CHAPTER 3

ADMINISTRATIVE ISSUES AND DEPARTMENTAL PHENOMENA

This chapter deals with changes in administrative structures affecting the mathematical and computer sciences, teaching loads, the uses of various instructional formats, computer use in instruction, the teaching functions and discipline sources of graduate teaching assistants, and issues considered important by department chairpersons.

HIGHLIGHTS

- The creation of new computer science departments and the broadening of departmental duties and names to include computer science were frequent administrative changes.

- In five major introductory courses, 41% of university students are taught in large lecture sections (over 80 students) whereas in private colleges only 2% are. About one-fifth of all students in these five courses are taught in sections of 40 to 80 students.

- There is little required use of computers in college algebra or calculus or in any mathematics course other than numerical analysis or other computing related courses.

- Since 1980 the number of graduate teaching assistants has been stable in university mathematics departments but has gone up markedly in statistics and computer science departments and in public college mathematics departments.

- About 95% of all graduate teaching assistants in mathematics, statistics or computer science are students in the same or related subjects.

- Salary levels and departmental support practices were widely regarded as major problems in many departments.

ADMINISTRATIVE STRUCTURES

The Survey questionnaire sought information on administrative changes in the period 1980-1985 affecting departments in the mathematical and computer sciences. Questions 2a and 2b (see Appendix B) referred to consolidations or divisions of departments. Table 3-1 gives administrative changes reported in university, public four-year college and private four-year college categories.

TABLE 3 - 1

1980-1985 ADMINISTRATIVE CHANGES AFFECTING MATHEMATICAL OR COMPUTER SCIENCES DEPARTMENTS

	Total Number Of Institutions	Consolidations	Divisions
Universities	157	12	22
Public 4-Year	427	80	62
Private 4-Year	839	158	75

Of the institutions reporting consolidations:

(a) about 40% involved formation of schools or divisions with several new mathematics and computer science departments included in these changes;

(b) about 35% were mathematics and computer science consolidations but in many instances these appeared to be simple expansions of mathematics departments and/or name changes;

(c) about 25% involved new departments such as mathematics and physics, computer science and electrical engineering, etc.

The "division of departments" reported are almost all accounted for as new computer science departments. In the three categories of institutions, new computer science departments from 1980 to 1985 were sepaarately calculated as 11, 59 and 102. Not all would have occurred as divisions of departments. In the university category a few other divisions into various mathematical science departments likely occurred.

As mentioned elsewhere, there are now projected to be separate computer science departments in 105 of the 157 universities, in 141 of the 427 public four-year colleges, and in 150 of the 839 private four-year colleges.

INSTRUCTIONAL FORMATS

The Survey sought information (Question 4) from all respondents as to the sizes or types of classes taught in selected introductory subjects. The specific question, a slight variant of that used in the 1980 Survey, asked for the numbers of students taught in:

(1) small classes (less than 40 students),

(2) large classes (between 40 and 80 students),

(3) lectures (over 80 students without recitation or quiz sections),

(4) lectures (over 80 students with recitation or quiz sections),

(5) self-paced instruction and

(6) other formats (See Appendix B).

The five subjects were College Algebra, Calculus (Math., Eng., Phys. Sci.), Calculus (Bio., Soc., Mgmt. Sci.), CS I (Computer Prog. I), and

Elementary Statistics. (The subjects were those used in the 1980 questionnaire except that "college algebra" replaced "finite math" since enrollments in college algebra were much higher than those in finite math).

To clarify the question, the various courses were listed with the identifying numbers used on the questionnaire form. The statistical analysis (projections) of the results were complicated by occasional incomplete or misleading answers to this particular question. However the overall results were generally consistent with those reported in 1980. In the 1975 Survey, a different type question was used and thus results from 1975 cannot be compared directly.

Generally, there were two major findings of which only the first is Vvident from Table 3-2:

(1) There are sharp differences in instructional formats between universities, public four-year colleges and private four-year colleges and

(2) Within any of the 3 categories of institutions, the reported differences in formats for the five subject areas studied were rather minor, particularly for the two calculus courses and computer programming. College algebra generally was taught in somewhat smaller sections and statistics in somewhat larger.

TABLE 3 - 2

PERCENTAGE OF STUDENTS TAUGHT IN VARIOUS FORMATS
IN FIVE STANDARD INTRODUCTORY COURSES

Class Format	University		Public 4-Year		Private 4-Year	
	1980	1985	1980	1985	1980	1985
<40	36	38	67	62	79	82
40 - 80	31	20	21	22	13	16
>80, no Quiz Sec.	10	12	2	5	1	-
>80, Quiz Sec.	21	29	9	10	7	2
Self-Paced or Other	1	1	-	1	-	-

The table shows that in universities there appears to be a trend away from large classes (40-80) toward lectures with quiz sections. In universities more than 40% of students in these five subject areas are taught in a large lecture format whereas in private colleges only 2% are.

It is also worthy of note that a negligible number of students (less than 1% in these five subject areas) are taught in "self-paced" or "other" modes; the standard formats totally predominate. The mathematical community is definitely not convinced of the efficacy of non-standard modes of instruction when it comes to course content needed for further work. The 1975 Survey showed that there was widespread experimentation with various alternative forms of instruction. It is clear from the 1980 and 1985 results that in the basic introductory courses the standard formats totally predominate. Similar turning away from various alternative modes or forms of instruction was evident in the two-year college category (see Chapters 5 and 6).

COMPUTER USE IN INSTRUCTION

All respondents were asked to indicate (Question 5) the number of sections in various courses in which the use of computers (micros/ minis/ mainframes) is required. A comparable question had not been asked in 1980. The responses were not of good statistical quality. Thus the results, listed as percentages of the total number of sections for the named courses, are summaries of all responses rather than projections. The results reveal relatively little obligatory computer use in mathematics courses except for those subjects closely identified with computing or computation. See Chapter 4 for a discussion of computer use in computer science courses and Chapter 5 for related two-year college phenomena.

TABLE 3 - 3

REQUIRED COMPUTER USE IN MATHEMATICS AND STATISTICS COURSES
AS PERCENTAGE OF ALL SECTIONS TAUGHT IN SELECTED SUBJECTS

Course and Number	Univ.	Pu. 4-Yr.	Pr. 4-Yr.	Total
College Algebra (5)	0%	0%	3%	0%
Calculus (15)	5%	8%	6%	7%
Diff. Equations (17)	15%	11%	13%	13%
Discrete Math. (18)	11%	28%	19%	18%
Linear Algebra (19)	15%	7%	23%	13%
Numerical Analysis (37)	91%	85%	82%	87%
Elementary Statistics (45)	29%	23%	43%	29%

The issue of the (required) use of calculators in mathematics or statistics courses in four-year colleges or universities was not pursued in the 1985 Survey.

GRADUATE TEACHING ASSISTANTS

In the 1980 Survey there were two questions about teaching assistants: one about the total number of teaching assistants, including the numbers who were graduate students in various types of departments (those reporting, other mathematical (computer?) science or not mathematical science) or, who were undergraduates. The second question dealt with the utilization of teaching assistants (teaching own classes, conducting quiz or recitation sections, paper grading, tutoring, other). There seemed to be ambiguity about the term "teaching assistant" if undergraduates were counted: e.g. "Are undergraduate paper graders teaching assistants?" In 1980, 50% of all mathematics teaching assistants

in private colleges were tutors, whereas only 8% of teaching assistants in the university category were tutors, presumably indicating an uncertainty as to whether or not to count undergraduate students. From the last three columns of Table 3-4, it appears evident that some undergraduate paper graders or tutors were counted in various categories in 1980.

To clarify the terms in use, it was decided to request information for graduate teaching assistants only in the 1985 Survey. Thus the 1985 data are not directly comparable to the 1980 data, particularly in the private college category. According to the 1980 Survey report "more than one-fifth" of all teaching assistants reported were undergraduates. See Table 3-5 for a comparison of counts of teaching assistants or graduate teaching assistants reported in 1980 and 1985. In Table 3-5, the private college mathematics category clearly reveals a count of many undergraduates classed as teaching assistants in 1980. For 1985, with only GTA's included, the number of teaching assistants was much lower. For other phenomena, see the discussion following Table 3-5.

In Table 3-4 are given the 1985 percentage distribution of graduate teaching assistants by principal teaching function by category of department.

The reader should note, as pointed out in the introduction to this report and in Chapter 2, that the university and public college categories are not identical, or directly comparable with, the AMS Survey Groups I, II, and III and M. For technical reasons, the Department of Education lists from which the Survey sampling was drawn produces a set of institutions for the university category which effectively replaces a number of large public universities in AMS Groups I, II, and III with smaller private universities. These larger universities then appear in the public four-year college category. Thus the Survey totals on GTA's in universities would be expected to be somewhat lower than in AMS Group I, II, and III data and the public four-year college totals would be expected to be somewhat higher than in AMS Group M data. That is the case. But the overall totals are not inconsistent.

TABLE 3 - 4

PRINCIPAL TEACHING FUNCTIONS OF GRADUATE TEACHING ASSISTANTS
1985
(Rows sum to 100%)

Type of Department:	Teaching Own Class	Conducting Quiz/Recit. Sections	Paper Grading	Tutoring	Other
University					
Math. (n=5038)	47%	40%	8%	4%	1%
Stat. (n=711)	24%	52%	14%	6%	4%
C.S. (n=1746)	36%	26%	23%	11%	4%
Public 4-Year					
Math. (n=2077)	44%	41%	9%	6%	0%
Stat. (n=85)	29%	15%	56%	0%	0%
C.S. (n=530)	23%	15%	35%	24%	3%
Private 4-Year					
Math. (n=111)	60%	34%	3%	3%	0%
C.S. (n=30)	40%	20%	40%	0%	0%

The high incidences of "paper grading" and/or "tutoring" functions in statistics and computer science departments probably reflect the different nature of homework or projects in those subject areas as compared to mathematics. They presumably reflect both (1) the handling of data and/or computers, requiring different types of activities and knowledge than grading freshman mathematics papers and (2) some different patterns of instruction including a higher percentage of lecture sections.

The following table of reported numbers of graduate teaching assistants (teaching assistants for 1980) with their principal teaching function is perhaps even more revealing than would be corresponding percentages. The numbers for which data are given for 1980 are extracted from the totals and percentages reported in 1980, since the actual numbers for 1980 are not available.

TABLE 3 - 5

NUMBER OF TEACHING ASSISTANTS FOR 1980 AND
GRADUATE TEACHING ASSISTANTS FOR 1985
BY PRINCIPAL TEACHING FUNCTION

	Teaching Own Class	Conducting Quiz/Recit. Sections	Paper Grading	Tutoring	Other
University					
Mathematics Depts.					
1980	2745	1592	604	439	55
1985	2368	2015	403	202	50
Statistics Depts.					
1980	44	229	153	120	0
1985	171	369	100	43	28
Computer Science Depts.					
1980	329	381	653	471	0
1985	629	453	402	192	70
Public 4-Year					
Mathematics Depts.					
1980	445	230	230	414	230
1985	913	852	187	125	0
Computer Science Depts.					
1980	23	0	51	15	0
1985	122	80	185	127	16
Private 4-Year					
Mathematics Depts.					
1980	81	219	277	577	0
1985	67	38	3	3	0

The universally higher numbers in the "paper grading" and "tutoring" functions for 1980 over 1985 (except for Public 4-Year Computer Science Departments with almost twice as many departments in 1985) strongly

suggest that many undergraduates assigned to these functions were counted as teaching assistants in 1980. The sum of the actual numbers in columns 1 and 2 for university mathematics departments shows a small gain from 1980 to 1985 in teaching assistants actually teaching rather than a small loss superficially suggested by gross data. The impressive five year gains in columns (1) and (2) for most public college and university categories indicate a substantially broader use of teaching assistants for teaching, consistent with the generally sizeable increases in part-time and non-professorial full-time faculties in these categories (compare with the figures in Table 2-4).

By comparing the 1980 and 1985 data and questions, it seems clear that some private colleges as well as public four-year colleges use some undergraduates for teaching functions.

It would be nice to have fairly reliable estimates of the percentage changes in the numbers of graduate teaching assistants in the various categories of departments for which we have data on the number of teaching assistants in 1980. Based on estimates from the "over 20%" figure of undergraduates among the 1980 teaching assistants and from an analysis of the principal teaching functions of teaching assistants in 1980 and 1985, it seems clear that:

(1) the number of graduate teaching assistants in university mathematics departments in 1985 was substantially the same as that in 1980;

(2) the number of graduate teaching assistants in university computer science departments who actually performed teaching functions increased by about 50% from 1980 to 1985, and;

(3) the number of mathematics department graduate teaching assistants in public four-year colleges who actually performed teaching functions more than doubled from 1980 to 1985.

In other categories the 1980 figures were sufficiently small and the procedures too uncertain to make meaningful estimates of percentage increases from 1980 to 1985.

With respect to the public four-year college computer science category, it should be noted that the number of departments went up 100% from 1980 to 1985.

WHAT DO GRADUATE TEACHING ASSISTANTS STUDY?

In the 1980 Survey report, it was stated that in university mathematics departments more than 20% of teaching assistants were not mathematics graduate students. The exact figure was not given, nor was there a breakdown into undergraduate or graduate students in another statement that "more than 20%" were in "other departments". Table 3-6 below gives information for graduate teaching assistants in 1985. Overall, almost all (92%) of the graduate teaching assistants are students in the department for which they teach and half of the rest are students in other mathematics or computer science departments.

TABLE 3 - 6

DEPARTMENTS IN WHICH GRADUATE TEACHING ASSISTANTS STUDY

1985

	Number	Percentage In Own Department	Percentage In Other Mathematics Or Computer Sci. Dept.
University			
Mathematics	5,038	91%	6%
Statistics	711	91%	2%
Computer Science	1,746	98%	2%
Public 4-Year			
Mathematics	2,077	86%	1%
Statistics	85	100%	0%
Computer Science	530	100%	0%
Private 4-Year			
Mathematics	111	92%	8%
Computer Science	30	100%	0%
Total	10,328		

The widely reported earlier use by state university mathematics departments of graduate teaching assistants who were students in engineering or other disciplines seems to have largely ended.

Since this Survey dealt with undergraduate phenomena including, of course, teaching assistants, but not with graduate education, per se, there was no attempt to identify numbers of graduate research assistants or associates. There was also, perhaps regrettably, no attempt to identify citizenship status of graduate teaching assistants. AMS, NSF and other studies address parts of this latter issue.

DEPARTMENTAL CONCERNS

As a new initiative to give a statistical base for possible new studies on the status of the profession in academe, the Survey included two lists of questions, one on professional activities of faculty and how they affect faculty advancement and/or salary decisions and the second on problems of the mid-80's as seen by department chairpersons. Each question had a scale of 0 to 5 with zero representing no importance and 5 representing major importance. The results were tabulated for all categories of institutions for both mathematics and computer science departments and for university statistics departments. The numbers shown in the remaining tables in this chapter are (1) the percentage of all departments giving a 4 or 5 response for the particular question and (2), in parentheses, the percentage giving a 0 or 1 response for the same question. The percentage giving a 2 or 3 response can be found by subtracting the sum of the two percentages given from 100. The difference in the two numbers given is a measure of the preponderance of departmental attitudes on the subject. Note that high percentages do not measure the intensity of feeling, as such, but rather the breadth of concern.

IMPORTANCE OF PROFESSIONAL ACTIVITIES

Table 3-7 gives the results of the questionnaire on the importance of various professional activities in faculty advancement and/or salary decisions by category of institution. The results confirm conventional wisdom, university departments value published research and colleges, particularly private colleges, value teaching performance. Service to the department or institution is much more commonly important to colleges than to universities. In universities, mathematics departments and statistics departments have remarkably similar priorities.

Generally the computer science department responses on professional activities were quite similar to the mathematics department responses. They are given separately in Chapter 4.

TABLE 3 - 7

IMPORTANCE OF PROFESSIONAL ACTIVITIES IN ADVANCEMENT AND/OR SALARY DECISIONS

	Mathematics			Stat.
	Univ.	Pu. 4-Yr.	Pr. 4-Yr.	Univ.
Classroom Teaching Performance	70 (3)	81 (2)	96 (4)	71 (6)
Published Research	96 (0)	70 (10)	26 (39)	100 (0)
Service to Department and/or University (College)	31 (5)	63 (5)	66 (0)	31 (11)
Talks at Profess. Mtgs.	42 (5)	49 (11)	13 (28)	25 (11)
Activities in Profess. Societies and/or Pub. Service	22 (8)	45 (4)	33 (9)	31 (6)
Supervision of Grad. Students	34 (7)	21 (32)	-------	81 (0)
Undergraduate/Grad. Advising	9 (22)	24 (20)	39 (12)	21 (21)
Years of Service	1 (52)	34 (29)	46 (16)	15 (47)
Expository and/or Pop. Articles	22 (13)	37 (14)	14 (40)	14 (19)
Textbook Writing	9 (35)	17 (35)	11 (58)	12 (50)

PROBLEMS OF THE MID-80'S

In the 23 questions on problems of the mid-80's there were several questions where the responses stood out significantly. The results for these questions are given separately in Table 3-8A. The remaining results are given in three tables, (1) those dealing with student issues, Table 3-8B, (2) those dealing with faculty issues, Table 3-8C and those dealing with support issues, Table 3-8D. We give the results in approximate order of decreasing importance as seen by departmental chairpersons. The concerns not commonly considered as major problems are almost as interesting as those considered important. Generally, those concerns identified as major problems are those which need addressing by the community. As to be expected, for some concerns there are wide variations reported among departments in the various types of universities or colleges and between departments in the mathematical and computer sciences. The responses for computer science are summarized separately in Chapter 4 in Tables 4-18 and 4-19A to D of this report. The heavy emphasis on salary and support issues reported in Table 3-8A means there is continuing pressure for upward salary adjustments and that there should be continuing pressure for better departmental support services. Clearly the larger community should be concerned with departmental support practices.

As in Table 3-7, the percentage of departments identifying the concerns as of major (minor) importance is given in Tables 3-8A to D.

TABLE 3 - 8A

MAJOR PROBLEMS

	Mathematics			Stat.
	Univ.	Pu. 4-Yr.	Pr. 4-Yr.	Univ.
Salary Levels/Patterns	66 (6)	69 (2)	60 (0)	64 (8)
Departmental Support Services (Travel, Secret. etc.)	61 (13)	62 (10)	36 (23)	70 (0)
Research Funding	71 (8)	45 (17)	17 (63)	51 (14)
Maintaining Faculty Vitality	54 (13)	54 (5)	41 (21)	48 (18)

TABLE 3 - 8B

STUDENT ISSUES

	Mathematics			Stat.
	Univ.	Pu. 4-Yr.	Pr. 4-Yr.	Univ.
Lack of Quality of Undergraduate Majors	38 (15)	62 (6)	39 (7)	31 (9)
Lack of Quantity of Undergraduate Majors	39 (18)	54 (20)	42 (9)	22 (21)
Lack of Quality of Department Graduate Students	50 (2)	44 (21)	------*	56 (14)
Lack of Quantity of Department Graduate Students	52 (14)	53 (24)	------*	55 (20)
Remediation	39 (28)	66 (5)	45 (17)	0 (42)
Class Size	52 (12)	39 (21)	21 (32)	60 (6)

* Since relatively few of the departments in this category have graduate programs, the responses are not given.

TABLE 3 - 8C

OTHER FACULTY ISSUES

	Mathematics			Stat.
	Univ.	Pu. 4-Yr.	Pr. 4-Yr.	Univ.
Teach. Load of Full-Time Fac.	44 (22)	59 (17)	59 (9)	40 (27)
The Need to Use Temporary Fac.	42 (18)	44 (28)	42 (31)	35 (32)
Promotion-Tenure Process Above Departmental Level	24 (47)	39 (26)	15 (29)	36 (22)
Advancing Age of Tenured Fac.	29 (24)	25 (31)	14 (39)	21 (41)
Lack of Experienced Senior Fac.	11 (55)	14 (48)	15 (51)	33 (52)
Losing Full-Time Faculty to Industry/Government	15 (48)	10 (64)	9 (65)	51 (34)

TABLE 3 - 8D

OTHER SUPPORT ISSUES

	Mathematics			Stat.
	Univ.	Pu. 4-Yr.	Pr. 4-Yr.	Univ.
Upgrading/Maint. of Computer Facilities	34 (21)	42 (29)	46 (33)	48 (9)
Office/Lab Facilities	45 (23)	30 (29)	19 (37)	50 (23)
Computer Facilities (Classroom)	38 (18)	37 (31)	40 (23)	39 (18)
Classroom Lab Facilities	41 (16)	22 (25)	26 (33)	29 (20)
Computer Facilities (Fac. Use)	31 (23)	33 (32)	25 (30)	39 (18)
Networking Facilities	26 (35)	30 (35)	16 (46)	27 (27)
Library: Holdings, Access, etc.	20 (46)	25 (35)	10 (43)	16 (40)