President should also be an articulate leader, understanding and supportive of the role of the institute, and possess leadership qualities (21, p. 1).

In the December 21, 1983, meeting, the Trustees voted to add four members to its board. They were Rev. J. Donald Monan, President, Boston College; Kenneth Ryder, President, Northeastern University; Richard Hill, Former Chairman of the Board, Bank of Boston and Chairman, Dartmouth Board of Trustees; and William Hogan, President, University of Lowell. Each accepted the prestigious appointment and actively participated in the activities of the Board (21, p. 2).

In 1984, several events affected the future of WIGS. Those events include the appointment of the second president of WIGS and achieving NEASC accreditation.

The search for president proceeded with the deadline for applications and nominations extending until March 30, 1984. From ninety-eight applications and seventeen
nominations, the committee selected twenty-two semifinalists (21, p. 1). Three candidates were invited to WIGS for interviews, then two finalists were invited for a second set of interviews. Finally the committee "recommended to the Trustees that Edmund T. Cranch be appointed President" (21, p. 1). The appointment of Cranch was accepted by the Trustees, however, Cranch would not assume his responsibilities as full-time president until July, 1, 1985.

In reply to a recommendation of the NEASC Visiting Committee, the Long Range Planning Committee of WIGS developed a five-year plan as a guide to the future development of the school. This plan outlined the direction and priorities for the next five years, 1984-85 through 1989-90 (21, p. 3, 4).

WIGS was initially dependent on tuition income or resources of either Wang Laboratories or the Wang family. The commitment of financial stability by the Wang family to WIGS remained its foundation of fiscal structure during the formative years. Realizing this could not be the primary source of funding forever, steps were made to develop other resources.

1. The institute established a senior post of Vice-President for Development.

2. Potential sources of gift support were reviewed and funding objectives and procedures were identified.
3. Trustees set a target of $500,000 in gifts from new sources as a guide for fundraising efforts in 1984.

4. During fall 1983, and spring 1984, over 200 grant requests for support were made to various corporations seeking funds in support of students and general operations.

5. The number of non-Wang Laboratories and non-Wang family donors rose to sixty-three in fiscal year 1984 compared to twenty in fiscal year 1983.

6. Efforts were under way to establish an alumni association and an alumni fund.

7. In April, 1984, the Trustees appointed eight of their number to serve as the Development Committee Board (21, p. 8).

Successful faculty recruitment efforts increased full-time faculty from six members in April, 1983, to nine members in September, 1984. Three members were added to adjunct faculty, available to teach elective courses on an as-needed basis (21, p. 9). Priorities were given to retention of faculty and continued recruitment to keep the student teacher ratio at 1 to 5 or 1 to 6. Long range plans included expanding the faculty size from twelve to fifteen full-time members by 1990.

In order to allow more time for professional development, the teaching load was reduced to one course per semester. This allowed faculty members to allot about half of their time to teaching and half of their time to professional development. Professional development activities included basic research, development of software packages, involvement in professional societies, and
writing, editing and reviewing of scholarly works (23, p. 10).

On August 13, 1984, MSE degrees were conferred on fifteen graduates, including ten men and five women, the first women graduates from WIGS. Evelyn F. Murphy, State Secretary of Economic Affairs delivered the commencement address praising Wang on his farsightedness of providing such a model institute (29, p. 34).

Enrollment for fall, 1984, was at an all time high with fifty-eight students. There were thirty-three new matriculants, compared to nineteen the previous year. Eighteen were part-time and fifteen were full-time students. (See Appendix C)

By October, 1984, many of the challenges by the NEASC Visiting Committee had been tackled by WIGS. They were ready to request reconsideration of accreditation. Wang forwarded a report outlining the measures taken to satisfy the recommendations and suggestions made by the Visiting Committee. As a direct result, WIGS was awarded initial accreditation status on December 7, 1984 (1, p. 7). Accreditation was retroactive to April, 1983.

The New Administration

Nancy Martin, founding member of the faculty, left WIGS in the summer of 1985. "More than any other individual she had been responsible for the high standards which were
established as requirements for admission and which had applied in the measure of scholastic performance" (26, p. 5). Among her accomplishments at the institute were creating the framework of the Summer Institute in Computer Science, creating and directing the Corporate Associates Program, establishing WINSE and the Product Release Board which approved student products prior to their release (26, p. 5).

President Edmund T. Cranch began his leadership role of WIGS on July 1, 1985. On Friday, October 11, 1985, Cranch was inaugurated. This event-filled day found the institute having graduated fifty-one students in four graduating classes, with sixty-two students currently attending WIGS. The day’s events included a welcome given by Trustee Paul Guzzi, addresses and panel discussions about software engineering and Chinese studies in addition to the gala inauguration itself (12).

In 1985 plans were made to expand the current facility to facilitate about seventy students and the staff and faculty to accommodate this goal. During 1985 enrollment had reached the maximum number the current facility could handle. The Institute Planning Committee found the expansion of the current facility the most economically feasible plan with an additional building adding approximately 35,000 square feet of space and recommended
this plan to the Board of Trustees. The Trustees approved and the necessary arrangements were made to begin building (19, p. 1). Building commenced in 1986 and was completed in 1987.

The Beginning of the End

On August 10, 1986, WIGS proudly graduated thirty students, the largest class in its short history, at its fifth commencement ceremony. The fall semester of 1986 brought twenty-six new students in addition to thirty-five returning students. (See Appendix C) Competition for enrollment was higher than previous years (18, p. 5). More full-time students including six foreign students constituted the entering and returning student population (18, p. 5). As the sequence of events unfolded in the months that followed, this proved to be the last entering class of WIGS.

Late in February, 1987, the announcement was made that Wang Institute would merge with Boston University. This announcement was made necessary when "Doctor Wang, in terms of his and his family's philanthropy, decided to be a catalyst for new types of things," according to Wang Institute Trustee and Wang Laboratories Senior Vice-President Paul Guzzi (28, p. 1). This announcement in form of a memorandum to faculty, staff, students and alumni was indeed a shock. The memorandum explained the reasons
underlying the merger lay in the conclusion of Wang, after spending approximately $20 million in support of Wang Institute, that the philanthropy of the Wang Family and Wang Laboratories should be directed to endeavors which are more broad-based than day-to-day operational support of a specialized institute (11, p. 1).

In January, 1987, a recommendation was made to the Board of Trustees of WIGS to merge with another academic institution. "On January 28, 1987 the Trustees voted to adopt this recommendation and instructed their Executive Committee to initiate detailed negotiations to select a merger partner and to determine the guidelines, content, and schedule for a merger" (11, p. 1). "Boston University emerged as the most suitable merger partner" (11, p. 1). As part of the agreement the Tyngsboro campus "will retain its unique identity as the 'Wang Institute of Boston University'" (11, p. 1). The software engineering was phased out, but the Distinguished Lecture Series, Corporate Associates Program and Summer Institute would be continued (11, p. 1).

On March 31, 1987, the WIGS Board of Trustees resigned and the Boston University Board of Trustees were installed in order for WIGS to be able to grant degrees in August, 1987 (9). After working out the details of the merger, Boston University took on the responsibility of payroll for the faculty and staff. Some of the staff were retained by
Boston University, but majority of the administrators, staff and faculty knew their days at WIGS were numbered.

On August 9, 1987, forty students graduated from Wang Institute. These were the last recipients of the Master of Software Engineering degree from WIGS. This was a happy moment in the lives of the graduates, but a sad moment in the short history of this landmark institution of higher learning.
CHAPTER BIBLIOGRAPHY


11. Guzzi, Paul, and William Pechilis, "Merger with Boston University and Phasing-out of the MSE program," memorandum to faculty, staff, students, and


Studies, Tyngsboro, Massachusetts, October 2, 1984.


34. "Wang Institute Makes Changes in MSE Program."


CHAPTER III

A LOOK AT VARIOUS ASPECTS OF WANG INSTITUTE

Policies of the Institute

The Board of Trustees, having ultimate responsibility for the governance of the Institute, adopted and approved all policies relating to the operation of Wang Institute. The President assisted in policy formulation and communication through the chain of command of the administration. The President was assisted by the Executive Committee for the School of Information Technology, composed of the Vice President for Administration, the Vice President for Finance, and two faculty members. The regular report to the president consisted of the minutes of the meetings of the Executive Committee (30, p. 8). The duty of the NAAC was to act in an advisory capacity. According to Robert L. Gordon, member of the NAAC since its early stages in 1979, most of the recommendations made by the NAAC were made with respect to course offerings and content, review of accreditation material, examination of entrance requirements and several faculty policy issues (16). Figure 1 exhibits the delegation of powers and responsibilities of the administration of the Wang Institute.
Figure 1. Delegation of Powers and Responsibilities
According to institute memoranda, minutes of meetings of the administration, trustees, the NAAC, faculty and support staff, a policy was not created until a need for that policy existed. The young academic institution went through the typical growing pains that continue to plague even the oldest of educational environments. As the institute grew in administrative and support staff, faculty, and student population, policies were created governing all aspects of the school. In the minutes of the NAAC meeting of March 17, 1983, Wang described the policy development philosophy at the institute stating "certain recommendations from the faculty [came] to Wang and he [brought] them to the attention of the Trustees" (22, p. 4). Trustees weighed the voice of the faculty heavily as they did not want to be detrimental, especially on issues where faculty support was unanimous (22, p. 4). In 1985, while the institute was becoming more stabilized, both faculty and administration formulated policy handbooks (23, p. 1).

The faculty played an important role in formulation of academic policies and governance procedures of the school while acting as advisors to the various administrative departments. "Faculty govern[ed] themselves as a Committee of the Whole, apportioning responsibilities among themselves, and participate[d] in weekly faculty meetings" (30, p. 8).
"The Wang Institute of Graduate Studies School of Information Technology Student Handbook" was the chief policy guidebook of the students. Student items of academic policy included academic policy admission requirements, evaluation procedures for admission, conditional admittance, transfer of credit and the usual cadre for an academic institution. Also included in academic policies listed in the student handbook were limits on course enrollment, results of incomplete course work, course audit, drop and add procedures, student leave of absence, attendance and grading. Course enrollment limitations were set by the instructor in consultation with the Faculty Chair. Policy governing attendance, rules of conduct at Wang Institute, use of institute property, and course evaluations were added to the 1985-86 student handbook. The 1986-87 student handbook stated new policies regarding student absence due to religious beliefs and make-up classes due to institute cancellation.

The uniqueness of the institute required there were also policies addressing use of software, use of computer facilities, twenty-four hour library access, and alumni computing privileges. The Product Release Board controlled distribution of software and tools developed at Wang Institute.

Policies governing the faculty included a rigorous evaluation process. This involved student course
evaluations, a self-evaluation report based on the criteria which had been established for annual review and made available to the entire faculty, an open forum peer review with the reviewed faculty member excused, and a process for written recourse and reconsideration if necessary (30, p. 18). "The Chair of the Faculty bears primary responsibility for faculty recruitment" (26, p. 10). Upon recommendation of successful candidates, "faculty appointments [were] made by the President with initial contractual agreements of three to five year periods of employment" (26, p. 10). All faculty members were required to have at least two years of industrial software experience (30, p. 17).

Another policy governing faculty was that of course documentation leading to an internal curriculum review. In the effort of curriculum integration internal evaluation process Bouhana, Chair of the Curriculum Committee, stated in a March 18, 1983, memorandum the objectives were fourfold:

1. identification of current topic units relevant to the MSE program,
2. decide which sets of topic units should comprise specific core and elective courses,
3. eliminate redundant coverage of complete topic units in different courses, and
4. maximize integration of similar topics in different courses (4, p. 1).
### TOPIC UNIT SPECIFICATION

**DATA GLOSSARY**

<table>
<thead>
<tr>
<th>CURRENT COURSE:</th>
<th>The course name in which this topic appears.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DURATION:</td>
<td>The number of lectures (Fall/Winter) used to present the topic. Fractions are OK.</td>
</tr>
<tr>
<td>SEQUENCE:</td>
<td>The lecture number(s) in which the topic is discussed. If this is not known exactly, give an estimate if it is meaningful to do so. There are 26 lectures in each Fall and Winter semester.</td>
</tr>
<tr>
<td>HISTORY:</td>
<td>The courses and semesters (F/W/S) and years in which the topic has been taught. Also indicate any modifications that may have been made to the topic unit.</td>
</tr>
<tr>
<td>PREDECESSORS:</td>
<td>Suggested prerequisite topics. If the topic is free-standing, write N/A.</td>
</tr>
<tr>
<td>SUCCESSORS:</td>
<td>Suggested successor topics. If the topic is free-standing, write N/A.</td>
</tr>
<tr>
<td>OBJECTIVE:</td>
<td>The goal of the topic with respect to a specific course or to the curriculum in general. Why the topic is pedagogically significant.</td>
</tr>
<tr>
<td>SUBTOPICS:</td>
<td>A list of more atomic topics comprising the main topic.</td>
</tr>
<tr>
<td>NAME:</td>
<td>Your name.</td>
</tr>
<tr>
<td>DATE:</td>
<td>Today's date.</td>
</tr>
</tbody>
</table>

(4)

Figure 2. Topic Unit Specification.
Each course was divided into no more than ten topic units. The preparer filled out a topic unit specification for each topic identified. Figure 2 shows the information required with an explanation of each item.

In an April 15, 1983, memorandum Bouhana described the efforts of the faculty in developing and refining of the Master of Software Engineering may be characterized as planning, preparation, documentation and review. The planning and preparation phases were typical in course development. The documentation phase included preparing course notebooks for every teaching of a core, project or elective course. These course notebooks were placed on reserve in the library for reference by students, faculty, and visitors interested in a detailed perspective of the curriculum. The review process involved both an internal review to "appraise the faculty of the design and content of courses" and an external review by the NAAC (5, p. 2).

Curricular Philosophy

The Master of Software Engineering Degree is the only degree ever offered at the Wang Institute. It was a rigorous program in software engineering that involved integration of technical and managerial skills with the goal of maintaining academic and industrial standards. "Software engineering integrate[d] the technical skills, professional discipline and managerial ability needed to design,
implement and maintain reliable and cost effective software systems that meet the requirements of the user" (38, p. 5).
The program offered at the institute was "designed to help students develop a solid understanding of formal methods and practical techniques of software engineering" (26, p. 9).

Software engineering was defined as "the technological discipline concerned with systematic production and maintenance of software products that are developed and modified on time and within cost estimates" (15, p. 1). Software products were classified as having multiple users and often multiple developers and maintainers (15, p. 1). Primary goals of software engineering were to "improve the quality of software products and to increase the productivity and job satisfaction of software engineers" (15, p. 1). Technical skill, managerial control and good communication skills were crucial to the software engineer.

Engineering principles such as project planning, project management, systematic analysis, methodical design, meticulous fabrication, validation, and ongoing maintenance were fundamental to the software engineer. The concept of software engineering combined these engineering principles with computer science, management science, and economics.

The fundamental philosophy of the program is the concept of professional practitioner. Students learned the science and art of software production using computer written exercises, projects and use and evaluation of
analytic and automated tools (38, p. 5). "The curriculum and its delivery were structured to enhance the student's ability to create, implement, and manage a software development project" (14, p. 9).

The program was originally designed by the NAAC and the members constantly reassessed documentation on courses both core and electives and the topics contained within each course as was evident by minutes of their meetings. A software curriculum recommendation prepared for the IEEE Computer Society served the initial basis for the program (26, p. 9). The initial curriculum was oriented toward meeting the needs of those who develop software and those who manage software development as recommended by the NAAC, approved by the Board of Trustees and implemented by the faculty. A constraint placed upon the program was that it was not to duplicate existing educational programs in the area.

The curriculum consisted of eleven three-credit-hour courses. The term of each course was a semester. The eleven courses included six core courses, two required project courses and three electives. Two of the required courses covered management material while four covered software and systems topics. The required core courses were Formal Methods, Programming Methods, Management Concepts, Computing Systems Architecture or Operating Systems,
Software Project Management, and Software Engineering Methods. The structure of the Wang Institute Master of Software Engineering degree program is shown in Figure 3. Figure 3 shows the prerequisite structure for the program while Table I shows suggested programs of study for full-time and part-time students. Course objectives, descriptions and outlines of major and minor topics are included in Appendix B.

Elective courses provided an opportunity for students to develop additional skills in areas of software engineering, computer science and technical management. Elective courses were offered according to faculty availability and student interest. Typical electives included topics in management systems, database management systems, programming languages, translator implementation, system design algorithms, expert systems, user interfaces, workstation design and graphics, computer networks, programming methodology, computing systems architecture, validation and design. Table II illustrates the variety of elective courses taught at Wang Institute and the years each was taught.

The culmination of the program were two project courses (six credit-hours) that made up the equivalent of a master's thesis in traditional master's programs. "The project courses emphasize[d] team techniques, communication skills, planning, reporting, reviewing and documentation"
Figure 3. Structure of the Wang Institute Master of Software Engineering Degree Program including pre-requisite structure.
### TABLE I

**PROGRAMS OF STUDY OF THE WANG INSTITUTE MASTER OF SOFTWARE ENGINEERING DEGREE PROGRAM**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Full-Time 4 Courses</th>
<th>Full-Time 3 Courses</th>
<th>Part-Time 2 Courses</th>
<th>Part-Time 1 Course</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fall</strong></td>
<td>FM</td>
<td>FM</td>
<td>FM</td>
<td>FM</td>
</tr>
<tr>
<td></td>
<td>PM</td>
<td>PM</td>
<td>MC</td>
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<tr>
<td></td>
<td>MC</td>
<td>Mc</td>
<td>Ar</td>
<td></td>
</tr>
<tr>
<td><strong>Winter</strong></td>
<td>PrMg</td>
<td>PrMg</td>
<td>PM</td>
<td>PM</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>Se</td>
<td>E</td>
<td></td>
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<tr>
<td></td>
<td>E</td>
<td>E</td>
<td>Pr</td>
<td></td>
</tr>
<tr>
<td><strong>Summer</strong></td>
<td>E</td>
<td>E</td>
<td>E</td>
<td></td>
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<tr>
<td></td>
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<tr>
<td></td>
<td>E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fall</strong></td>
<td>Ar</td>
<td>Ar</td>
<td>MC</td>
<td></td>
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<tr>
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<td>E</td>
<td>E</td>
<td>Pr</td>
<td></td>
</tr>
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<td><strong>Winter</strong></td>
<td>PrMg</td>
<td>PrMg</td>
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<td><strong>Summer</strong></td>
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<td><strong>Fall</strong></td>
<td>E</td>
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<td>Ar</td>
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<tr>
<td><strong>Winter</strong></td>
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<td>SE</td>
<td></td>
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</table>

**Notation**

- FM: Formal Method
- MC: Management Concepts
- PrMg: Project Management
- Pr: Project
- PM: Programming Methodology
- Ar: Architecture
- SE: Software Engineering
- E: Elective
<table>
<thead>
<tr>
<th>Course Title</th>
<th>80-</th>
<th>81-</th>
<th>82-</th>
<th>83-</th>
<th>84-</th>
<th>85-</th>
<th>86-</th>
<th>87</th>
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<tbody>
<tr>
<td>Management of Technical Organization</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Topics in Management Systems</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Operating Systems</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Database Management Systems</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Programming Languages</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Topics in Programming Methods</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Topics in Computer Systems</td>
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<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Directed Study</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Management Information Systems</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Translator Implementation</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>A Quantitative Approach to Managing &amp; Engineering Software</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
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<tr>
<td>System Design Algorithms</td>
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<td>X</td>
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<td>Validation &amp; Verification</td>
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<td>X</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>Expert Systems (Technology)</td>
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<td>X</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>User Interfaces</td>
<td></td>
<td></td>
<td></td>
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<td>X</td>
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<tr>
<td>Godel, Escher, Bach</td>
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<td>X</td>
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<tr>
<td>Workstation Design &amp; Graphics</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td>X</td>
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<tr>
<td>Introduction to VLSI Design</td>
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<td></td>
<td></td>
<td></td>
<td>X</td>
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<tr>
<td>Principles of Computer Networks</td>
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<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Programming Environments</td>
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TABLE II CONTINUED

<table>
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<tr>
<td>User Interface Design,</td>
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<td>Implementation &amp; Evaluation</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Computing Systems Architecture</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>X</td>
</tr>
</tbody>
</table>

(38, p. 13). The projects included activities such as specification, design, implementation, testing and modification of system software (38, p. 13). Major aspects in the project courses were team work and use of modern tools and techniques to analyze, specify, design, implement, test, integrate, and modify software products.

Through the evolutionary process of refinement, the contents of the individual courses had changed; however, the curriculum structure remained intact (30, p. 9). Each topic area covered theoretical and practical techniques while the students had the opportunity of evaluating tools of software engineering.

Graduates of the Master of Software Engineering program should:

1. have gained an understanding of and experience with a variety of tools and techniques applicable to software development and maintenance tasks,
2. possess the necessary theoretical foundations to assess new developments in software engineering and apply them to particular situations,

3. be able to plan, organize, supervise, and exert technical leadership of software projects involving three to seven programmers, and

4. move quickly into positions of increasing technical and managerial responsibility (30, p. 10, 11).

The regular faculty rotated teaching the core courses. In order to maintain consistency much effort was placed on consistent documentation of the core offerings. According to William McKeeman, Professor at WIGS with longest tenure, teaching methodologies included traditional lecture, student interaction, and methods involving mini projects where intensive use of machines was used to acquire skills (20). Richard Fairley added to this inventory small class interaction, student team work and in those courses that involved traditional lecture the use of demonstrations and hands-on interaction with software (13). Classes were deliberately kept small so that interaction could take place at a highly manageable level. The teachers worked as counselors from the outside to help the students handle stress according to McKeeman. The project courses were kept to a maximum of six students and used small software applications of real life customers from the surrounding community. The products coming out of the projects classes had to be approved by the Faculty Product Release Board. Approved products were patented by the institute for use in
the public domain (18). McKeeman was quoted as saying, "We [were] interested, not so much in inventing bridges, as we [were] in building bridges you would not mind driving across" (18).

The program was described as having a good mix of the practical and academic aspects of software engineering. Tony Bolt, a foreign student from Australia, stated, "It [the curriculum was] well thought out, showing signs of maturity and continue[d] to change to make improvements" (2). Students Richard Rosenthal, Mark Ellison, and Lori Menard concur that the program is rigorous and time-consuming. They equated the amount of work involved to that of a physician's residency stating they often worked twenty-hour shifts to meet the deadlines for the deliverables or assignments for many of the courses. There was an "air of extreme professionalism" with the program (29, p. 11, 21). Wolfgang Krull, a 1983 graduate of Wang Institute, said in talking of the program, "They put you to the limit [at the Wang Institute]" (39). Emphasis of team work was so strong Robert Halsam, a WIGS graduate of 1983 describes, "In my first year, there were three or four of us about to take a final. The professor walked in and told us to prepare the answers as a group. We worked until noon, went out to lunch and came back at one o'clock to present the group answers" (18).
In a lengthy survey of the alumni of the Wang Institute of the 1982, 1983, and 1984 graduates performed in late 1984 by administrative staff, twenty-seven of the thirty-four graduates by that date responded. The consensus of the group to the intensiveness of the Master of Software Engineering program was that it was about right. They appreciated the low student-teacher ratio, sometimes 6 to 1 or 5 to 1, the contact with the faculty, "exploring and understanding with other students and the faculty," and the selection of courses (34). The alumni were in agreement that the elective course offerings were satisfactory. When polled on the most useful course or topics studies at Wang Institute, Programming Methodology ranked first, Software Engineering ranked second, Formal Methods third, Project Management and Management Concepts were tied for fourth position (34).

The Curriculum Committee was organized to "establish the pre- and post-conditions for each course; help specify the units which comprise each course; help faculty determine the internal content of the units and evaluate the pre- and post-conditions for the Master of Software Engineering program" (38, p. 16). This committee consisted of the Faculty Chair, the faculty, and one full-time student representative and one part-time student representative. The student representatives served as liaisons to the other students (38, p. 9).
Each candidate for graduation had to

1. satisfactorily complete eleven courses as outlined in the curriculum,
2. complete eight of the eleven courses in residence at the School of Information Technology,
3. complete all requirements for the degree within five years of the date of first registration, and
4. earn a minimum cumulative grade point average of 80 (17, p. 8).

A student's grade point average was defined as "the average of points earned by the student in those courses completed at Wang Institute. 'I' grades were not computed in the grade point average" (17, p. 8). The high academic standards were further reflected by the minimum course grade for which credit was awarded was 75. Students were put on probation if the cumulative grade fell below 80 (17, p. 8).

The grading policy at Wang Institute was based on a non-competitive concept. Work of each student was evaluated and graded independently of other students. Students were highly encouraged to form study groups. It was this high level of collegiality that helped make the program successful according to the survey. Student progress was reviewed by the faculty each semester. Students showing insufficient progress were suspended or dismissed from the Institute (17, p. 9).

The goals at the Wang Institute were to develop software engineering skills in the students, to evolve an
intellectual structure for the body of software engineering material, to develop and test pedagogical materials, and to make those materials available to those parties who are interested (14, p. 17). According to Robert L. Gordon, Director of Workstation Development and Marketing at Prime Computer Inc. and member of the NAAC, "The most important accomplishments [of the Wang Institute] were achieving a national focus on software engineering, the refinement of a model curriculum for a masters program in software engineering, and the development of a professional attitude among the graduates by training mature students with prior industrial experience" (16).

There are few schools in the United States that grant masters' degrees in software engineering. Seattle University has had this degree offering since 1979, and it remains a strong program. According to Mary Ann Ransom, secretary of the Department of Software Engineering at Seattle University, approximately fifty to seventy-five applicants are accepted to this program in the fall each year (27). "Several other schools, including Carnegie-Mellon University, the University of Maryland, and Texas Christian University offer programs of study in software engineering within the constraints of traditional computer science departments" (14, p. 13).
A Look at the Students

Students attending Wang Institute were extremely dedicated to the profession of software engineering. The stringent admission requirements included:

1. A Bachelor's degree from an accredited institution of higher learning with a minimum grade point average of 3.0 (based on A = 4.0),

2. At least one year of full-time software development work experience. Participation in group efforts in an industrial setting is important, and a variety of activities and projects is preferred.

Three letters of recommendation from professionals familiar with the software development work of the candidate must be submitted. In addition, letters from current or former professors may be submitted.

3. Specific expertise in computer science and mathematics including:

- Programming in a block-structured high-level language (e.g., Pascal, PL/I, C, Ada);
- Assembly language programming, including macros;
- Data structures (lists, stacks, queues, trees, etc.); and
- Discrete mathematics (e.g., set theory, logic, graph theory, combinatorics).

Expertise in these areas may have been gained through academic course work or self-education. Usually, successful completion of the following Computer Science Department courses provided the required subject area expertise: "Pascal for Programmers," "Assembly Language Programming," "Data Structures" and "Discrete Mathematics."

4. Submission of a three to four page essay on a software development or maintenance project in which the applicant has participated, an expository survey of a technical subject, or a
The report or essay must be authored solely by the applicant. Each applicant was also asked to submit a one or two paragraph statement of objectives and expectations in enrolling in the MSE program.

5. English language communication skills.

6. GRE General Aptitude Test scores (verbal, quantitative, and analytical) must be submitted (38, p. 6).

Strong candidates were invited to the institute for a formal interview to "assess the candidate’s work experience, determine the candidate’s knowledge of subject prerequisites, assess the candidate’s oral communication skills and to allow the candidate an opportunity to learn more about the degree program" (38, p. 6).

According to Phyllis DiCostanzo, Recruitment Director, out of thousands who inquired each year, approximately thirty students were admitted each year. (See Appendix C) The admissions committee, consisting of three faculty members, hand-picked the group of students. In addition to the oral interview, applicants were tested on mathematics and computer science skills (8).

Students who attended WIGS were highly motivated and mature. They brought professional expertise which they shared with other students. One of the calling cards of the institute was a rich intellectual environment that was brought about not only by the faculty, but by the sharing of knowledge among the students. The team concept produced an
environment where the students had to share in order to accomplish projects they were assigned. It was not unusual to see groups of students going to lunch together to discuss ideas and industry trends. "Students here are very unusual. They want to be the best they can be," stated Wolfgang Krull, alumni of WIGS (39).

Students taking three or four courses were classified as full-time and were not expected to be involved in any work activities outside of the institute. Students taking fewer than three courses were classified as part-time. Part-time students at WIGS were expected to obtain at least eight hours of release time per week for each class in which they were enrolled in order to attend the scheduled classes and participate in other activities on campus. Students were expected to attend a substantial majority of the workshops, colloquia, and seminars offered at the institute. These special offerings were scheduled to accommodate part-time students as much as possible. All students were expected to be familiar with the various software systems used in the courses, as well as other tools such as editors and electronic mail systems used at the institute. Students had to dedicate adequate time to learn the various software systems and develop a level of proficiency sufficient to accomplish the task at hand.

While most activities required that the student be on campus, some work could be done away from school using a
dial-in computer terminal or microcomputer equipped with a modem. Part-time students were discouraged from working full time, not taking release time but working extra hours to compensate for time spent in class. This practice cheated the student, the student’s colleagues in team projects, the employer, and the faculty and administrative staff of the full benefit of student participation at the institute.

The responsibility of obtaining potential students was that of the Recruitment Office. This office served the dual purpose of informing the public about the existence of Wang Institute and generating inquiries about the MSE program. They were successful in that goal as thousands of inquiries were received each year. The students were actively recruited from a target pool of software professionals from all over the world. The first response to inquirers from the target pool was a letter and a student brochure. About a week later, a packet of information containing a view book, school bulletin, application, newsletter, and other information was sent to anyone making any type of inquiry to the Wang Institute, according to Phyllis DiCostanzo. All inquiries were logged in a database making up the inquiry pool. Those inquirers that were software professionals formed the target pool. The target pool came from all over
the world. Those from the target pool that made formal application became the application pool (8).

The Applications Committee screened the applications for those meeting the strict entrance criteria. Those applicants who qualified were interviewed and tested leaving the accepted applicants. Matriculants were those accepted applicants who enrolled in classes (28). The September, 1986, class had thirty-four matriculants of the thirty-nine applications accepted (1). Appendix C shows statistics for the years 1981-86.

The enrollment goal, as stipulated in the five-year plan, of forty-five part-time MSE students and twenty-five full-time students in a total class required an entering class of about thirty-five new students each September (28). A total of 167 students attended WIGS to work toward the MSE degree. Part-time students constituted the majority of students. Only forty-one percent of the total enrollment of the seven entering classes were full-time students. (See Figures 4, 5) Twenty-three percent were out-of-state matriculants. (See Figure 6) Foreign matriculants comprised eleven percent (See Figures 7, 8), while only nineteen percent were female. (See Figure 9) Twenty percent of the students already had advanced degrees. (See Figure 10) Thirty-five percent of the student population had highest degrees with a computer science major, sixteen percent had a mathematics major, seventeen percent had an engineering
Figure 4. MSE Total Class, Part vs Full-Time Students
Figure 5. MSE New Matriculants, Full-time vs Part-time
Figure 6. MSE New Matriculants, Out-of-state vs Local Matriculants
MSE APPLICANTS

FOREIGN MSE APPLICANTS

TOTAL APPLICATIONS vs FOREIGN APPLICATIONS

= Total Applications
■ = Foreign Applications

Figure 7. MSE Applicants, Foreign MSE Applicants
Figure 8. Foreign MSE Applicants, Applicants/Accepts/ Matriculants
Figure 9. MSE New Matriculants, Male vs Female
Figure 10. MSE New Matriculants, Students with Advanced Degree Prior to Attending Wang Institute
Figure 11. MSE New Matriculants, Highest Degree - Major
Figure 12. MSE New Matriculants, Grade Point Averages by Year
Figure 13. MSE Total Class, Corporately Sponsored Full-Time
Figure 14. MSE New Matriculants, Average Years of Software Work Experience.
Figure 15. MSE Total Class, Graduate Assistants
major and thirty-two percent had other majors. (See Figure 11) Overall grade point average for entering students was 3.33. (See Figure 12) Twenty-one percent of the full-time students were corporately sponsored (See Figure 13), twenty-seven percent of the total number of students were graduate assistants, while nineteen percent of the full-time students either quit jobs or took a leave of absence to attend WIGS. The number of years of experience ranged from one to twenty years, although 5.16 years was the mean. (See Figure 14) Appendix C shows actual figures for each entering class.

Several students worked as graduate assistants each year to subsidize their educational expenses. (See Figure 15) The grants for the graduate assistant were made possible through an endowment from Wang. A significant percentage of each class was returning MSE students. (See Figure 16) Not all applicants who were accepted enrolled in classes and many were rejected or withdrawn prior to selection. (See Figure 17) Table III shows summary statistics for all students who attended WIGS.

Efforts of the recruiting office appeared to be successful and on schedule for growth goals set in the five-year plan. The new matriculants heard about WIGS from a variety of sources such as the advertising in professional publications, company and WIGS forums, posters, word-of-mouth, and other advertising. (See Figure 18)
Figure 16. MSE Total Class, New vs Returning MSE Students
### TABLE III

**SUMMARY OF MATRICULATION STATISTICS**  
WANG INSTITUTE OF GRADUATE STUDIES 1981-1986

<table>
<thead>
<tr>
<th>Number Attending</th>
<th>% of Total</th>
<th>% of Full-Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total attending</td>
<td>167</td>
<td></td>
</tr>
<tr>
<td>Total number of graduates</td>
<td>121</td>
<td>72%</td>
</tr>
<tr>
<td>Total Full-Time</td>
<td>69</td>
<td>41%</td>
</tr>
<tr>
<td>Total Part-Time</td>
<td>98</td>
<td>59%</td>
</tr>
<tr>
<td>Total Out-of-State</td>
<td>38</td>
<td>23%</td>
</tr>
<tr>
<td>Total Foreign Students</td>
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<td>11%</td>
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<tr>
<td>Total Male Students</td>
<td>135</td>
<td>81%</td>
</tr>
<tr>
<td>Total Female Students</td>
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</tr>
<tr>
<td>Total Corporate Sponsored</td>
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<td>13% 30%</td>
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<tr>
<td>Total Graduate Assistants</td>
<td>35</td>
<td>21% 51%</td>
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<tr>
<td>Self-Sponsored Full-Time</td>
<td>13</td>
<td>8% 19%</td>
</tr>
<tr>
<td><strong>Highest Degree Major</strong></td>
<td></td>
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</tr>
<tr>
<td>Computer Science</td>
<td>59</td>
<td>35%</td>
</tr>
<tr>
<td>Math</td>
<td>26</td>
<td>16%</td>
</tr>
<tr>
<td>English</td>
<td>28</td>
<td>17%</td>
</tr>
<tr>
<td>Other</td>
<td>54</td>
<td>32%</td>
</tr>
<tr>
<td><strong>Overall Average Software Work Experience</strong></td>
<td>5.16 years</td>
<td></td>
</tr>
<tr>
<td>Total Students Returning</td>
<td></td>
<td></td>
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<tr>
<td>% New</td>
<td>% Total</td>
<td></td>
</tr>
<tr>
<td>School year</td>
<td></td>
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<tr>
<td>9/81</td>
<td>18 50%</td>
<td>18 50%</td>
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<tr>
<td>9/82</td>
<td>20 53%</td>
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<td>9/83</td>
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<td>9/84</td>
<td>25 43%</td>
<td>33 57%</td>
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<tr>
<td>9/85</td>
<td>47 65%</td>
<td>25 35%</td>
</tr>
<tr>
<td>9/86</td>
<td>27 44%</td>
<td>34 56%</td>
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Figure 18. New MSE Matriculants, How 1986 Matriculants First Heard About Wang Institute
Both full-time and part-time students were corporately sponsored. American Telephone & Telegraph, Banyan Systems, Bell Laboratories, Bolt, Beranek and Newman, Computervision, Data General, Data Products Corporation, Dataflow Systems Corporation, Digital Equipment Corporation, Draper Laboratories, GTE Corporation, Hewlett-Packard, Prime, Raytheon Company, Wang Laboratories, were among the corporations who fully or partially sponsored students. Even some of the foreign students were sponsored by agencies such as the Australia Department of Social Security. Of the 169 students who attended WIGS, 121 or seventy-two percent received MSE degrees.

Students came to WIGS for a variety of reasons. Susan Marie Cardwell, one of the first women to graduate from WIGS, said, "Many of us came to the institute out of frustration, believing that there had to be a better way to approach the development of software than that which is prevalent in industry ... better than that which earned the profession the epithet 'hacker'" (7, p. 48). Others came because they were blocked in position in terms of promotion, responsibility, and salary growth, before returning to school. Other reasons were the desire to obtain state-of-the-art technical skills, become a professional in their career, and obtain a supervisor/managerial role. Many were attracted by the mix of software and management skills (34).
Students not only attended classes and worked on projects, but many served as service agents to the school and/or the students by serving on various committees. The Computer Center Advisory Committee, which advised the Computer Center regarding policy and acted as a pipeline between the student body and the Computer Center management, consisted of one member from each of the faculty, library and administration, and two full-time and one part-time student. The Library Advisory Committee, composed of the librarian, one faculty representative, one full-time and one part-time representative, advised on library policies, services and special projects. The Recruitment Advisory Committee, comprised of the recruitment staff, one faculty member, and two student representatives (one full-time and one part-time) acted as advisors on recruitment of MSE students. The Student Affairs Advisory Committee, which provided a mechanism for students to express their wishes and concerns to the faculty and administration of the institute through the Student Services Office, was composed of the coordinator of student services, one faculty member and two members from the student body. Two students, the registrar, and one faculty member comprised the Student Orientation Committee which helped plan and implement the student orientations held at the beginning of each semester (38).
A majority of the graduates returned to jobs they had before they came to WIGS. The students were not allowed to recruit other students because of the corporate sponsorship commitment. Some students moved to other positions, generally in the area of software engineering. Many part-time students left their employers and went with others, according to McKeeman, due to a difference in viewpoint (20). A majority of the students moved to higher positions after completing the MSE program (34).

The Faculty

In the beginning of WIGS as the faculty members were hired, the work load was tremendous. According to McKeeman in the beginning the faculty "initially ran the place" (20). In addition to the teaching load of five courses per year, there were new course preparations, establishing a rapport with the local community with whom they would be working on student projects, planning new programs, continual committee meetings, meetings with the NAAC, and meetings with students. Initially there were no efforts toward research. Most of the faculty’s time revolved around teaching and service to the institute, students and the community (20).

The faculty membership was composed of a blend of computer science disciplines, industrial practices and management science (17, p. 5-1). The faculty were selected because they brought both academic and industrial experience
to the MSE program to enrich the educational experience of the students "through the depth and breath of the faculty's professional backgrounds" (30, p. 16). All faculty members were required to have at least two years of industrial experience (30, p. 16).

Several types of appointments formed the instructional staff. Full-time regular faculty consisted of three ranks, Assistant Professor, Associate Professor, and Professor. The selection criteria for full-time regular faculty consisted of "the appropriate terminal degree or equivalent professional experience, and must have shown promise of continuing professional development and achievement" (17, p. 5-4). Associate Professor status could be achieved after five years of academic experience and attainment of a "record of achievement sufficient to have gained recognition on and off campus from scholars or professionals in the candidate's field" (17, p. 5-4). Professor status could have been achieved after more than ten years of academic and professional experience.

Part-time regular faculty responsibilities were the same as full-time with the exception that the level of effort did not exceed three days per week during regular hours, while full-time entailed at least a four-day per week commitment. Part-time appointments were made at the ranks of Associate Professor, Associate Professor of the Practice, and Professor of the Practice. The general criteria applied
to Associate Professor of the Practice were the same as those of Associate Professor. Criteria for Professor of the Practice were the same as those of Professor (17, p. 5-6). Professors of practice taught one course per semester.

Lecturers consisted of instructors of courses who were not members of regular faculty. Often these instructors participated in the distinguished lecture series which were seminars and lectures on current topics in computer science. The title Distinguished Lecturer was used for individuals of national or international repute (17, p. 5-6).

The rank of Visiting Faculty was assigned to certain appointments made on a temporary basis in regard to persons on leave from another educational institution or industrial concern (17, p. 5-7).

As stated in the self-study for the New England Association of Schools and Colleges, "a faculty member in the School of Information Technology is first and foremost a teacher" (30, p. 16). The duties assigned to faculty consisted of responsibility for the instruction, evaluation and advising of MSE students and for curriculum and degree program development for the School of Information Technology (30, p. 16). The faculty was responsible for faculty recruitment, student admission, and assisted in recruitment of students (30, p. 16). They pursued scholarly professional activities to keep in the forefront of
developments in software engineering. Coordination among faculty members was achieved through regular meetings.

Faculty members were recruited through recommendations from resident faculty, colleagues, visiting lecturers and the NAAC, advertising in professional journals and technical publications (30, p. 16). "Faculty were selected on the basis of appropriateness of academic preparation, demonstrated excellence in teaching, previous industrial experience, and recognition among peers in their subject areas documented by external reviewers" (30, p. 16). The selection process involved the formal resume, meeting with resident faculty, and presentation of a colloquium talk to students. Faculty input and students' input through evaluations were an important aspect of the selection process. Recommendations for rank and contract length were forwarded to the Board of Trustees who made final selection and approval (30, p. 17).

Each faculty member had a contract of definite duration which was renewable upon demonstration of continuing excellence of service and through self, peer, and student review (30, p. 17). There was no tenure system at WIGS. Annual evaluations were based on "effectiveness and creative contribution in teaching, effectiveness and creative contribution in governance, and effectiveness and creative contribution in collegiality" (30, p. 17). Teaching criteria included course innovation, documentation, and
integration. Governance criteria consisted of execution an innovation of committee duties and other faculty task assignments. Collegiality components were technology transfer seminars, conference recaps, and intra-faculty information transfer and cooperation (30, p. 17).

Additional contract renewal considerations were professional development assessed through internal information and external letters of recommendation (30, p. 18). Faculty members were encouraged to experiment in the organization, design and content of courses. This was also considered in the evaluation process.

Faculty met annually as a Committee of the Whole to evaluate performances of one another. The member under evaluation was absent from the group. A statement was prepared by the group, the absent member returned, read the statement, and then was given the opportunity for reconsideration if necessary. The Chair of the Faculty forwarded the materials to the President, who acted and informed the faculty in written memo (30, p. 18).

Faculty salaries were set high, at industry equivalents (3, p. 102). Such salaries were double to triple average rates in most traditional universities (3, p. 57). McKeeman stated of his position at WIGS:

One reason we are not at Harvard is that their faculty is pressured to publish or perish. Here we concentrate on developing and teaching new material because the field of software engineering is new. And
we are convinced that by offering salaries equivalent to the best in industry, we can attract the top-rated faculty necessary to make the Institute work. Harvard would not allow that (3, p. 103).

When the MSE program was started there were no textbooks appropriate for the innovative courses. The faculty used research papers. Since then, several books were published, including some authored by faculty at WIGS. Fairley said, "Not only [were] we graduating students, but we [were] creating materials that . . . help[ed] the rest of the world. So in that sense, we [were] real trail-blazers" (31, p. 4).

Nancy Martin, former professor at WIGS, organized and taught the first offerings of three of the six core courses, the first elective offerings at WIGS, and developed a guide to project course documentation used extensively by faculty and students alike (35, p. 5). Martin left WIGS in the summer of 1985 to pursue consulting activities in her own company.

McKeeman found great satisfaction in fulfilling the unique educational mission of the school. He particularly appreciated the students who were so deeply engaged in their studies (10, p. 2). Susan Gerhart, who joined the faculty as Professor of Information Technology in 1982, stated

What interested me about teaching here [was] that part of the mission of the School of Information Technology [was] to define software engineering as well as to educate software engineers. I [was] glad to be part of an institution which recognize[d] software engineering as a discipline distinct from computer science, and
which emphasize[d] professional graduate education. (25, p. 2)

Mark Ardis, who joined the faculty in 1983 as Associate Professor in the School of Information Technology, stated of his appointment, "I [was] looking forward to having the opportunity to teach software engineering the way it really should be taught. What [was] especially exciting about the MSE curriculum [was] the integration of practical and theoretical principles of software engineering" (9, p. 2).

The faculty typically came from a mixture of education and industrial experience with a combination of skills and expertise that enhanced the MSE program. The WIGS started with a faculty of three members in its first semester and had a faculty of eleven members at its peak which was the 1986-87 school year. The following were faculty members during the peak year.

Mark Ardis, Ph. D. University of Maryland, 1980, did research in programming environments, object-oriented programming, specification and verification of programs. He joined the faculty in July, 1983.

Philip Bernstein, Ph. D. University of Toronto, 1975, specialized in implementation and theoretical aspects of database systems and transaction processing systems, particularly concurrency control, recovery, query optimization, and database system architecture. He was a faculty member since March, 1985.

John Brackett, Ph. D. Purdue University, 1963, had interest in the area of computer tools to support requirements analysis and architectural software design, with emphasis on the validation of the dynamic behavior of proposed systems. He joined the faculty in March, 1986.
Billy Claybrook, Ph. D. Southern Methodist University, 1972, performed research activities included the design and implementation of transaction management systems, as well as project management game playing. He was a member of the faculty since March, 1985.

Richard Fairley, Ph. D. University of California, Los Angeles, 1971, did research on the development of a comprehensive set of automated software tools for planning, tracking, and controlling software projects and had been a faculty member since January, 1983.

Hassan Gomaa, Ph. D. Imperial College, London University, 1976, had research interests in software design methods for real-time and distributed systems. He joined the faculty in October, 1986. Prior to this, he worked at General Electric on software architectures for computer integrated manufacturing systems and robot controllers.

David Lomet, Ph.D. University of Pennsylvania, 1969, performed research on database algorithms, access methods, concurrency and recovery, in addition to strongly typed programming languages, and RISC machine architecture. His faculty appointment began August, 1985.

William McKeeman, Ph. D. Stanford University, 1966, concentrated on research involving programming methods including testing and reviews, programming languages, especially static analysis, fast compilers and recognition algorithms. He joined the faculty in August, 1981.

Gary Perlman, Ph. D. University of California, San Diego, 1982, performed research on experimental psychology, technical communication, programmer productivity, and empirical methods in software engineering are among Perlman’s research activities. He was also involved in the development of software tools for user interfaces. He was on the faculty since October, 1984.

Sri Raghaven, Ph. D. Georgia State University, 1984, had interests in Decision Support Systems, Knowledge-Based Systems, and their application techniques to software engineering, management issues in software engineering, and applications development techniques. He joined the faculty in March 1985.
Bo Sanden, Ph.D. Royal Institute of Technology, Stockholm, 1978, concentrated on software design, especially systematic construction of real-time systems, and embedded systems with parallel processes. He joined the faculty in August, 1986. (12, p. 5-6)

The faculty came from a varied background which lent itself well to the MSE program. Each seemed to complement the other to enhance the program with the appropriate mixture of software engineering and management although a little heavy on the technology side Fairley indicated to the NAAC in 1985 (24, p. 2).

Other Programs Offered

Several programs in addition to the MSE program were offered by the Wang Institute of Graduate Studies. These programs "not only supplement[ed] the MSE course offerings, but also reflect[ed] the institute’s commitment to meet the needs of industry through education" (19, p. 8). The Distinguished Lecture Series, The Corporate Associate Program and The Summer Institute of Computer Science were innovative enhancements to the MSE programs.

The Distinguished Lecture Series

On October 21 and 22, 1981, the Wang Institute of Graduate Studies launched its maiden voyage in the Distinguished Lecture Series with approximately a hundred attendants. Speakers at this initial seminar included Michael Marcotty, Professor of Computer Science at Wayne State University, John William Poduska, President of Appollo
Comuters, Peter Freeman, Professor of Computer Science at the University of California, and Jeffrey Buzen, Vice-President of BGS Systems, Inc. Topics ranged from "What Is Software Engineering and Why Do We Need It?" to "Reusable Software Engineering" to "The Role of Entrepreneurial Management in the Computer Industry" and "Computer Performance Evaluation and Capacity Planning" (36, p. 2).

These series were made possible by a grant from the Warner & Swasey Corporation and were presented in the fall and winter semesters. The lectures addressed a wide variety of subjects related to software development. Internationally recognized experts from industry and academia such as Captain Grace Hopper, Harlan Mills, Edsger W. Dijkstra, Barry W. Boehm, David Gries, and David Lorge Parnas participated in the series. These powerful personalities along with many other noted experts in the industry drew thousands of software engineering professionals to the lectures (19, p. 8).

These Distinguished Lectures were open to the public at no charge. "In addition, colloquia which feature lectures on advanced technical topics [were] offered periodically throughout the academic year" (19, p. 8).

The Distinguished Lecture Series was one example of services offered to the community of professionals that surrounded the WIGS in addition to serving as a means to advertise the MSE program and WIGS facilities. Prior to
each lecture a multimedia presentation on the WIGS and its offerings was presented.

A Colloquium series was also offered by the institute. This series differed slightly from the Distinguished Lecture Series in that the lectures were of a more technical nature and were advertised informally (30, p. 14).

"Unlike so many other schools, the institute recognize[d] the importance of working with industry in order to achieve its educational goals" (19, p. 8).

The Corporate Associate Program

The Corporate Associate Program was "designed to strengthen ties between companies interested or involved in software development and MSE students and faculty" (19, p. 8). It was hailed as an "effective vehicle for technology transfer. . . to promote timely and frequent exchanges between Corporate Associates and faculty" (19, p. 8).

The Corporate Associate Program was initiated to foster the following objectives:

1) establish strong and mutually beneficial technical and service relations between the School of Information Technology and industry, pursuant to the community service goals of the Institute;

2) provide a bi-directional medium of communication between the School and companies for the timely transfer of existing and emerging software engineering technology and experience; and

3) increase the visibility of the professional activities and interests of faculty, thereby
enhancing the overall scope and reputation of the School and of the Institute (26, p. 28).

Corporations joined the Corporate Associate Program by paying an annual fee that provided services such as technical seminars, faculty colloquia at member sites, exchange of ideas with faculty, presentations by students whose attendance at the institute was not company-sponsored, distribution of technical reports and product release user manuals, Summer Institute in Computer Science credit, and special benefits for member-sponsored students (30, p. 14,15).

Administered by technical and administrative directors at Wang Institute, membership and services were coordinated through the Corporate Liaison office along with a technical representative from each member corporation who assisted in meeting the needs of the company (30, p. 15).

**The Summer Institute of Computer Science**

The Summer Institute of Computer Science formerly known as the Eastern Institute of Computer Science was a series of intensive, non-degree courses in computer science. This series began in the summer of 1981. Taught by highly qualified experts from academia and industry, these courses were offered during the summer months each year. The Eastern Institute was advertised in conjunction with the Western Institute which sponsors courses in cooperation with the Stanford University Computer Science Department and the University of Santa Clara Electrical Engineering and
Computer Science Department (30, p. 15). In 1984, the name was changed to the Summer Institute in Computer Science and was promoted separately.

The courses were open to all qualified computer science professionals and were highly specialized and technical in nature. Prerequisites were identified for each course and enrollment was based on a first come, first serve basis. Among the courses offered were Program and System Development, Operating Systems, and Compiler Construction (30, p. 15).

The Summer Institute brought professors to WIGS campus that were sometimes hired as faculty members later. Examples of this situation were found in the hiring of Philip Bernstein, Susan Gerhart, and Jan Madey each of whom presented courses in the Summer Institute.

Courses usually lasted for one week. The fees participants paid included access to library facilities, computing facilities, textbooks, lecture notes, and lunch. Scholarships were available to full-time faculty who taught computer-related topics in colleges and universities (32, p. 14). Courses were limited in size to allow for the maximum interaction between participants and faculty (33, p. 13).

Summer Institute students had access to the same computing facilities as MSE students. In 1987 these facilities included a DEC VAX 11/785, a DEC VAX 11/750, a
Masscomp 5500, a Wang VS-100 and a variety of personal computers connected via WangNet and Ethernet (33, p. 13). "Since 1981, more than 1,200 men and women from over 120 corporations, colleges, universities, and government agencies have attended the Summer Institute courses" (33, p. 13). With tuition set at $1,200 per course and enrollment limited from ten to seventy-five students, it is clearly evident that was a successful program and a profit making venture.

The surrounding communities were not the only ones to benefit from the Summer Institute. WIGS reaped several benefits. "Outside faculty provide[d] an educational link with other institutions. More diverse course offerings [were] possible without placing an extra burden on Wang Institute Faculty. Wang Institute visibility was enhanced by the presence of distinguished outside faculty" (26, p. 27).

Summer Institute provided a service and responded to a need that existed in the region. Many employees were unable to take formal classes for credit in a long term or summer term because of the length of time involved. Summer Institute offered them a short, intensive program lasting no longer than a week. The benefit was two-fold: "A company [could] afford to release an individual for that period of time and the individual [was] comfortable with an absence of only one week" (26, p. 27).
Chinese Studies Program

The Chinese Studies Program was initiated in 1983 as an additional dimension to the institute’s mission. It was designed to support full-time post-doctoral research on any period or area of Chinese studies in the humanities or social science. The research had to contribute significantly to the understanding of Chinese history, society, and culture (37, p. 1).

Each year a limited number of fellowships of up to $25,000 each were awarded. Eligibility requirements included a doctoral degree at the time of application, knowledge of China through academic accomplishment and proficiency in the Chinese language (37, p. 1).

Fellowships were awarded based on nominations made from applications evaluated by the Chinese Studies Advisory Committee. Nominations were based on excellence and scholarly promise with preference given to those scholars in early stages of their careers (37, p. 2).

Evaluation criteria included the professional training, academic position, experience as a teacher and scholar, and accomplishments in publications of the applicant. The Advisory Committee also considered the quality, feasibility, innovativeness, significance, and likelihood of completion of the selected research topic (37, p. 2, 3). Over thirty
of these fellowships were awarded beginning with the 1984 calendar year.

A pilot project of Fellowship in Sinology awarded fourteen Chinese scholars to conduct research in the humanities and social sciences in China in 1986 for the 1986-87 school year. This pilot project was arranged in conjunction with selected Chinese universities (37, p. 10).

As another component to advance knowledge, promote understanding, and enhance communication in Chinese Studies, WIGS sponsored two international conferences in 1986. One conference was on languages and dialects in China. The second conference was on Ancient China and Social Science Generalization (37, 11, 12).

This program, under the direction of Margaret Fung, "helped convey the mission and ideas of Wang Institute and its Chinese Studies Program to hundreds of scholars in the field, while furthering the understanding of this unique facet of the institute" (6, p. 7).
CHAPTER BIBLIOGRAPHY


27. Ransom, Mary Ann, Secretary, Department of Software Engineering Seattle University, Seattle, Washington, telephone interview with Patricia Green, (July 30, 1987).


32. Summer Institute in Computer Science, Twelve 5-Day Seminars, brochure, Wang Institute of Graduate Studies, Tyngsboro, Massachusetts, 1986.


CHAPTER IV
SUMMARY AND CONCLUSIONS

Future Planning

The announcement of the Wang Institute merger with Boston University was a shocking surprise to the staff, faculty, students and the Advisory Committee. For a time everyone involved was left with a sense of insecurity. Even Massachusetts State Chancellor of Higher Education Franklyn Jenifer expressed concern about the merger fearing Wang Institute students may not get the degrees on which they had planned (7). Degree-granting authority for the MSE degree was bestowed on the Board of Trustees for WIGS, not for Boston University.

Under the terms of the agreement, Wang Institute would phase out its MSE degree program and offer graduate courses in computer science, business administration and engineering (8). According to minutes of the students with officials representing Boston University and the Board of Trustees, WIGS faculty remained committed to finishing the academic year (6). Joseph Meng, Vice President of External Programs at Boston University, stated Boston University was "obligated to insure the completion of current degrees" (6). Boston University wanted to keep students and faculty happy
during the transition and wanted to be fair to all involved (6).

The negotiating lawyers found a technical problem with the merger. In order to confer the MSE degree, the structure had to allow some of Wang Institute to exist as a separate entity (6). Boston University assumed all WIGS academic records and payroll switched over to Boston University (6).

President of WIGS, Edmund Cranch, left WIGS on March 31, 1987, when the transfer to Boston University took place. He was optimistic stating, "Sometimes the unexpected nature of adversity ends up creating new opportunities, if you don't collapse under the weight of it and make the best of it" (4). He explained "the Wang Institute was a risky venture, because it is difficult to start such a pioneering program without the support and momentum of a larger institution" (4). The problem stricken financial state of affairs surprised Cranch and the faculty who realized the academic risk all along.

Essentially, the school had an income of $1 million with a budget of $4 million. Meng said, "The economics were not good. Because it was so highly specialized the number of students it could attract was very limited" (4).

Paul Guzzi, member of WIGS Board of Trustees, stated of the merger,
The decision to merge with Boston University represents a natural step in the Institute’s evolution. In reviewing the Institute’s future expansion, the Trustees concluded that its long-term objectives would be best achieved through consolidation with another university. Because Boston University is a well-established and respected institution, and because of its commitment to high academic standards, the Institute can continue to expand its academic horizons by affiliating itself with Boston University (10).

According to Steven Mayhew, WIGS graduate, "the MSE program did not fail" (5). It sought to investigate and teach new software development methods that might be used to deal with increasingly complex systems (5). It "succeeded in developing software engineers with these critical qualities" it takes to lead the development of complex systems (5).

According to Cranch the MSE program was successful enough to interest several other institutions in starting similar ones. "The things that we learned will be propagated at other educational institutions. We will take with us what we learned," stated Cranch (10).

The WIGS was in the process of initiating a doctorate program. The doctoral program was to have components of breadth established by course work, depth "established through seminars, directed studies, and apprenticeship," and research that demonstrates" a clear concern for the technology of software processes and products" (3). Students were to spend two years in full-time residence beyond the Master’s program. The NAAC was in process of
looking at justification, curriculum implications, faculty impact and resource requirements (2). This doctorate plan was part of a five year plan for WIGS and had undergone significant planning and discussion. These plans were simply cast aside.

The merger afforded Boston University with the benefit of an extremely usable facility, now known as Wang Institute of Boston College, at which programs can be developed and serve the needs of residents in the Merrimack Valley and Southern New Hampshire. The Summer Institute in Computer Science and the Distinguished Lecture Series will be continued. In Fall, 1987, Boston University Metropolitan College began offering "courses and programs in fields such as computer science, administration, technical writing, and marketing, as well as seminars in management and technical training" (1).

Conclusions

The Wang Institute of Graduate Studies was originated to meet a need that existed within high technology computer industry.

1. Wang officials felt they were in a more tenable position than were their counterparts in education to commence the Master of Software Engineering program as quickly as they did. Traditional education bureaucracy may
have inhibited the experimental nature of the degree offering.

Had Wang funded such a program within an existing higher education institution within the New England area, it is likely that the computing facilities available to the students would have been the same. The core curriculum may have been much different as a result of input from other departments. Success of any deviation of the MSE program as it existed is merely speculation and beyond the scope of this study.

2. Wang Institute differed from traditional institutions of higher education with programs in computer science. The emphasis at WIGS was in software engineering. The original curriculum was oriented toward meeting needs of those who develop software and those who manage software development. It incorporated software management skills, people management skills, and group dynamics with software development skills.

The program had mixed practical and academic aspects of software engineering. Students equated the program to that of residency of a physician because of its practical practice with live systems. Courses traditionally included in computer science degrees were electives in the MSE program at WIGS.

The MSE core curriculum was innovative with a spirit of cooperative effort on the part of the faculty. Electives
consisted of special interests of faculty and students.

3. The primary mistake made by WIGS was the dependency on funding from Wang. This problem was pointed out by the Visiting Committee of the New England Association of Schools. Some efforts were made to generate funding from other sources, but were met with little success. When the major source of funding was withdrawn, the only alternative was to merge with another higher learning institution such as Boston University. Other mistakes that were made in development of WIGS now seem minor in comparison.

4. Students attending WIGS were mature professionals attempting to become more professional in their status and knowledge of software engineering. They had a high degree of experience in their selected field. They could share experiences with one another which seemed to add to the intellectual level of the MSE program.

Stringent selection criteria prevented anyone but the best students from entering the program. Students were prepared for the rigor of the MSE program and seemed to perform well. Attrition rates were low. Successful completion rates were high.

5. The future of the MSE program lies in the hands of WIGS graduates and faculty. Some faculty members planned to start MSE programs at other institutions of higher learning. Many WIGS graduates will have an opportunity to share their
knowledge with their co-workers, affecting the software engineering industry in this way.

Among the major outcomes of the WIGS MSE program were achieving a national focus on software engineering, a tested prototype software engineering curriculum, and an elite group of high quality software engineers that have the potential of affecting software development of the future. The institute established a professionally oriented degree program that was targeted to experienced programmers (9).

Wang Institute of Graduate Studies no longer exists. It is too soon to evaluate the long term effects of WIGS and its MSE program. In a few years its effects on computing industry may be studied to see if significant changes in industrial practice were the result of WIGS. Will its demise lead to fewer trained software engineers? It may also be of interest to study other MSE programs to determine if the MSE program at WIGS had any affect on university curricula. Will the end of WIGS lead to dispersion and loss of expertise in teaching this unique blend of computer software technology and management?

Not a large higher education institution, and one of a short life, the Wang Institute of Graduate Studies has made its mark in the history of education.
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APPENDIX A

COMMISSION ON INSTITUTIONS OF HIGHER EDUCATION

CRITERIA FOR CANDIDACY AND ACCREDITATION
The New England Association of Schools and Colleges, Inc., is a voluntary, non-profit, self-governing organization having as its primary purpose the accreditation of educational institutions. Through its evaluation activities, which are carried out by four commissions, the Association provides public assurance about the educational quality of those schools and colleges that seek or wish to maintain membership, which is synonymous with accreditation. The Association is one of six regional accrediting bodies in the United States.

Institutions of higher learning achieve accreditation in the Association through its Commission on Institutions of Higher Education, which develops and applies criteria for the assessment of institutional effectiveness. These criteria consist of three distinct sets of measures against which institutions are evaluated. The first are the Requirements of Affiliation, which all institutions must meet. The second are the evaluative Criteria for Candidacy, which are applied to those institutions seeking candidacy for accreditation. Lastly, there are the Standards for Accreditation, against which institutions seeking to achieve or maintain accreditation are measured. In addition, affiliated institutions are expected to adhere to other policies adopted by the Commission affecting specific areas of institutional endeavor. Each of the criteria may be found on the pages following this introduction.

The Requirements of Affiliation (pp. 4-5) are largely capable of objective verification. Individually, they specify those fundamental organizational components, educational elements, and principles of disclosure that are essential to any institution which the Commission considers itself competent to assess. Taken together, the Requirements define the universe of institutions to which the Commission limits its activities.

Candidacy for accreditation is a pre-accreditation status; however, it is not accreditation. The Criteria for Candidacy (p. 5) are essentially qualitative or judgmental criteria which are designed to measure an institution's current state of educational effectiveness. In addition, the Criteria test the institution's potential to meet the Standards for Accreditation, though the achievement of candidacy does not assure eventual accreditation. Normally, a candidate institution has a maximum period of six years within which to achieve accredited status.

Like the Criteria for Candidacy, the Standards for Accreditation (pp. 6-12) are evaluative or judgmental in nature. They are twelve in number, developed to encompass the principal areas of institutional activity. By design, the Standards can be applied to the wide range of institutions capable of meeting the Requirements of Affiliation, regardless of differences in purpose, size, organization, scope or program, clientele served, support and control.
In evaluating an institution against the Standards, the Commission assesses and makes a determination about the effectiveness of the institution as a whole. The institution which meets the Standards collectively, the Commission concludes, has appropriate purposes, the resources needed to accomplish its purposes, can demonstrate that it is accomplishing its purposes, and gives reason to believe that it will continue to accomplish its purposes. While specific programs or courses may be reviewed as a part of the evaluation process, they are not accredited themselves. The Commission recognizes that some aspects of an institution are always stronger than others. Meeting the Standards does not guarantee the quality of individual programs, courses or graduates. However, serious weaknesses in a particular area may threaten the institution's accreditation.

The evaluative process by which the Commission's criteria are applied is essentially the same for candidacy and accreditation. The institution is required to conduct a self-study of its current state of development, assessing institutional compliance with Commission criteria, and to develop a report of its findings. An evaluation committee made up of faculty and administrators from accredited institutions is appointed by the Commission to review the self-study report and validate its contents through a visit to the institution. This committee then prepares a report indicating institutional compliance with the appropriate criteria. In taking action on the institution's status, the Commission considers all relevant information, including the institutional self-study and evaluation reports and the institution's response to the visiting committee's report.

Once affiliation as a candidate or an accredited institution is achieved, it must be periodically reaffirmed through on-site evaluations. For candidate institutions, these evaluation visits occur every two years. The evaluation of accredited institutions must take place at least once every ten years, though it often happens that institutions are visited more frequently.

In addition to periodic evaluations, each institution is required annually to update its description and data summary on file with the Commission. From time to time, institutions are also asked to submit reports on matters specified by the Commission. Occasionally, these are followed by limited site visits. Substantive changes initiated subsequent to the most recent reaffirmation of accreditation, which significantly alter the nature of the institution, its mission and objectives, its educational programs, or the allocation of resources, must be reviewed and approved by the Commission before they are included in the institution's accreditation.

Questions about the Commission's procedures, criteria or other policies and inquiries about the status of individual institutions should be directed to:

Charles M. Cook
Director of Evaluation
Commission on Institutions of Higher Education
New England Association of Schools and Colleges, Inc.
The Sanborn House
15 High Street
Winchester, MA 01890
To be affiliated with the Commission on Institutions of Higher Education of the New England Association of Schools and Colleges, as either a candidate or an accredited institution, an institution of higher education must meet the following requirements:

The institution:

1. has formally adopted a statement of mission, which demonstrates that the fundamental purposes of the institution are educational, and which is also appropriate to a degree-granting institution, and appropriate to those needs of society it seeks to serve;

2. offers one or more educational programs, at least one year in length and consistent with its mission;

3. has students enrolled in and pursuing its principal educational programs at the time of the Commission's evaluation;

4. awards the bachelor's, master's, or doctor's degree or, if it grants only the associate's degree, includes programs leading to degrees in liberal arts or general studies;

5. has, for each of its educational programs, clearly defined and published objectives appropriate to higher education in level, standards, and quality, as well as the means for achieving them, including a designated course of studies acceptable for meeting degree requirements, adequate guidance to degree candidates in the satisfaction of requirements, and adequate grading or evaluating procedures;

6. in addition to study of the areas of specialization proper to its principal educational programs, requires a coherent and substantive program of liberal studies at the postsecondary level, as either a prerequisite to or a clearly defined element in those programs;

7. has adopted a statement specifying the potential students it wishes to serve, and admits qualified students to its programs under admission policies consistent with this statement and appropriate to those programs;

8. awards only degrees appropriate to each graduate's level of attainment;

9. has available to students and the public a current and accurate catalog of comparable official publication setting forth purposes and objectives, entrance requirements and procedures, rules and regulations for student conduct, programs and courses, degree completion requirements, full-time and part-time faculty and degrees held, costs, refunds, and other items related to attending or withdrawing from the institution;
10. has a charter and/or other formal authority from the appropriate governmental agency authorizing it to grant all degrees it awards, has the necessary operating authority for each jurisdiction in which it conducts its activities, and is operating within its authority;

11. has a governing board that includes representation reflecting the public interest and that has the authority to carry out the mission of the institution;

12. has a chief executive officer whose full-time or major responsibility is to the institution and who possesses the requisite authority;

13. devotes all, or substantially all, of its gross income to the support of its educational purposes and programs;

14. documents a funding base, financial resources, and plans for financial development adequate to carry out its stated purposes;

15. has financial records that relate clearly to the institution's educational activities and has these records externally audited on a regular schedule by an independent certified public accountant or a state audit agency;

16. has graduated at least one class in its principal educational programs before the Commission's evaluation for accredited status. If the institution has graduated its first class not more than one year before the Commission's evaluation, the effective date of accreditation will be the date of graduation of that first class.

**CRITERIA FOR CANDIDACY**

To be granted Candidate for Accreditation status an applicant institution must demonstrate that it:

1. meets the Requirements of Affiliation;

2. has, with the intention of meeting the Commission's Standards for Accreditation, effectively organized sufficient human, financial, learning, and physical resources into educational and other activities so that it is accomplishing its immediate educational purposes;

3. has established and is following realistic plans to acquire, organize, and appropriately apply any additional resources needed to comply with the Commission's Standards for Accreditation within the candidacy period;

4. meets the Commission's standard on Ethical Practices.
Institutional Mission and Objectives

An institution accredited with the Commission on Institutions of Higher Education must define its mission and develop a clear, concise, and realistic statement of objectives. Mission and objectives are acceptable as a basis for institutional affiliation only if they are within the general scope of higher education, are appropriate for the educational role of the particular institution, and are implemented in a manner that complies with the standards established by the Commission. Furthermore, the mission and objectives of the institution must be consistent with its charter and/or other operating authority.

The Commission recognizes that there are great variations among the purposes of institutions of higher learning. However, institutions eligible for affiliation have certain common educational aims. Among these are to provide instruction in a defined body of knowledge recognized to be at the collegiate level, to increase students' interest in intellectual matters, to enrich their cultural lives, to help them develop powers of discrimination and judgment, to foster their commitment to ethical, intellectual, social, and perhaps religious values, and to encourage the pursuit of lifelong learning. These are essentials of higher education and should be expressed in suitable terms and proportions in statements of institutional mission and objectives.

Each affiliated institution also defines as a part of its goals those additional aims and emphases that reflect its particular character. Among these might be specific preparation for employment, for the next level of education, for specialized research and public service, for continuing education, for short-term pursuits, or simply for life in society. Such further goals are realistically determined in the light of such factors as the purpose for which the institution was founded, the point of view it represents, the community in which it is located, and the institution's resources.

Equally important, and necessarily compatible with institutional goals, are the objectives of particular units and curricula. Whereas institutional goals are generally framed in broad terms, these objectives ought to be more precise and geared directly to particular learning and understanding.

The institution's statement of mission and objectives should be understood by its faculty, administration, and trustees and should appear in appropriate institutional publications.
Its mission and objectives should give direction to all of the institution's educational activities and to its admission policies, selection of faculty, allocation of resources, and overall planning. It should result in reasoned choices among potential activities.

Within a program of ongoing self-study, the statement of mission and objectives should be periodically reappraised to ensure that it provides an accurate portrayal of the institution and describes goals that are attainable to a reasonable degree. The institution should regularly assess the fulfillment of its mission and objectives by undertaking studies of the institution's impact on students and graduates. To the greatest extent possible, the institution should endeavor to describe explicit achievements expected of its students and to adopt reliable procedures for assessing those achievements.

**Evaluating and Planning**

The institution should have effective mechanisms for systematic self-evaluation and planning.

All areas of major concern, together with the persons who serve in them, should be evaluated periodically to determine their effectiveness in fulfilling institutional objectives.

The institution should have a structure to review its objectives and to plan for the future. On the basis of current information, including that derived from evaluation processes, the institution should examine proposals to strengthen itself and to prepare itself to meet changing circumstances. Planning should be a continuing, consistent, thorough and objective process, receiving the support necessary to make it effective.

**Organization and Governance**

The authority and responsibilities of each organizational component of the institution (governing board, administrative officers, faculty, students, and other significant constituencies), together with the processes by which they function and interrelate, should be clearly described by means of a constitution or by-laws or some equivalent means. Provisions for the distribution of authority and responsibility should be depicted in a table of organization which represents the actual working order of the institution.

The governing board is the legally constituted body which holds the property and assets of the institution in trust. It is responsible for sustaining the institution and its objectives; it should exercise ultimate and general control over its affairs, and provide adequate representation of the public interest.

The primary task of the president and administrative staff is educational leadership competent to establish conditions which provide good learning opportunities for students, good working conditions for faculty and staff, and good communication processes both inside and outside the institution. Their second, but no less important, task is the management of resources in support of institutional objectives.
Both the governing board and the administrative staff should give active support to the development of an instructional staff of high quality.

The faculty should have a major role in developing and conducting the academic program and in maintaining the standards and conditions which pertain directly to instruction and research. Faculty committees, whether statutory or ad hoc, are ordinarily essential to the smooth operation of an institution.

Within the policies established by the governing board, provision should be made for the consideration of student views and judgments in those matters in which students have a direct and reasonable interest.

Programs and Instruction

The institution should offer programs of study which are consistent with its statement of objectives, appropriate to an institution of higher education, adequately supported, and accurately described in its catalog.

In a broad sense of the term, an institution's educational program comprises all of its influences on students. The skill with which these influences are brought to bear on students in the achievement of institutional objectives is an important criterion in assessing the quality of an institution.

In a specific sense, an academic program is a curriculum of studies, however defined, which leads to a degree or other form of academic recognition.

Each academic program should be consistent with, and clearly related to, the objectives of the institution.

An undergraduate program, whether general, specialized, or professional, should show an appropriate regard for the humanities, the natural sciences, and the social sciences, by ensuring that at least a quarter of the student's programs consist of courses from these three areas.

A baccalaureate program should include a commitment to a particular area of inquiry and should afford competence in the area of specialization.

A graduate-level program should provide for advanced levels of scholarship and competence in the area of specialization.

Each program should contribute to the personal growth of students by helping them to develop responsible, independent judgment, to weigh values, and to understand fundamental theory.

In fulfilling their responsibilities to their constituents and providing community service, institutions may develop a variety of supplemental programs. Where programs in continuing education and special instructional activities are offered, on or off campus, they should be integral components of the institution's total commitment. Provisions for such activities should include an adequate administrative organization, a competent faculty, a sound financial base, and appropriate facilities.
Programs need not be limited to traditional patterns of study. However, every program—whatever its content, format, location or time of scheduling—should be supported by sufficient institutional resources.

The instruction of students should be the central focus of the resources and services of the institution. Methods of instruction should vary with the discipline to be taught and with the abilities and experience of the students. Responsible experimentation should be encouraged, and the institution should stimulate and assist the faculty to achieve a high quality of instruction.

Clearly identified institutional standards of scholarship, appropriate to each level of instruction, should be applied consistently and rigorously in each course of studies.

Research activity by faculty and students should be governed by institutional policies which ensure consonance with the objectives of the institution, adequate administrative controls, freedom of investigation by the researcher, and proper health and safety provisions.

Special Activities

If an institution chooses to sponsor or lend its name to conferences, institutes, workshops, or other activities, it must assume full responsibility for the appropriateness and integrity of the activity. The institution should administer special activities within its organizational structure and ensure that they do not compete unduly for resources needed for its other programs and services.

Faculty

The institution should maintain a faculty which is academically qualified and numerically sufficient to perform the responsibilities assigned to it. Conditions of service should be equitable and administered ethically, and should provide faculty members with academic freedom and opportunities for professional growth.

The recruitment, appointment, promotion, and retention of well-qualified faculty members are matters of major importance. The policies and procedures to be followed in these activities should be clearly stated in institutional documents, and due attention should be given to pertinent legal requirements in the areas of non-discrimination, equal opportunity, and affirmative action employment practices.

The preparation and qualifications of all members of the instructional staff should be suited to the field and level of their assignments. Those in the conventional academic fields should hold advanced degrees or present evidence of scholarship or creative achievement appropriate to their position; those in professional or technical fields should have equally appropriate preparation and attainments.
Academic and other professional assignments should allow the faculty member time for adequate preparation, for attention to the academic needs of students, and for continuing professional growth.

Effective faculty performance requires a climate of reasonable security. The institution, therefore, should provide the faculty member with an adequate salary, a well-planned program of benefits periodically re-examined to keep it current with changing economic conditions, and a form of contractual security or faculty tenure.

Provision should be made for regular and open communication among members of the faculty and between the faculty and administrative officers of the institution.

Student Services

The institution should provide student services which support institutional objectives and assist students to achieve academic and personal growth while making progress toward their career goals.

The institution should have an orderly and ethical program of admission, based on the appraisal of the prospective student's intellectual and personal qualifications in relation to the institution's objectives and educational program. It should comply with the requirements of equal opportunity and affirmative action legislation.

Adequate counseling services and current information about financial assistance and career placement should be available to all students.

A formal program of student counseling (academic, personal, and career) should be available and appropriately publicized to the students. In cases of special need - for example, foreign students, the culturally disadvantaged, the handicapped, veterans - additional services should be provided.

The institution should develop and publish clear policies describing student rights and responsibilities. Procedures protecting student rights to due process should be clearly articulated and widely publicized.

Observing the requirements of right-to-privacy legislation, the institution should maintain and safeguard accurate academic records.

Adequate provisions should be made for the safety, health, and protection of students.

A diversified, well-coordinated, and adequately supported program of extra-curricular activities suited to the students' needs and interests should be provided.

Current information about graduates and their progress in careers should be maintained. The interest of alumni in institutional development should be encouraged.
Library and Learning Resources

The institution should provide those learning resources necessary to support the educational program and the intellectual and cultural development of faculty and students.

The institution should have its own library or collection of learning resources. Collections of print and non-print materials should be appropriate to the range and complexity of the educational program, to each curriculum of studies, and to student enrollment. Materials should be housed in convenient locations and readily accessible to students.

Adequate study space should be provided. The collection should be administered by a professionally qualified and numerically adequate staff.

The exchange of materials and services with other academic or local libraries and within library networks is encouraged.

Physical Resources

The physical plant - building, grounds, and equipment - should be adequate to support the objectives of the institution and to meet the needs of students. It should be well-maintained and conform to applicable legal requirements, especially those concerned with access, safety, and health.

Classrooms, laboratories, and other areas for instruction should be properly equipped and adequate in number and size.

Financial Resources

The institution should be financially stable. Its resources should be sufficient to carry out its objectives and adequately support its programs and activities, now and in the foreseeable future.

It should have control of its financial resources and budgetary process and be free from undue influence or pressure from external funding sources or agencies.

The process by which the institution's budget is established, and resources allocated, should be clearly defined and consistently implemented.

Financial resources should be managed prudently, economically, and with due regard for legal and contractual requirements. An external audit of financial resources and transactions should be performed annually and reviewed by the appropriate individuals or responsible groups within the institution.

Financial statements, audits, and other reports of the fiscal condition of the institution should employ, whenever possible, a format in customary use among institutions of higher education.
The institution should subscribe to and exemplify high ethical standards.

In dealing with the general public, students, faculty and staff, and administrative officers, the institution should observe the *spirit* as well as the letter of legal requirements. It should adopt policies and procedures which ensure fair and equitable treatment of all those associated with or affected by its programs and services. Attention should be given to such matters as equitable student refunds and non-discriminatory practices in admission and employment.

**Publications and Advertising**

Publications, advertising and other communications of information concerning the institution's programs, services, activities and personnel, should emphasize the institution's educational opportunities and should represent them in language which is accurate, clear and unambiguous.

The institution's catalog should include its statement of objectives, its admission and transfer-credit policies, and accurate description of each academic program and course of studies, the requirements for a degree or other form of academic recognition, the members of the instructional staff together with their academic qualification, the schedule of fees and charges, the institution's refund policy, a description of learning and physical resources, and other information which the institution considers significant.

Programs, courses, services, and personnel not available during a given academic year should be clearly identified.

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It should be re-emphasized that the Standards for Accreditation are primarily qualitative in nature. They are applied to the institution as a whole and are interpreted within the framework of the institution's stated objectives.

Certain expectations of the Commission on Institutions of Higher Education are contained in detailed policy statements issued from time to time by the Commission. The policy statements listed on the following page are published in the Accreditation Handbook, which may be purchased from the Commission office.
Code of Good Practice in Accreditation

Collective Bargaining

Collegiate Athletics

Complaints Against Affiliated Institutions

Contractual Relationships with Non-Regionally-Accredited Organizations

Ethical Practices

Evaluation of Institutions Operating Interregionally

External Budget Control

General Education Requirements in Specialized Programs

Graduate Education

Innovation

Institutional Integrity

Nondiscrimination

Nontraditional Study

Off-Campus Educational Activities

Operationally Separate Units

Periodic Review of Accredited Institutions

Programs on Military Bases

Recruitment of Foreign Students

Relationship Between General & Professional or Specialized Accrediting Agencies

Role of the Generalist

Role of System Administration in Institutional Evaluation

Study Abroad

Substantive Change

Transfer and Award of Academic Credit

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APPENDIX B

CORE COURSE DESCRIPTIONS
2. Formal Methods

2.1 Course Content

2.1.1 Course Prerequisites

The only prerequisite to this course is admission to the M.S.E. program. However, admission requirements include knowledge of discrete mathematics and data structures; both of these subjects are prerequisites to Formal Methods.

2.1.2 Course Description

Formal Methods provides a formal foundation for the theory and practice of software engineering. The principal theme of the course is the production of correct, reliable and efficient systems. Underlying this theme is the study of tools for expressing and using abstractions. Formal techniques for specifying abstractions and for defining hierarchies of abstractions, including both operational and definitional specification languages, are presented. Verification techniques for showing that an implementation is consistent with a specification are discussed. State transition and applicative models of computation, regular expressions and context-free languages are discussed. Fundamental techniques for the analysis of space and time complexity of algorithms are presented. Applications of the above to problem solving and to programming languages are explored.

2.1.3 Outline of Major and Minor Topics

1. Proofs (2 lectures)
   a. Predicate Calculus
   b. Natural Deduction
   c. Mathematical Induction
2. Verification (4 lectures)
   a. Hoare-style Axioms
   b. Procedures
   c. Assertions
   d. Weakest Preconditions
   e. Theory of Testing
3. Abstraction (4 lectures)
   a. Control Abstraction
   b. Data Abstraction
   c. CLU
   d. Ada
4. Specification (4 lectures)
a. State-machine
b. Algebraic
c. Operational
d. Proofs

5. Formal Language Theory (4 lectures)
   a. Finite-state Machines
   b. Applications of Regular Expressions
   c. Context-free Languages and LR Parsing
   d. Recursive and Recursively Enumerable Sets

6. Analysis (5 lectures)
   a. Concepts
   b. Sorting
   c. Searching
   d. Complexity

2.1.4 Assignments and Project(s)

Students do about five "textbook-style" problems each week. For example, a verification assignment might require five simple proofs. The purpose of these problems is to allow students to test and reinforce their understanding of the readings.

In addition to their weekly homework assignments, each student must select one additional exercise, called a specialty project. The purpose of this project is to investigate some topic that is particularly relevant to the student's experience. Some suggestions are given below, but students are encouraged to compose their own assignments.

1. Verification
   a. Continue reading in The Science of Programming [Gries 81] and do any of the unanswered exercises in the last chapter.
   b. Prove a real program.
   c. Investigate the functional correctness approach—do some examples.
   d. Investigate verification of concurrent programs—do an example.
   e. Investigate correctness-preserving transformations—invent or perform some.

2. Abstraction
   a. Implement some interesting data abstractions in Ada, CLU, Modula2 or Simpl-D.
   b. Investigate the support of data abstraction in C or Pascal—give a methodology for the use of existing features.

3. Specification
   a. Use AFFIRM to specify and verify some abstract data type.
   b. Compare Prolog to algebraic specification—develop some equivalent examples.

4. Language Theory
   a. Jackson's design notation is equivalent to regular expressions. Describe the problems of structure clashes and backtracking in terms of finite state machines.
3. Programming Methods

3.1 Course Content

3.1.1 Course Prerequisites

Application of Formal Methods is the prerequisite course; substantial programming experience in a high level language, required for admission to the program, is also essential.

3.1.2 Course Description

This course covers principles and techniques of programming used by individuals, but within a team context. The quality of programs is discussed in terms of readability, maintainability and efficiency. Programming principles are illustrated using tools such as profilers, revision control, and style analyzers. Verification and validation are approached via formal reviews, testing and proof technology. Some design methods are introduced to provide a basis for further study in the Software Engineering Methods course and for use in class projects. Appropriate documentation is discussed in conjunction with each topic.

3.1.3 Outline of Major and Minor Topics

1. Coding Quality (6 lectures)
   a. coding quality
   b. programming environments
   c. coding style
   d. documentation
   e. static and dynamic analysis
   f. efficiency
   g. configuration management

2. Reviews (2 lectures, see also 5.c below)
   a. introduction, people problems, preparations, reports
   b. code walkthroughs
   c. code inspections, checklists
   d. reviews

3. Testing (4 lectures)
   a. blackbox: error guessing, random test generation, the QA approach
   b. whitebox: flow analysis, path selection, sensitization
   c. regression: test harness, levels of testing
   d. validation: bebugging
   e. case studies: Ada compiler verification

4. Proving (1 lecture)
5. Design (12 lectures)
   a. Overview, compare and contrast
   b. The Jackson method (JSP)
      i. structure charts
      ii. structure clash
      iii. inversion
   c. The NRL/SCR/Parnas method
      i. program families
      ii. modularization by information hiding
      iii. undesired events
      iv. abstract interfaces
      v. active design reviews
      vi. rational design
   d. The Spiral Method (Boehm)
   e. Ada as a Design Language
   f. Exception Handling

3.1.4 Assignments and Project(s)

1. coding quality
   a. critical review of coding style
   b. extraction of documentation in code
   c. finding portability problems, using static analysis
   d. methodological improvement of efficiency
   e. portable packaging of files and directories

2. reviews
   a. review of a simple coding standard
   b. inspection of program cal relative to the coding standard

3. testing
   a. blackbox test of program cal
   b. whitebox test of program cal
   c. regression harness for program cal
   d. test suite validation for program cal

4. design
   a. SCR modularization
   b. program families
   c. abstract interfaces
4. Software Engineering Methods

4.1 Course Content

4.1.1 Course Prerequisites

The course prerequisites or corequisites are:

1. Formal Methods;

4.1.2 Course Description

The following course description for Software Engineering Methods is extracted from the 83/84 Wang Institute bulletin.

"(Software Engineering) Completes the study of the software life-cycle begun in Programming Methods by focusing on the product definition and requirement analysis phases, and the documentation and validation of each life-cycle phase. The emphasis is on system analysis and the relationships among the various stages of the software development model. Topics include techniques appropriate to needs analysis including interviewing with users, documented analysis of existing methods and procedures, documented review of system objectives, performance criteria, systems constraints, assumptions, and items for resolution. Needs analysis is followed by a discussion of techniques appropriate to requirements analysis including specification of system outputs, inputs, major functions, data description, and data flow; analysis of alternative system configurations; and system performance characteristics. Requirements specification languages are reviewed. In addition to creating a test plan from the system specifications, the preparation of the system acceptance criteria document is discussed. A detailed outline of the products expected from each stage of the life-cycle and validation techniques - such as walkthroughs and reviews for each stage - is presented. Project control documents such as project notebooks and project support libraries are prepared."

This offering of the Software Engineering Methods followed the bulletin's description. The exception was the addition of a module "Empirical Methods."

4.1.3 Outline of Major and Minor Topics

1. Software Development Life-Cycle Models
2. Needs Analysis/Feasibility Study
3. Requirements Definition
   a. Formal Specification
   b. Structured Analysis
   c. PSL/PSA
   d. JSD
4. Empirical Methods
a. Measurement  
b. Sampling Techniques  
c. Basic Statistics  
d. Data Analysis  
e. Models and Regression  
f. Research Evaluation  

5. Quality Assurance and Validation & Verification  
   a. Plans  
   b. Reviews  
   c. System and Acceptance Testing  

6. User Interfaces and Prototyping  
7. Maintenance and Documentation  

4.1.4 Assignments and Project(s)  

The students were asked to prepare a "conceptual" paper individually and a collective project - the "definition study project." The definition study project was the most important part of the course. Students worked in groups to determine the system requirements for a real world problem. Part of this involved interviewing the people who have presented the problem for study.  

4.1.4.1 Course Deliverables  

There were three major deliverables in the course:  
1. Definition Study Project Report  
2. Conceptual Paper  
3. Exam on Empirical Methods consisting of  
   a. short answers to technical questions  
   b. report on analysis of some real system performance data  

In addition, the Definition Study Project was divided into phases, and documents were produced at the end of these phases. These documents were required for revision by the instructors. The timetable for these documents, however, were set by each group.  

Definition Study  

A list of possible topics was presented to the students at the beginning of the course. The students formed 8 groups and chose the following topics:  
1. Medical instrument prototyping system.  
2. Test generation and optimal testing.  
3. Long-distance resource sharing.  
4. Tracking software problems in the field.  
5. Cost tracking of computer system projects.  
6. Information management system for UNIX.  
8. An information service center.
5. Computing System Architecture

5.1 Course Content

5.1.1 Course Prerequisites

This course has no prerequisites beyond those of admission to the MSE program.

5.1.2 Course Description

This course surveys technical features of computer systems architecture, principally viewed through operating systems abstractions. Operating system abstractions are used as a unifying theme because most software engineers are principally aware of their computer's architecture through such abstractions. However, unlike a conventional course on operating systems, this course spends significant time on the hardware facilities that underly those abstractions, thereby giving students a close look at hardware/software tradeoffs.

The course covers the standard operating system topics of process management, process communication, processor scheduling, memory management, file management, segment management, and protection. It also covers the following topics in computer architecture: interrupt structures, hardware memory organization, I/O device and channel architectures, capability based architectures, and reduced instruction set computers. Many example systems are treated both in the lectures and readings.

5.1.3 Outline of Major and Minor Topics

1. Introduction (1 lecture)
   a. viewing hardware functions as software abstractions
   b. virtual machines and levels of abstraction
   c. relative costs of hardware and software abstractions

2. I/O and Interrupt Architecture (2 lectures)
   a. device interfaces
   b. polling
   c. interrupts
   d. supervisor calls
   e. channels

3. Process Management (2 lectures)
   a. multiprogramming
   b. the process abstraction
   c. implementing processes
   d. hardware support for processes

4. Process Communication and Synchronization (2 lectures)
a. the mutual exclusion problem  
b. test-and-set hardware  
c. semaphores  
d. message passing  
e. monitors  
f. deadlocks  

5. Memory Management (4 lectures)  
   a. loaders  
   b. memory management algorithms for nonpaged memory  
   c. virtual memory  
   d. address translation hardware  
   e. page replacement algorithms  
   f. sharing memory between processes  

6. Segment Management (3 lectures)  
   a. address space management  
   b. linkers  
   c. the segment abstraction  
   d. segmentation hardware  
   e. shared segments  

7. File Systems (4 lectures)  
   a. software I/O subsystem  
   b. virtual devices  
   c. basic file management  
   d. virtual file systems  
   e. record management and access methods  
   f. hierarchical name spaces and name servers  

8. Protection (3 lectures)  
   a. protection mechanisms v. security policies  
   b. protection matrices  
   c. access control lists  
   d. capabilities  
   e. rings of protection  
   f. capability-based architectures  

9. Special Hardware Topics (5 lectures)  
   a. stack computers  
   b. reduced instruction set computers (RISC)  
   c. IBM 360/370 architecture  
   d. the Sequoia Computer
6. Management Concepts

6.1 Course Content

6.1.1 Course Prerequisites

None.

6.1.2 Course Description

This course provides the formal foundations in the management principles that are central to the study and practice of software engineering. It clarifies the role of management studies within the multidisciplinary software engineering field, and provides a conceptual base with which a student can identify, understand, articulate, and synthesize management-related issues in software engineering. It also provides skills, contingency frameworks, and strategies for effectively dealing with management-dominant issues during the practice of software engineering.

The course begins by providing a formal understanding of the structure and behavior of organizations. This is followed by the study of the functioning of different functional units of an organization, such as accounting, finance, and marketing. Focus is on understanding the nature of work done by these functional units, the factors which influence their decisions, and the implications of these for software engineering functions.

Thereon, a scenario of a software engineer advancing through an organization is used for organizing the topics. The stages of individual contributor, team member, middle-level technocrat, and strategic manager are considered in this scenario. The roles, functions, skills, and strategies relevant to each of these career stages are identified and studied. Towards the end of the course, topical managerial issues related to the software industry are examined.

Tools & techniques that can support a software engineer manager are identified and studied throughout the course. Discussion format and cases are used as the teaching mechanisms.

6.1.3 Outline of Major and Minor Topics

Why Organizations?

1. Limitations of individuals and strengths of organizations
2. Division of labor
3. Task specialization
4. Roles & Communication paths
5. Coordination & control
6. Authority, Responsibility & Accountability

Structure of Organizations

1. Organizational Missions
2. Organizational chart
3. Formal & Informal structures
4. Roles, Communication paths, Conflicts
5. Line/Staff functions
6. Organic and mechanistic structures
7. Organizational culture
8. Organizations from Different Perspectives
   a. Input-Process-Output view
   b. Functional Perspective
   c. Information Processing perspective
   d. Political Coalition Perspective
   e. Organizations as adaptive systems

Organizational Functions
1. Strategic Planning
2. Production
3. Marketing
4. Finance
5. Accounting
6. Research & Development
7. Legal
8. Administration
9. Social

Organizational Behavior

Structuring of Organizations
   Design Parameters
   Design of Positions
   Unit Grouping, Unit Size
   Design of Planning & Control Systems
   Design of Decision-making Systems

Contingency Factors
   Age and Size
   Technical System
   Environment
   Power

Structural Configurations
   Simple Structure
   Machine Bureaucracy
   Professional Bureaucracy
   Divisionalized Form
   Adhocracy
   Hybrids

Organizational culture
   Accumulation of Power
   Inertia & Resistance to change
   Organizational effectiveness

Individuals in Organizations
   Needs and Motivation
   Roles, Responsibilities, Accountability
Task Structure, ambiguity & conflicts
Reward, Punishment, and Incentive Schemes
Formal & Informal communications
Reward, Punishment, Incentive Schemes

Perceptions & Reality
  Organizational Power
  Organizational Politics
  Organizational Culture

Career Paths & Career advancement
Managerial Careers
Problems in Career Transitions

Stress management
Time management
Interviewing techniques
Assertiveness, Diplomacy
Inter-personal relationships
Professionalism
Loyalty: Professional, Organizational

Groups in Organizations

Group formation, development, structure
Role playing within groups
Group influences, Peer pressures
Group Processes
  Committees, Meetings
  Group decision-making
  GroupThink
  Brainstorming, Delphi, Synectics
Group Performance & Evaluation

Middle-level Management

Operationalizing organizational goals & objectives
Instituting organizational policies & procedures
Planning, Organizing, Monitoring, Controlling

Managerial styles
Leadership skills
Motivation techniques

Designing positions, writing job descriptions
Hiring, firing decisions
Performance appraisals
Developing human resources
Proposals/Contracts: writing, evaluating.
Communications: upward, downward, and lateral
Coordinating with other functional units
Managerial Decision-Making
Theory of Games
Conflicts: Generation, Resolution

Strategic Management

Goals & Policy Setting
Strategic Planning
Technology Planning

Management of Change
Promoting Innovation & Creativity

Organizational Processes/Skills

Communication Skills
Inter-personal Relationships
Influencing, Persuading
Negotiating, Bargaining

Situation Management
Perceptions Management
Organizational Games

Management of Change
Diffusion of Innovations

Topical Issues:

Japanese Management Styles
Software Protection: Technical, Legal issues
Start-ups: Problems & issues
Hi-Tech Management

Software Tools for Managers

These are meshed with the appropriate topics.

Synthesis

Synthesizing and reinforcing the material covered in the course.

8.1.4 Assignments and Project(s)

The deliverables for this course were:

1. Course Notebook
2. Two Term Papers
3. One Short Case Analysis Report
4. Final Exam

Course Notebook:
7. Software Project Management

7.1 Course Content

7.1.1 Course Prerequisites

Pre - Programming Methodology and Management Concepts
Co - Software Engineering

7.1.2 Course Description

This course introduces students to many of the concepts, tools, and techniques for planning, staffing, monitoring, controlling, and leading a software project from inception to completion. The course is intended to provide students with the tools, techniques, and interpersonal skills necessary to manage a project of 5 to 20 staff members. Case studies and a term project (preparation of a software project plan) are used to give students an opportunity to utilize some of the tools and techniques discussed in class. Written assignments and in-class presentations give students the opportunity to practice their communication skills.

7.1.3 Outline of Major and Minor Topics

1. Planning (12 lectures)
   a. Product proposals and project plans
   b. Organizational structures
   c. Lifecycle models
   d. Work breakdown structures
   e. Cost estimation
   f. Cost/benefit tradeoffs
   g. Risk analysis

Monitor and Controlling (8 lectures)
   a. Project metrics for quality, schedule, budget, and progress
   b. Inspections, walkthroughs, reviews, and audits
   c. Earned value, cost-schedule-milestone charts, and risk analysis

Leadership and Motivation (6 lectures)
   a. Social styles
b. Motivation, job satisfaction, team building

c. Performance reviews

7.1.4 Assignments and Project(s)

Student assignments and projects include preparation and discussion of case studies, written critiques of readings, in-class discussions, oral presentations, and team preparation of term project deliverables.

Case studies include:

- A leadership style evaluation and analysis
- Two case studies dealing with leadership issues
- A group decision making exercise and analysis
- A risk assessment/crisis management case study
- The Medinet case study
- Two case studies based on Project FOUL
- A study of successful software projects

The leadership style evaluation involves completion of assessment instruments by the student and two colleagues. Style assessment is based on the Blake-Mouton grid and students are asked to analyze various leadership styles they have observed in light of the model. The two leadership case studies deal with the situations of erratic behavior on the part of a valued employee, and the emergence of an informal, but wrong-headed team leader.

The group decision making exercise involves a hypothetical survival exercise in which teams of 5 to 6 students must make consensus decisions about the best course of action. The case study involves an analysis of the various decisions that were made and the group dynamics that led to those choices.

The risk assessment/crisis management case study involves a start-up company that has missed the delivery date for their new product and is on the verge of losing their financial backing. The case study involves an analysis of the technical and managerial decisions that resulted in the present state of affairs and preparation of recommendations for regrouping and completing the project.

Medinet is a case study presented in the text Design of On-Line Computer Systems by Ed Yourdon. Project FOUL is from the text Managing a Programming Project by Phil Metzger. Medinet and FOUL are examples of project failures. In contrast, the final case study presents the students with some examples of projects that succeeded. The students are asked to read several papers that describe successful projects and summarize the factors that contributed to success while contrasting those projects to Medinet and Project FOUL.

The term project involves development of a project plan for a software system. The project requires teams of students to prepare items such as a project description, work breakdown structure, schedule, staffing plan, cost estimate, and risk analysis using project management tools. The project requires students to work in teams of 3 or 4, and various parts of the project plan are phased for delivery throughout the course. Lectures are key to providing the information needed to prepare the various parts of the project plan.
APPENDIX C

WANG INSTITUTE OF GRADUATE STUDIES
ADMISSIONS OFFICE STATISTICS ON NEW STUDENTS
### ADMISSIONS OFFICE
#### NEW MSE STUDENTS
January, 1981

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**NEW MSE STUDENTS**
September, 1981

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| Adv. Degree | 10 | 7 | 6 |
| G.P.A. | 3.3 | 3.4 | 3.4 |
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| Female | - | 2 | 2 |

**# Interviewed**

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- Word-Of-Mouth - - -
- Poster - - -
- Forum - - -
- Ad - - -
- Other - - -
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- Conditional Admit | 8 |
- Met Conditions | 7 |

**Highest Degree**
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- Math | 17% |
- Electrical Engineering | 22% |
- Other | 33% |
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### September, 1983

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September, 1984

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ADV. DEGREE

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MALE - 29 FEMALE - 8

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September, 1985

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- PART-TIME 24 14 11
- NON-DEGREE 1 1 0
- CORP. SPON. 6 5 5
- GRADUATE ASSIST 40 13 7

GRE

- VERBAL 580 615 623
- QUANTITATIVE 680 694 698
- ANALYTICAL 617 655 643

YRS. EXPERIENCE 4.2 5.1 5.8
ADV. DEGREE 23 9 4
G.P.A. 3.4 3.4 3.4

MALE 63 31 21
FEMALE 10 5 4

# INTERVIEWED 48 66%

SOURCE OF INFO:

| UNKNOWN | 41 | 54% | 7 | 16% | 4 | 15% |
| WORD-OF-MOUTH | 21 | 28% | 20 | 45% | 15 | 55% |
| POSTER | 5 | 7% | 5 | 21% | 3 | 11% |
| FORUM | 2 | 3% | 2 | 5% | 2 | 7% |
| AD | 2 | 3% | 2 | 11% | 2 | 7% |
| OTHER | 1 | 3% | 1 | 3% | 1 | 4% |

UNCONDITIONAL ADMIT - 22
CONDITIONAL ADMIT - 14
MET CONDITIONS 14

HIGHEST DEGREE

| COMPUTER SCIENCE | 42% |
| MATH | 8% |
| ELECTRICAL ENGINEERING | 21% |
| OTHER | 29% |
## ADMISSIONS OFFICE
NEW MSE STUDENTS
September, 1986

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UNCONDITIONAL ADMIT 18
CONDITIONAL ADMIT 17
MET CONDITIONS 16

HIGHEST DEGREE

| COMPUTER SCIENCE | 12 | 38% |
| MATH             | 4  | 12% |
| ELECTRICAL ENGINEERING | 7 | 22% |
| OTHER            | 9  | 28% |
BIBLIOGRAPHY

Primary Sources

Institutional Records and Publications


Arden, Bruce, Dean of College of Engineering and Applied Science University of Rochester and Member of Wang Institute of Graduate Studies National Academic Advisory Committee, Rochester, New York, letter to Patricia Green, August 7, 1987.


Boston University Metropolitan College The Wang Institute of Boston University Tyngsboro Massachusetts Bulletin, Boston, Massachusetts, 1 (Fall, 1987), 1.


"Dr. Mark A. Ardis Joins Faculty," Wang Institute of Graduate Studies Newsletter, 2 (Fall, 1983), 2.

"Dr. William M. McKeeman Joins Faculty," Wang Institute of Graduate Studies Newsletter, 1 (Fall, 1981), 1.


Gordon, Robert L., Milford, Massachusetts, letter to An Wang, May 11, 1981.
Gordon, Robert L., Milford, Massachusetts, letter to Patricia Green, July 7, 1987.


"Institute Graduates Second Class of Software Engineers," Wang Institute Newsletter, 2 (Fall, 1983), 1.


Liskov, Barbara, Professor of Computer Science and Engineering, Massachusetts Institute of Technology, Boston, Massachusetts, letter to Patricia Green, July 20, 1987.


Masters of Software Engineering, viewbook, Wang Institute of Graduate Studies, School of Information Technology, Tyngsboro, Massachusetts, June, 1983.

Meng, J. Joseph, Vice President for External Programs, Boston University, Boston, Massachusetts, letter to Patricia Green, May 15, 1987.


Minutes of the Wang Institute of Graduate Studies National Academic Advisory Committee, Wang Institute of Graduate Studies, Tyngsboro, Massachusetts, October 12, 1983.


Minutes of the Wang Institute of Graduate Studies National Academic Advisory Committee, Wang Institute of Graduate Studies, Tyngsboro, Massachusetts, December 1, 1983.


Minutes of Wang Institute of Graduate Studies, National Academic Advisory Committee Meeting, Wang Institute of Graduate Studies, Tyngsboro, Massachusetts, October 10, 1985.


Summer Institute in Computer Science, Twelve 5-Day Seminars, brochure, Wang Institute of Graduate Studies, Tyngsboro, Massachusetts, 1986.


Vyssotsky, Victor A., Member of National Advisory Committee of Wang Institute of Graduate Studies, Maynard, Massachusetts, letter to Patricia Green, July 14, 1987.


Personal Interviews

Bolt, Anthony, Student at Wang Institute of Graduate Studies, Tyngsboro, Massachusetts, interview with Patricia Green, June 19, 1987.


DiCostanzo, Phyllis, Wang Institute of Graduate Studies Recruitment Director, Tyngsboro, Massachusetts,
interview with Patricia Green, June 19, 1987.

Ellison, Mark, Student at Wang Institute of Graduate Studies, Tyngsboro, Massachusetts, interview with Patricia Green, June 23, 1987.

Fairley, Dr. Richard E., Faculty Chairman, Wang Institute of Graduate Studies, Tyngsboro, Massachusetts, interview with Patricia Green, June 23, 1987.

Flaherty, William, Assistant to Vice President of External Programs, Boston University, Boston, Massachusetts, interview with Patricia Green, June 22, 1987.

Long, Larry, Associate Professor of Industrial Engineering, Lehigh University, Bethlehem, Pennsylvania, member of New England Association of Schools Evaluation Team to Wang Institute of Graduate Studies on April 17-19, 1983, interview with Patricia Green, (February 19, 1987).

McKeeman, William, Faculty Chairman, Wang Institute of Graduate Studies, Tyngsboro, Massachusetts, interview with Patricia Green, June 22, 1987.

Menard, Lori, Student at Wang Institute of Graduate Studies, Tyngsboro, Massachusetts, interview with Patricia Green, June 23, 1987.


Ransom, Mary Ann, Secretary, Department of Software Engineering Seattle University, Seattle, Washington, telephone interview with Patricia Green, July 30, 1987.


Secondary Sources

Books


**Periodicals**


"Institutionalizing the Students of Software," *Computer Design*, (December, 1982).


Sexton, Thomas, "Murphy Challengers Wang Institute Grads with a Call to Battle Economic Inequality," The Lowell Sun, Lowell, Massachusetts, (August 13, 1985), 1.
Smith, Rosemary, "Prof: Like It or Not, We Need Computers,"
Daytona Beach Morning Journal, Daytona Beach, Florida,
(April 17, 1982).

"Software Engineering TC Urges Support for Wang Institute,"
Computer, (June, 1987), 84.

"The Master of Software Engineering," Training News, (March,
1983), 3.

High Tech, (November 15, 1982), 5.

Traite, Paul, "Wang Institute Merger with BU is Ill-
Advised," The Boston Globe, Boston, Massachusetts,
(March 17, 1987).

Wang, An, "Educating Enough Engineers," The Lowell Sun,
Lowell, Massachusetts, (March 1, 1982).

"Wang Institute Awards Fellowships to Scholars," The Sunday
Sun, Lowell, Massachusetts, (October 9, 1983).

"Wang Institute Becomes Part of BU," The Lowell Sun.
Lowell, Massachusetts, (February 26, 1987).

"Wang Institute Graduates 3d Class," Boston Globe, Boston,

"Wang Institute is Meeting Dual Role," New Hampshire

"Wang Institute Is Officially Dedicated," Massworld, A
Report on Economic Development in the Commonwealth of

"Wang Institute Makes Changes in MSE Program."
Computerworld, 17 (April 11, 1983), 40.

"Wang Institute Merges with Boston University," Connection,
(Winter/Spring, 1987).

"Watkins, Beverly T., "Higher Education Now Big Business for
Big Business," Chronicle of Higher Education, 24 7
(April 13, 1983), 1.

"WIGS Class of '82," Electronics, 54 (December 15, 1981),
261.

Other Sources


