

Some Trends in the Career Paths Followed by Alumni of the MIT
Mechanical Engineering Department

By

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SUBMITTED TO THE DEPARTMENT OF MECHANICAL ENGINEERING
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE
OF

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING
AT THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

JUNE 2003

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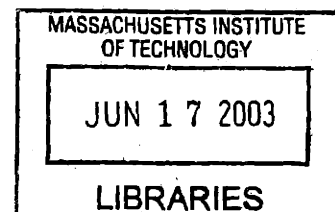
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Submitted to the Department of Mechanical Engineering
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Abstract

Data was collected in order to determine the career paths followed by graduates of MIT's mechanical engineering department. The data was obtained with the help of the Alumni Association of MIT. Data was obtained on current occupations for the graduating classes of 1967 through 1997. These occupations were sorted in to more general categories and then the categories were plotted in terms of percentage of graduates per year.

Anomalies were found over the initial study of every fifth class from 1972 through 1997. An expansion was made in the data analyzed to every other year from the class of 1967 through 1997 as well as every year from 1969 through 1974. Using this more comprehensive data set, it was concluded that most graduates, approximately two-thirds of each class, pursue careers in either engineering or management. Over the years following graduation, the percentage of engineers decreases while the percentage of managers increases.

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Introduction and Background

The general purpose of this research is to determine what career paths graduates of the MIT mechanical engineering department follow. In order to determine this, every fifth graduating class beginning in 1997 was examined. For each class, the occupations of the graduates were organized into a spreadsheet and then categorized. The information on each class' career paths was plotted and compared with the other classes. From this comparison, some conclusions were drawn about the general career patterns of the graduates. In total, 1665 graduates were studied and of these, 999 provided occupational information useful for this research. The number of graduates and respondents are as follows.

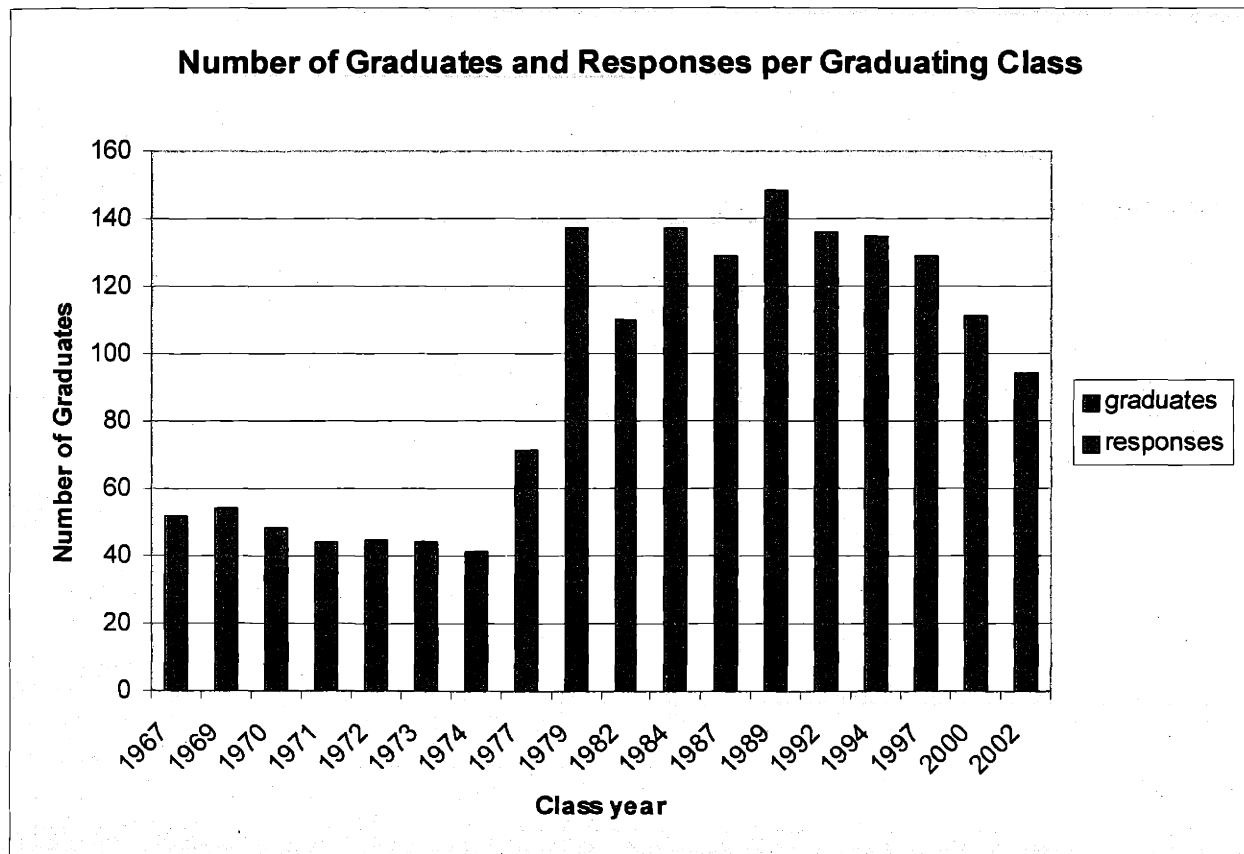


Figure 1 Number of graduates and respondents per graduating class 1967 through 2002

The impetus behind this research is to examine the career patterns in light of the courses offered by the mechanical engineering department. It can be argued that the mechanical engineering department should gear its courses to prepare the students for the peak of their careers. Students usually settle into their peak career approximately 10 years after graduation.

Research Methods

The data for this research was all gained with the help of the MIT Alumni Association. An initial meeting took place October 9, 2002 after which I signed up for the Infinite Connection. The Infinite Connection is an internet site that allows MIT students to register and then access information on MIT alumni. The site enables the user to search by a variety of fields including graduating year and major. Using these two fields I began by accessing the information on the graduating class of 1997. However, there are access limitations on the Infinite Connection. Students can only access information on 20 alumni in a 24 hour period. With 133 graduates in the class of 1997, it took approximately one month to gather and analyze the information on this class. For the analysis, information on each graduates name, location, employer, and occupation were taken and placed in a spreadsheet. This information was then sorted into occupational groupings and plotted. Not all graduates included all of the information mentioned; approximately 60% provided their occupation. This method was then used for the class of 1992 as well.

Although the initial method was functional, it was not efficient. It took approximately two months to complete the analysis of two graduating classes. On February 14, 2003, another meeting was held with the Alumni Association to see if anything could be done to remove the limitations on the Infinite Connection. The Alumni Association agreed to send me the information directly in a spreadsheet. It took approximately two weeks for the information on the classes of 1987, 1982, 1977, and 1972 to be sent to me. After this it took approximately another three weeks to do the analysis. After the analysis was complete, an anomaly was noted in the career patterns. This necessitated a request to the Alumni Association for the data on all of the graduating classes from 1967 to 1997. It took approximately a week for me to get the complete data set. I eventually decided to add the classes of 1994, 1989, 1984, 1979, 1974, 1973, 1971, 1970, 1969, and 1967 to my data set. This method of data gathering could be repeated again by asking the Alumni Association for information on other years.

The data from both data gathering methods started in spreadsheets organized by the graduate's last name. I then proceeded to sort the spreadsheets using the Microsoft Excel sort function to organizing them in terms of the information I needed for my analysis. I therefore sorted the data by graduating year then occupation. The spreadsheets from the initial method of obtaining data from the Alumni website were further organized into those who provided occupation information, those who provided enough information to contact for further work if necessary, and those with no contact information. This was only done for these two classes because they were the first two

classes so it was necessary to learn how much useful information I would obtain. If I had felt I did not have enough of a response from the classes to make my findings statistically meaningful, if only 25% of each class responded for example, then I intended to use the contact information to do a survey of all those whose occupations I did not have to increase my database. However, since 59% of the class of 1997 and 56% of the class of 1992 provided the occupation information I needed, I decided that I would not contact any alumni directly and for the rest of the classes merely sorted the spreadsheet into those providing an occupation and those not.

Once I had the data sorted into those who provided sufficient information and those who did not, I copied and pasted the occupation information and an identifying number into a separate spreadsheet. The identifying number was a way to keep track of which alumni's occupation was which in case I needed to go back and look at their complete information. As the analysis progressed, I found it easier to cut and paste all of the information on the graduates who provided an occupation into the separate spreadsheet. Once I had the graduates with occupations separated out, I proceeded to sort the occupations into categories. The occupations provided by graduates generally came in the form of a job title such as "CEO", "senior mechanical engineer", or "principal". As I was looking for the career patterns of the graduates, I needed to match the job titles to a particular occupation and then sort the occupations into categories. For example, the job title of CEO would fall under the occupation of management and I specifically sorted it into the category of upper level management. In order to sort some graduates, it was necessary to look at their employer information and do background research on the employer in order to determine what exactly the graduate's occupation was. The most common titles that required background research were "principal" and "partner". I found that these titles generally referred to a member of a consulting firm, although partner occasionally referred to a partner in a law firm but not until the earlier graduating classes. After going through a few classes of job sorting, I found that most classes have eight categories. The two largest are engineering and management. I divided these two categories into sub-categories since a few distinct ones seemed relevant to my work. Engineering was divided into general, design, and engineering management. I initially used senior engineering instead of engineering management but I decided that senior engineers were more in the general category where engineering managers were more of a distinct sub-category. Management was divided into general, upper level, and founder/self employed. These sub-categories are noted on the class bar charts, however, only the total engineering and management categories are noted in the final analysis and plot. The other smaller categories are: software/IS, consultant, attorney, doctor, academia, and other. The other category contains those graduates that have occupations

that do not appear consistently such as fashion designer or elementary school teacher. During the more recent graduating classes, the category of student is also present. My reasoning for using these categories is that the seven specified categories appeared consistently over the graduating classes and the eighth category of other is allowed to contain those who do not fit in the other seven.

The final step of data analysis was to plot the results of the job sort. I did this by counting the number of graduates in a class in each occupational category and then using an Excel bar chart to plot the category totals all together. The bar charts of the different graduating classes were then compared and the changes in the relationships between the numbers of graduates in the various occupational categories were noted. The relationships over time of the occupations will be discussed later in the report.

Results

The final amount of information obtained is very large. In order to facilitate reader comprehension, I am going to go over a sample class set of data in detail and then go into the more general data analysis.

The sample class is that of 1992. Due to restrictions on alumni information, I cannot include the initial spreadsheet with names, contact information, and job information for all of the alumni in this year. I will therefore begin with the second step in the data process; the sorted, numbered spreadsheet of all the alumni in 1992 who provided job information. The alumni were numbered in order to be able to reference their original information. This back-referencing was needed when the alumni were sorted into occupational groups because some of the job titles given did not directly indicate the occupation. For this class, 54 alumni did not provide job information, therefore the spreadsheet begins at number 55.

55	Sr project manager	89	IP Counsel
56	Toyologist	90	Engineer
57	Writer/director/producer	91	Sr engagement manager
58	Director of engineering	92	Sr member technical staff
59	Development engineer	93	Director revenue management
60	Family physician	94	Attorney
61	Neurosurgery resident	95	Christian Science practitioner
62	Management consultant	96	Design engineer
63	Principal tech support	97	Manager, advanced tech
64	Co-founder	98	Sr Engineer
65	Physician	99	Product developer, inventor
66	Staff research engineer	100	Attending physician
67	Staff associate	101	Engineering program manager

68	Graduate student	102	Sr Software engineer
69	Sr controls engineer	103	Software product manager
70	Manager	104	Sr SW/HW engineer
71	Engineer	105	Application development engineer
72	Product line manager	106	Engineer
73	Associate	107	Mechanical systems engineer
74	Project manager	108	Instructor
75	Sr Engineer	109	Engineer
76	Sr project engineer	110	Blackbelt, ACGTT
77	Physician	111	Post doctoral associate
78	President	112	Sr product engineer
79	Sr product development engineer	113	Assistant professor
80	Vice president	114	Founder & project engineer
81	Engineer	115	Anesthesiology resident
82	Director	116	President, Stanely assembly tech.
83	Investment manager	117	Projektlieferer
84	Manufacturing practice associate	118	Group controller
85	President and CEO	119	Sr manager
86	Outreach coordinator	120	Strategic program manager
87	Engineering consultant	121	Product development engineer
88	Product marketing manager	122	Sr Engineer

Table 1 1992 Data Sort, occupations and identifying numbers

The initial spreadsheet was sorted into those who provided occupation information and those who did not. Those who did provide information were then separated, as shown above, and only the identifying number and occupation were listed. This separated list was then sorted into job categories.

Engineer		Engineering manager	
Development engineer	59	Project manager	74
Staff research engineer	66	Sr project manager	55
Engineer	71	Manager, advanced tech	97
Engineer	81	Total	3
Engineer	90		
Product developer, inventor	99	Design	
Application development engineer	105	Design engineer	96
Engineer	106	Total	1
Mechanical systems engineer	107		
Engineer	109		
Blackbelt, ACGTT	110		
Projektlieferer	117	Manager	
Product development engineer	121	Management consultant	62
Sr Engineer	122	Manager	70
Sr product engineer	112	Product line manager	72
Sr Engineer	75	Product marketing manager	88

Sr project engineer	76	Sr engagement manager	91
Sr controls engineer	69	Software product manager	103
Sr product development engineer	79	Group controller	118
Sr member technical staff	92	Sr manager	119
Sr Engineer	98	Strategic program manager	120
Total	21	Total	9
Upper level		Founder & project engineer	114
President	78	Co-founder	64
Director of engineering	58	Total	2
Vice president	80	Consultant	
Director	82	Engineering consultant	87
President and CEO	85	Associate	73
Director revenue management	93	Manufacturing practice associate	84
Engineering program manager	101	Total	3
President, Stanely assembly tech.	116	Doctor	
Total	8	Anesthesiology resident	115
Software/IS		Attending physician	100
Sr Software engineer	102	Physician	77
Principal tech support	63	Family physician	60
Sr SW/HW engineer	104	Neurosurgery resident	61
Total	3	Physician	65
Academia		Total	6
Assistant professor	113	Attorney	
Instructor	108	IP Counsel	89
Total	2	Attorney	94
Other		Total	2
Toyologist	56	Student	
Writer/director/producer	57	Post doctoral associate	111
Staff associate	67	Graduate student	68
Investment manager	83	Total	2
Outreach coordinator	86		
Christian Science practitioner	95		
Total	6		

Table 2 1992 Data Categorization, job sort and count with identifying numbers

The number of graduates in each job category was totaled in the spreadsheet shown above. This data was then linked into another spreadsheet and plotted.

	number	percent	
Engineer	21	30.88%	36.76%
Engineering manager	3	4.41%	
Design engineer	1	1.47%	
Manager	9	13.24%	27.94%
Upper level manager	8	11.76%	
Founder	2	2.94%	
Software/IS	3	4.41%	
Consultant	3	4.41%	
Doctor	6	8.82%	
Attorney	2	2.94%	
Academia	2	2.94%	
Student	2	2.94%	
Other/unknown	6	8.82%	
Total	68	100.00%	

Table 3 1992 Data Plot, values for plot

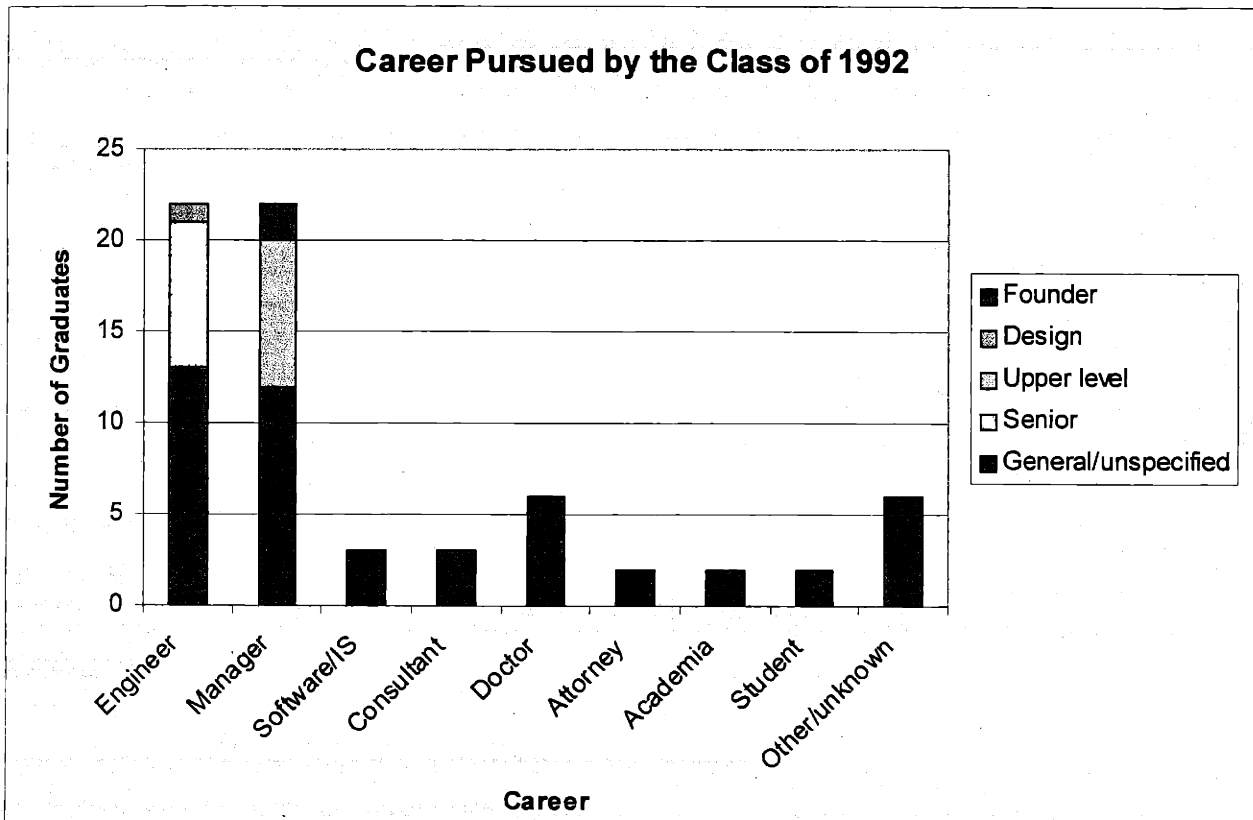


Figure 2 1992 Data Plot, plot of careers for class of 1992

The same spreadsheets and plots were done for every graduating class I studied. When all of the classes were completed, I then examined the resulting plots to see what trends emerged. The initial data for 1997, 1992, 1987, 1982, 1977, and 1972 was plotted together as follows.

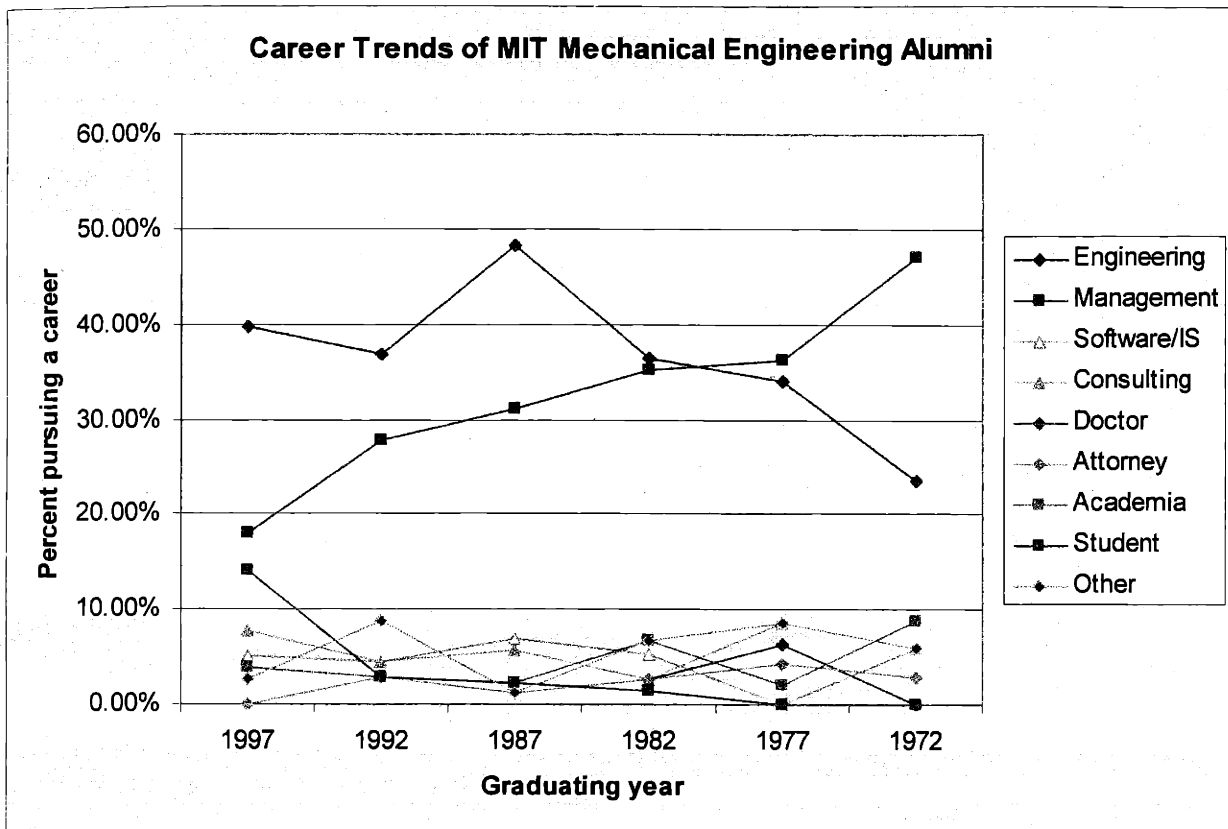


Figure 3 Career Trends 1972 through 1997, initial graph of trends

This plot shows that the majority of mechanical engineering graduates pursue either engineering or management. Further, the percentage of graduates in engineering drops from approximately 40% to 20% from 1997 to 1972 while the percentage of managers rises from approximately 20% to 40%. However, the large peak in engineers in 1987 and the large drop in engineers in 1972 disturbed me. I was hesitant in making any conclusions based on this data since there were only six years and two anomalies had occurred in those six years.

After requesting the complete data for 1967 through 2002 from the Alumni Association, I decided to increase the frequency of my sampling and to

do a larger study around one of the anomalies. I then sorted and plotted the data for 1994, 1989, 1984, 1979, 1974, 1973, 1971, 1969, and 1967. I hoped that the more frequent sampling would enable me to be more sure of my results and that a closer look into the 1972 anomaly would reveal something further about the nature of the variation.

The addition of the new data showed a greater fluctuation in the trend line but still the same general trends. I concluded that the two anomalies were likely part of a normal fluctuation in the career patterns. Since the trends remained after the added research, I felt I had achieved enough to draw conclusions based on the data. The graph of the final data set is as follows.

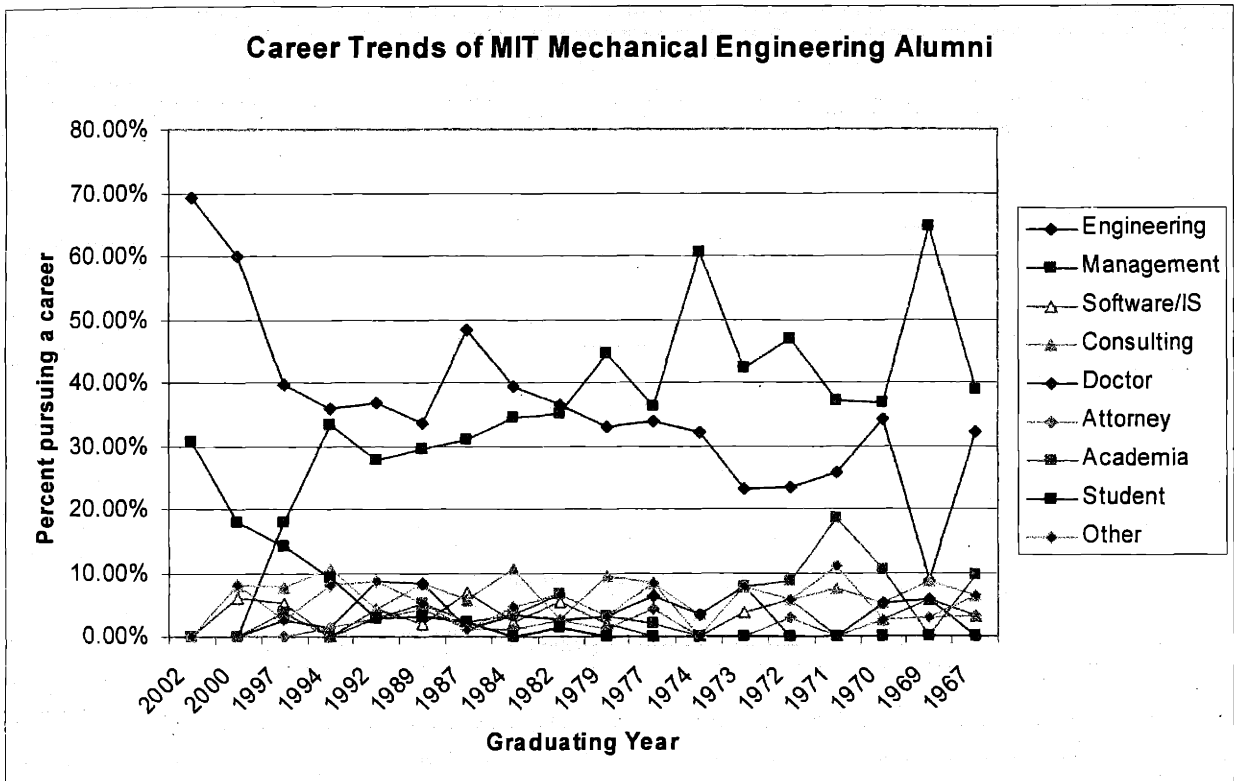


Figure 4 Career Trends 1967 through 2002, final graph of trends

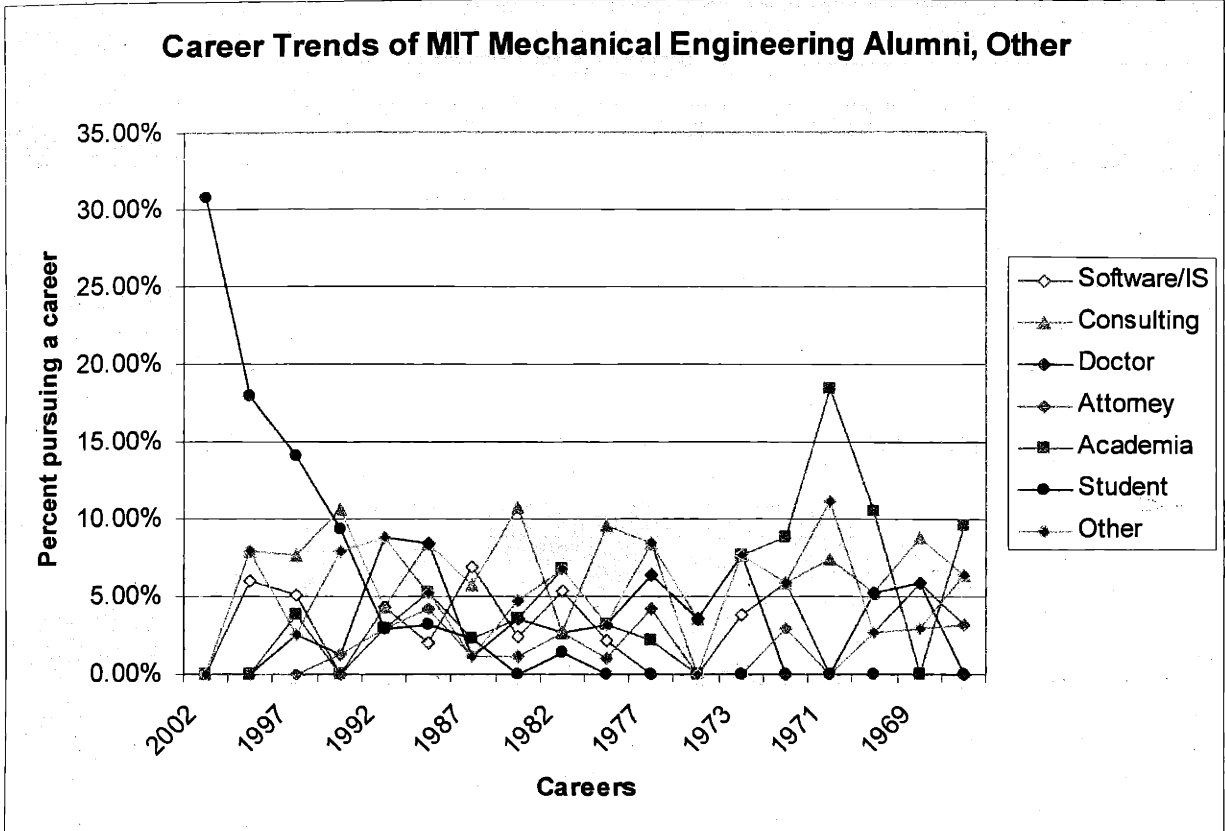


Figure 5 Career trends 1967 through 2002; expansion of other categories, non engineering and management

Some basic career path trends are evidenced in the final graph. Most, approximately two-thirds, of the graduates of the mechanical engineering department pursue either engineering or management. The trend over the years is for approximately twice as most graduates to begin as engineers and none in management. Ten years after graduation, the time at which it can be said students are settled into a career, approximately 37% of the alumni are in engineering versus 28% in management. After approximately twenty years, the number of engineers is roughly equal to that of managers. After this point, the number of managers continues to rise slightly and the number of engineers continues to decline slightly such that, after approximately thirty years, the number of managers is somewhat greater than that of engineers. It seems that the trend is less radical than was assumed from the original 1997 through 1967 data. The more comprehensive data set shows that the increase in managers and decrease in engineers is relatively slow after 10 years past graduation. The large change noted in the earlier results is likely due to the large peaks in the graduating class of 1972 and the lack of data points. The

other third of the graduates consistently follow a small number of other occupations.

Conclusions

As stated previously, the general trends found from this research are that most, approximately, two-thirds of MIT mechanical engineering graduates go into either engineering or management and that over the years the number of alumni in management increases while the number in engineering decreases. Over the years, the percentage of graduates in each occupation does fluctuate so the trend lines are not flat. Since enough data was studied in this research for a reasonable level of confidence in the results to be held, I feel that the trends still hold in spite of the fluctuation. The final stacked percentage graph of the trends is as follows.

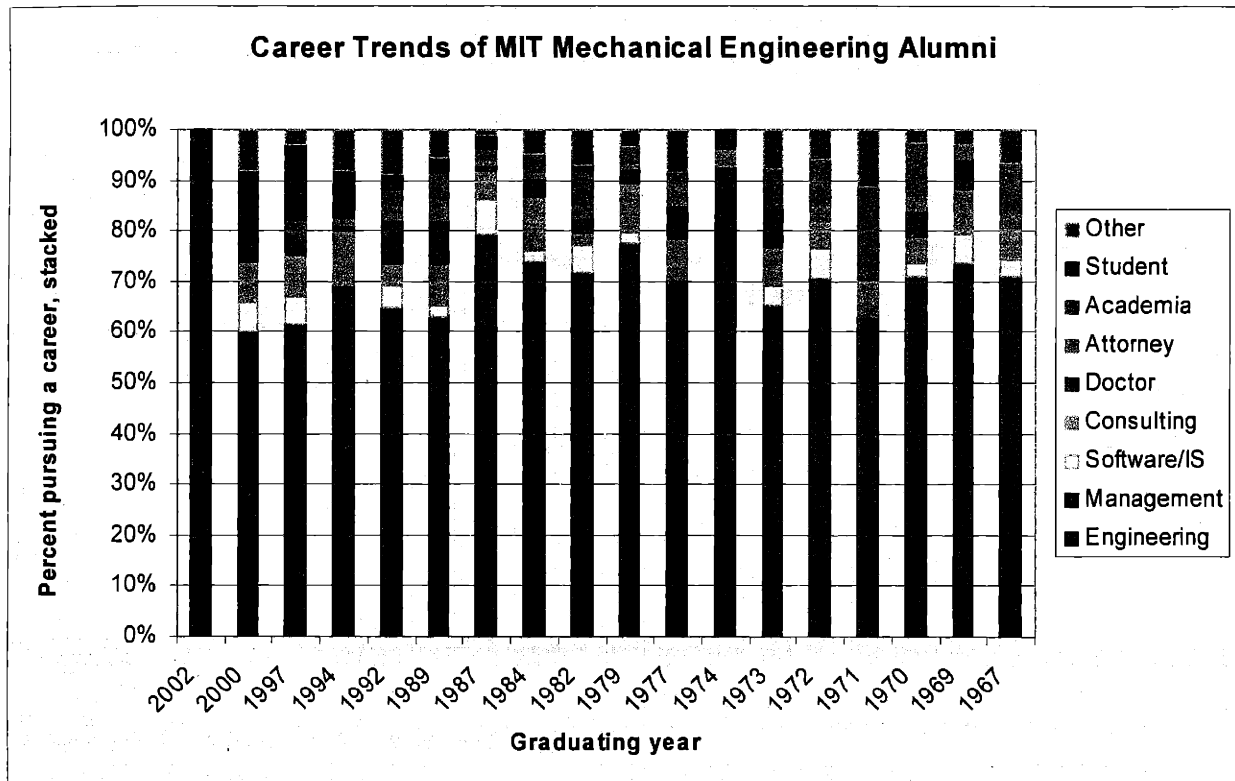


Figure 6 Career trends 1967 through 1997, final graph with stacked percentages

If it is assumed that the graduates reach their peak career around ten years after graduation, the data shows that by that point approximately one-third of the graduates are managers, one-third are engineers, and the remaining third are in a small variety of other occupations. This result could be interpreted in various ways by those looking for information on where MIT

be interpreted in various ways by those looking for information on where MIT mechanical engineering graduates go after graduation and how to best prepare them. It could be viewed that since so many graduates do not stay in engineering, more coursework should be flexible to allow them to pursue their other interests. On the other hand, it could be said that since the graduates are already following on these career paths with the current coursework, no change is necessary.

As I am not an expert on course evaluation and planning, I will leave this matter to those better suited. The research to this point is a good beginning at determining what careers MIT mechanical engineering graduates pursue and how to best prepare them for these careers. However, there are some possible biases in the methods used in the research. Most notable are the occupations missing from the occupational categories. There are no unemployed nor are there any home makers/stay at home spouses. These occupations are likely held by some members of the classes studied. It is possible that the alumni with these occupations choose not to give information. This could imply that the results are "top heavy", meaning there is a larger percentage of higher prestige occupations, such as CEO or patent counsel, represented in the results than is true for the class. However, with the amount of data analyzed, I still feel the conclusions drawn are worthwhile. As with any research, more could still be done. A more accurate determination of actual career paths could be made by researching what careers particular alumni have held over the years. Also, more research could be done into careers pursued by women in the department versus men. This research provides a good general basis for any further work in this area.

Appendices

The following are the plots of each graduating year's career data. These are included in the appendices so that the reader may reference them to better understand the information in each graduating class.

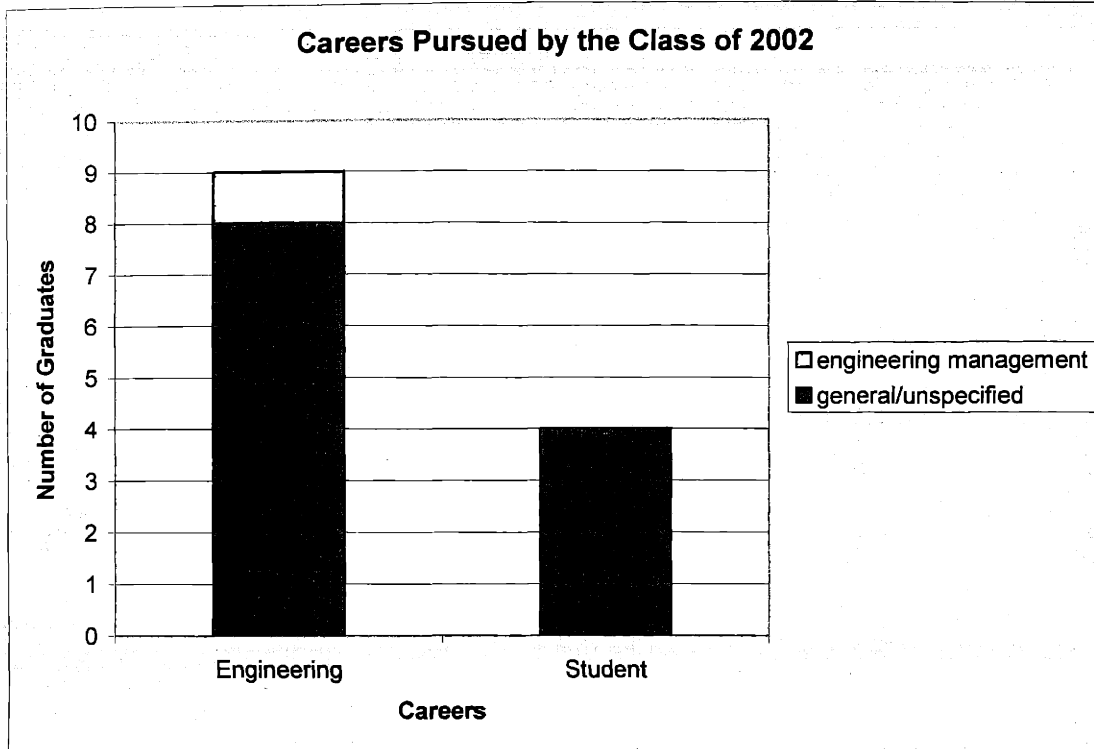


Figure 7 2002 Data Plot, plot of careers for class of 2002

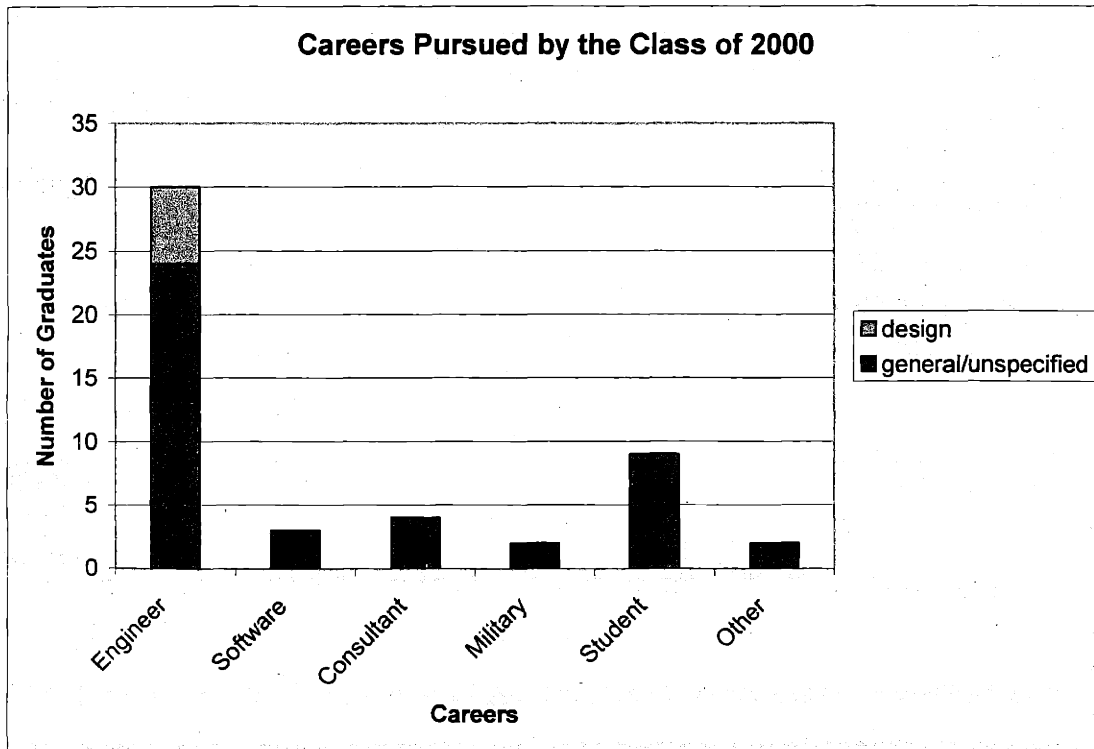


Figure 8 2000 Data Plot, plot of careers for class of 2000

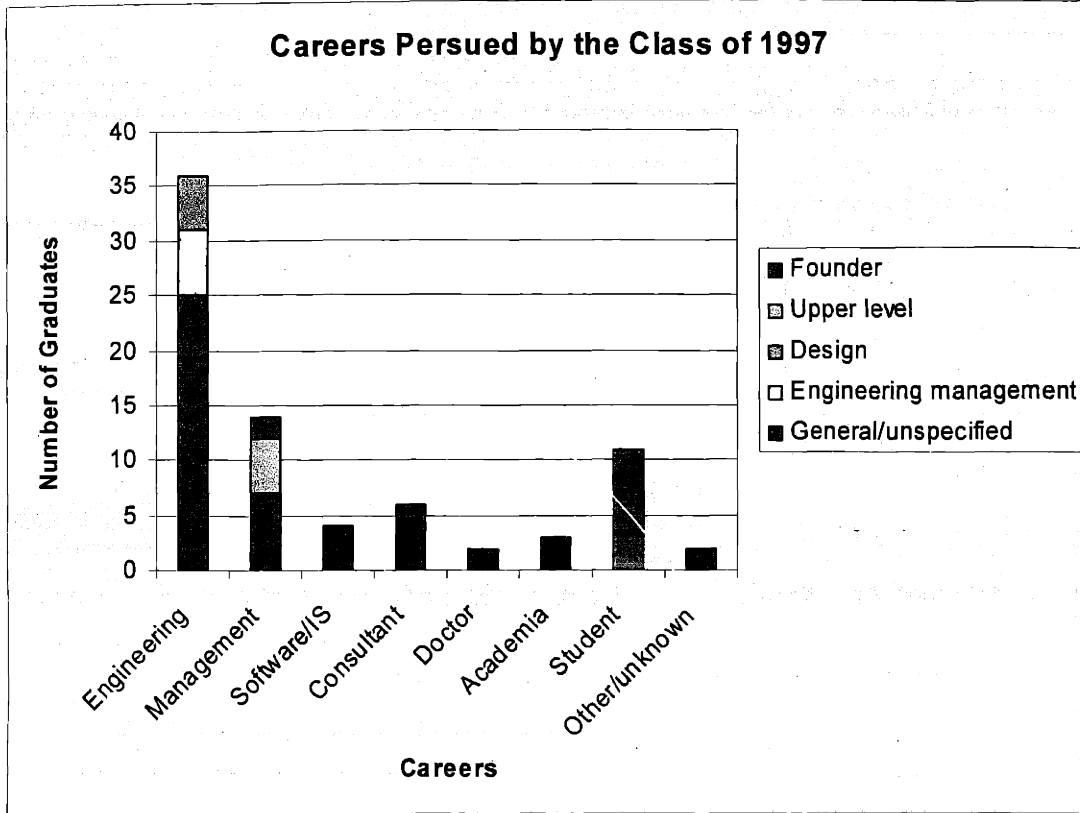


Figure 9 1997 Data Plot, plot of careers for class of 1997

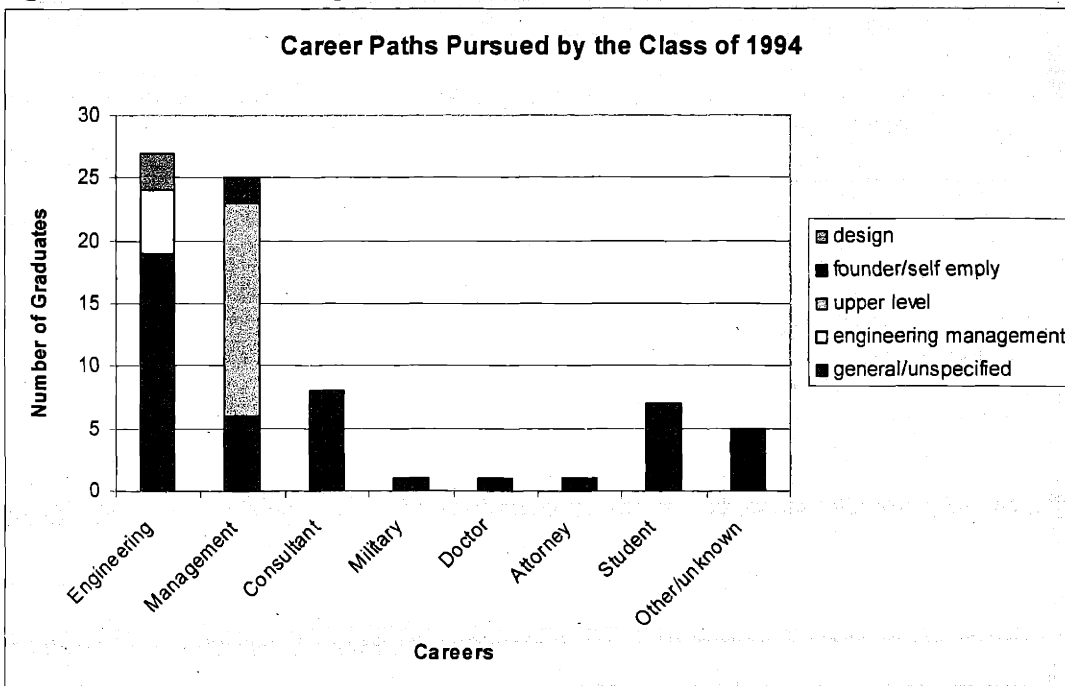


Figure 10 1994 Data Plot, plot of careers for class of 1994

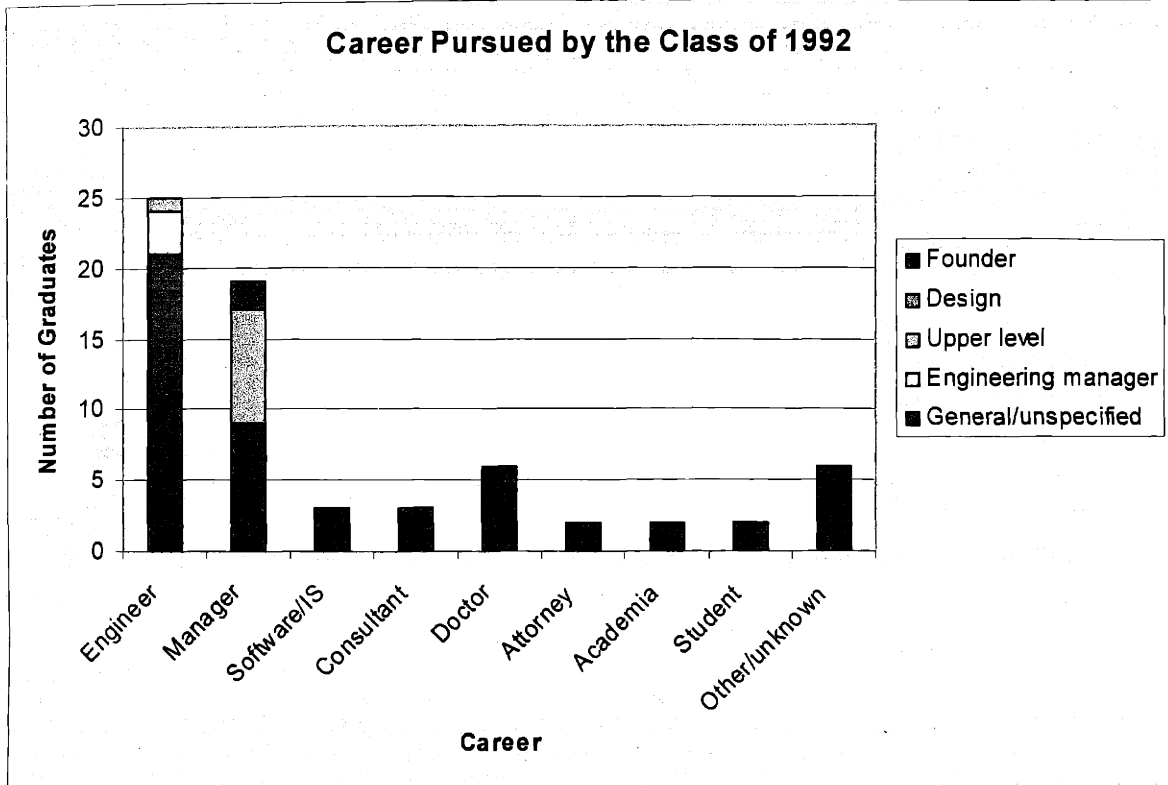


Figure 11 1992 Data Plot, plot of careers for class of 1992

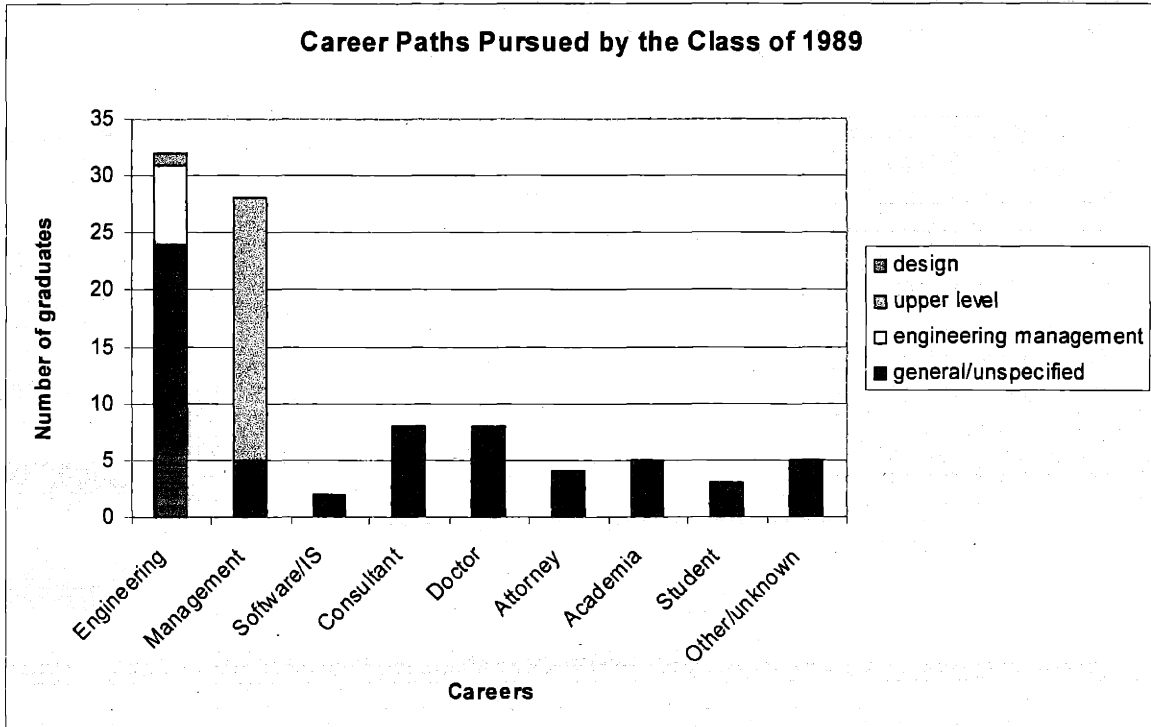


Figure 12 1989 Data Plot, plot of careers for class of 1989

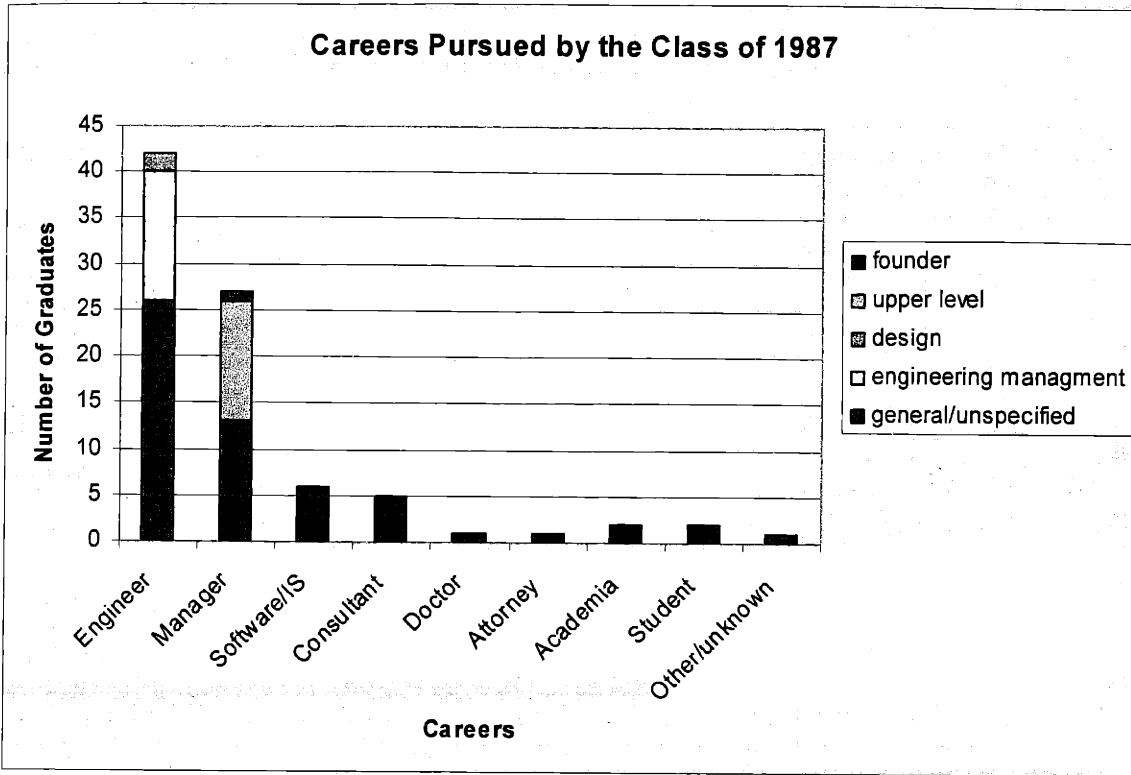


Figure 13 1987 Data Plot, plot of careers for class of 1987

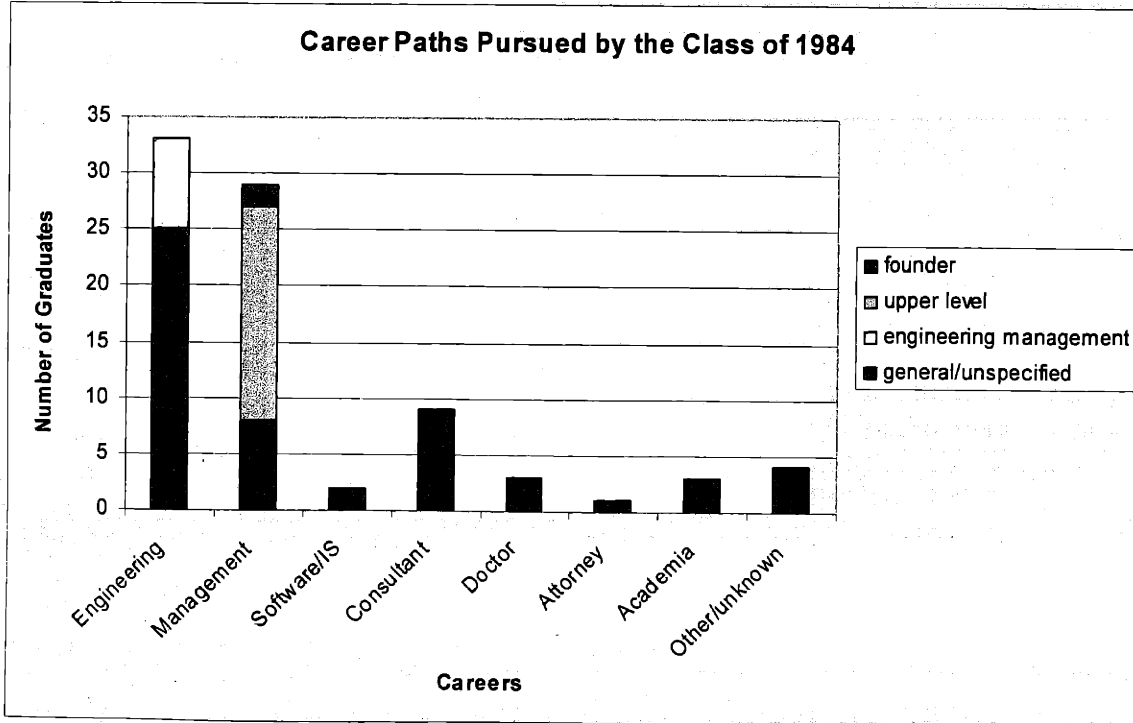


Figure 14 1984 Data Plot, plot of careers for class of 1984

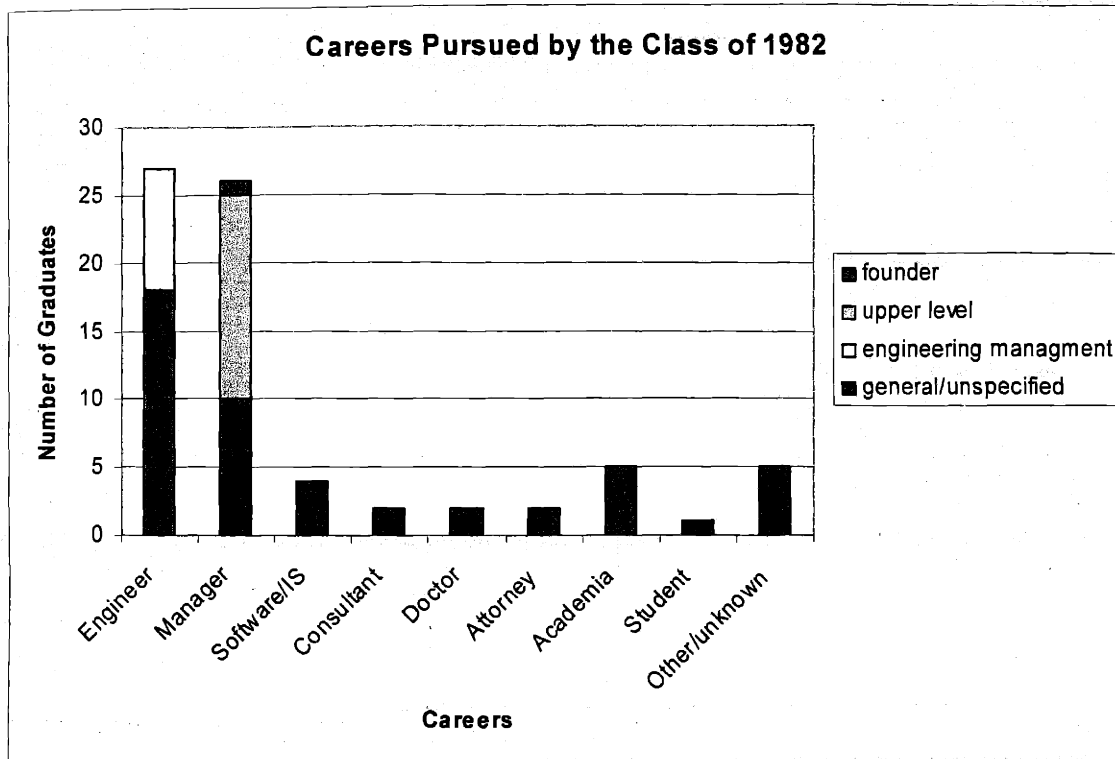


Figure 15 1982 Data Plot, plot of careers for class of 1982

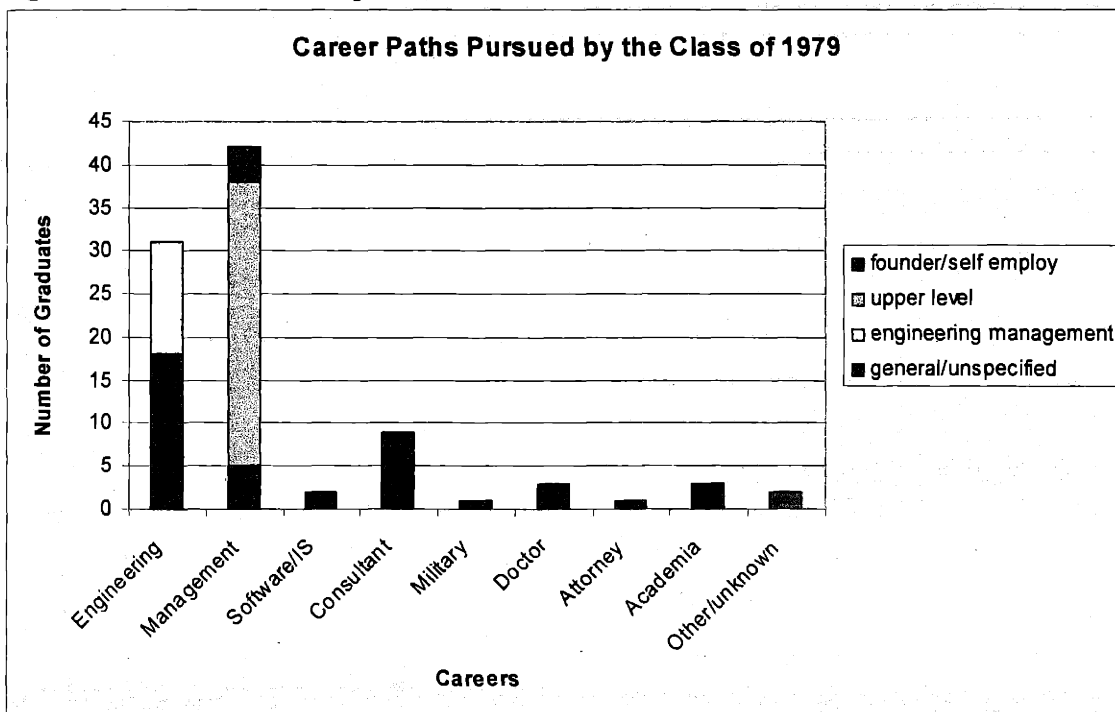


Figure 16 1979 Data Plot, plot of careers for class of 1979

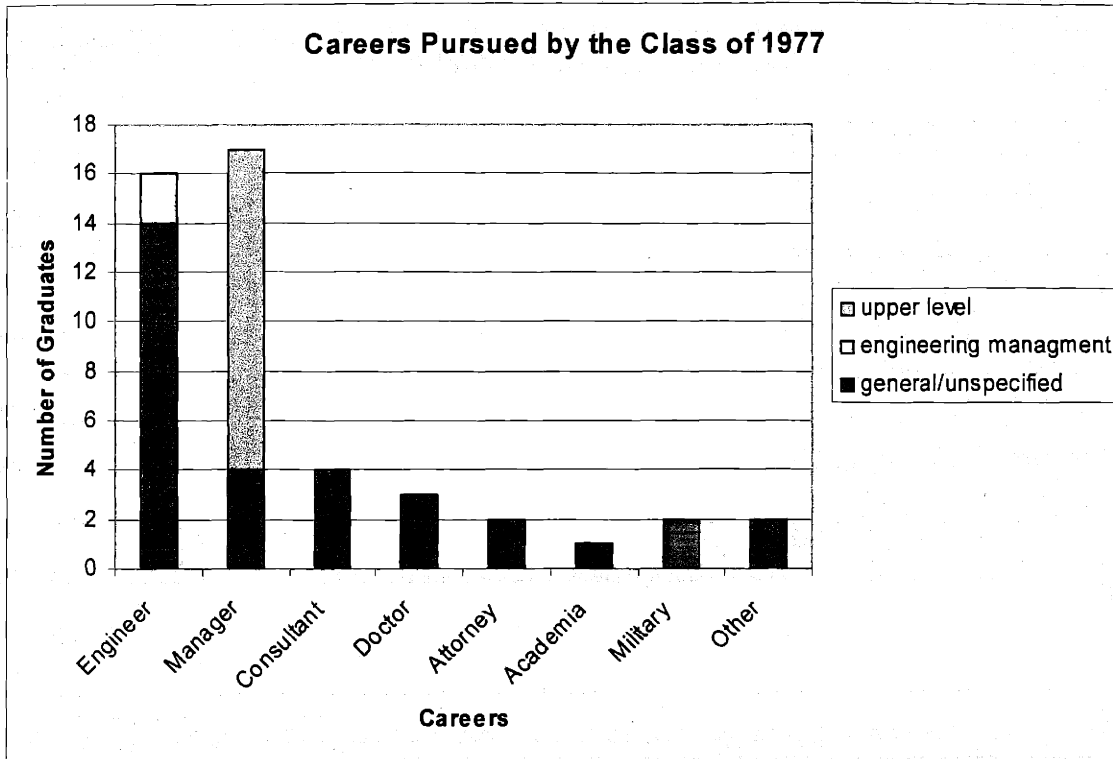


Figure 17 1977 Data Plot, plot of careers for class of 1977

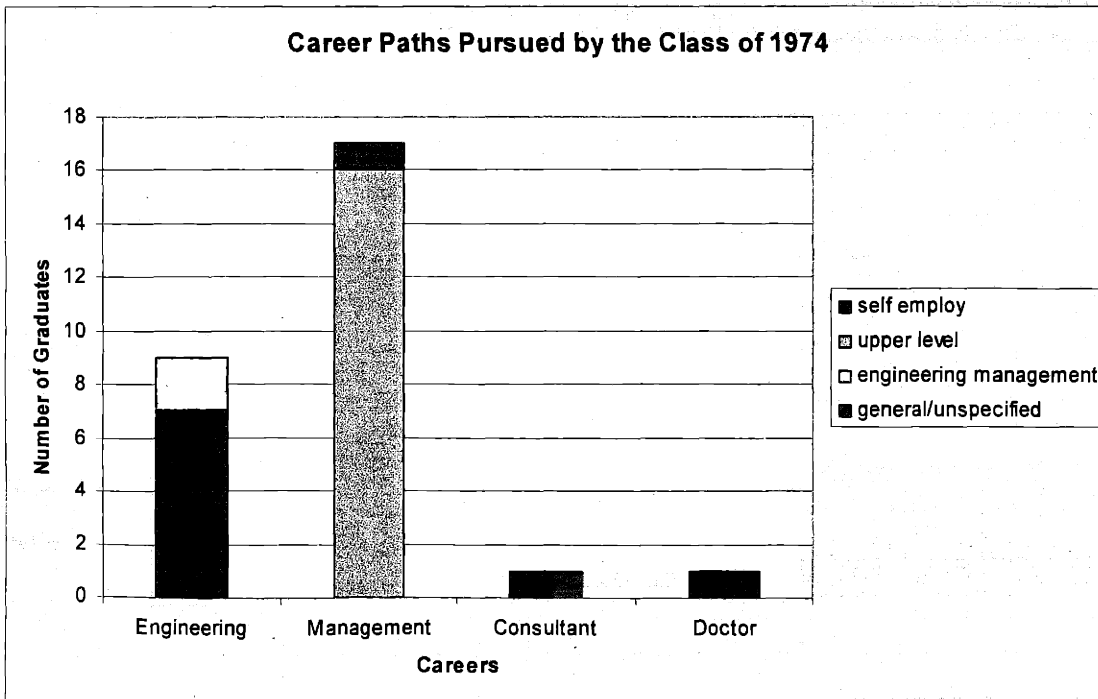


Figure 18 1974 Data Plot, plot of careers for class of 1974

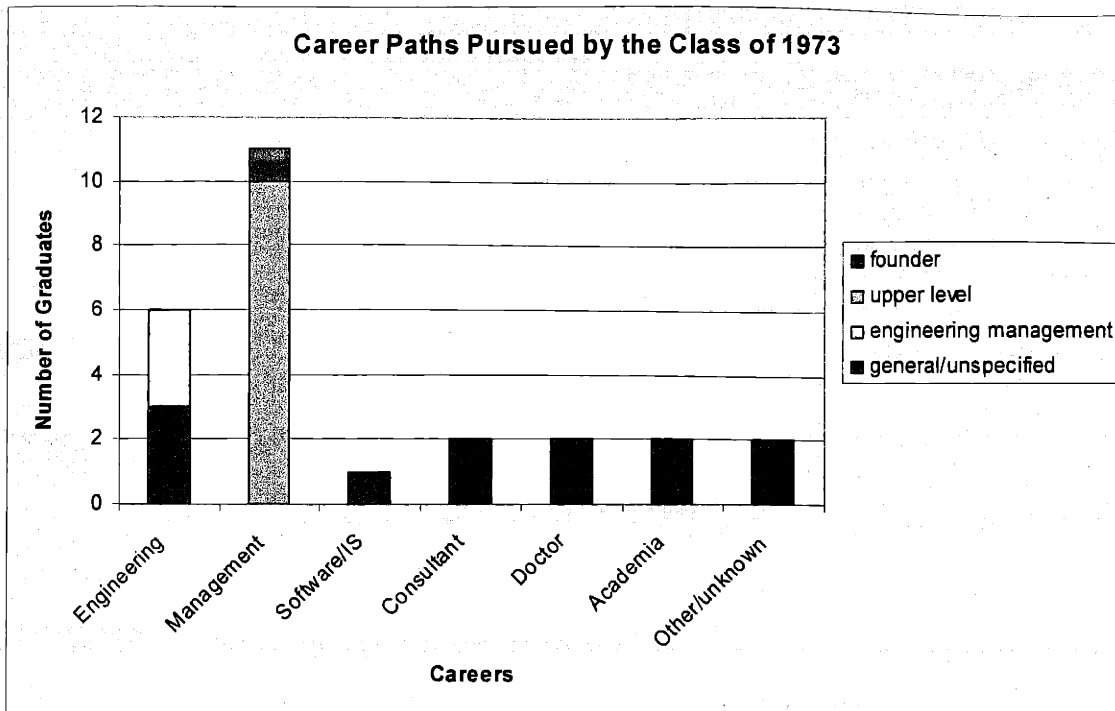


Figure 19 1973 Data Plot, plot of careers for class of 1972

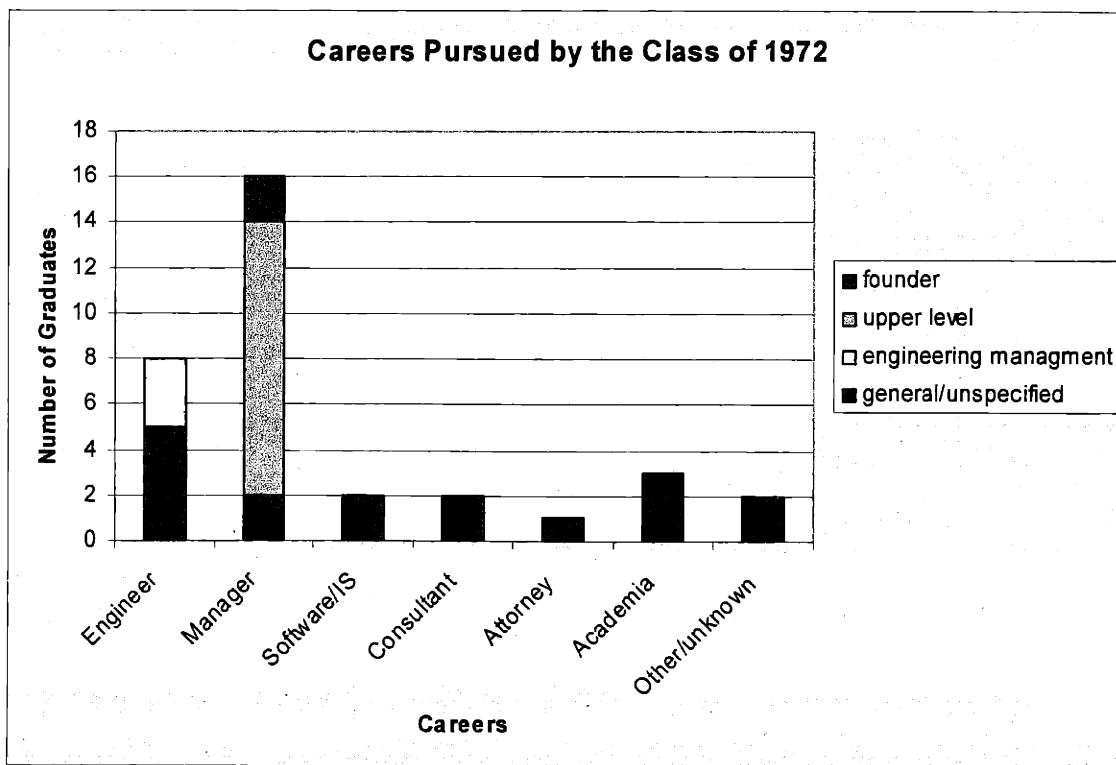


Figure 20 1972 Data Plot, plot of careers for class of 1972

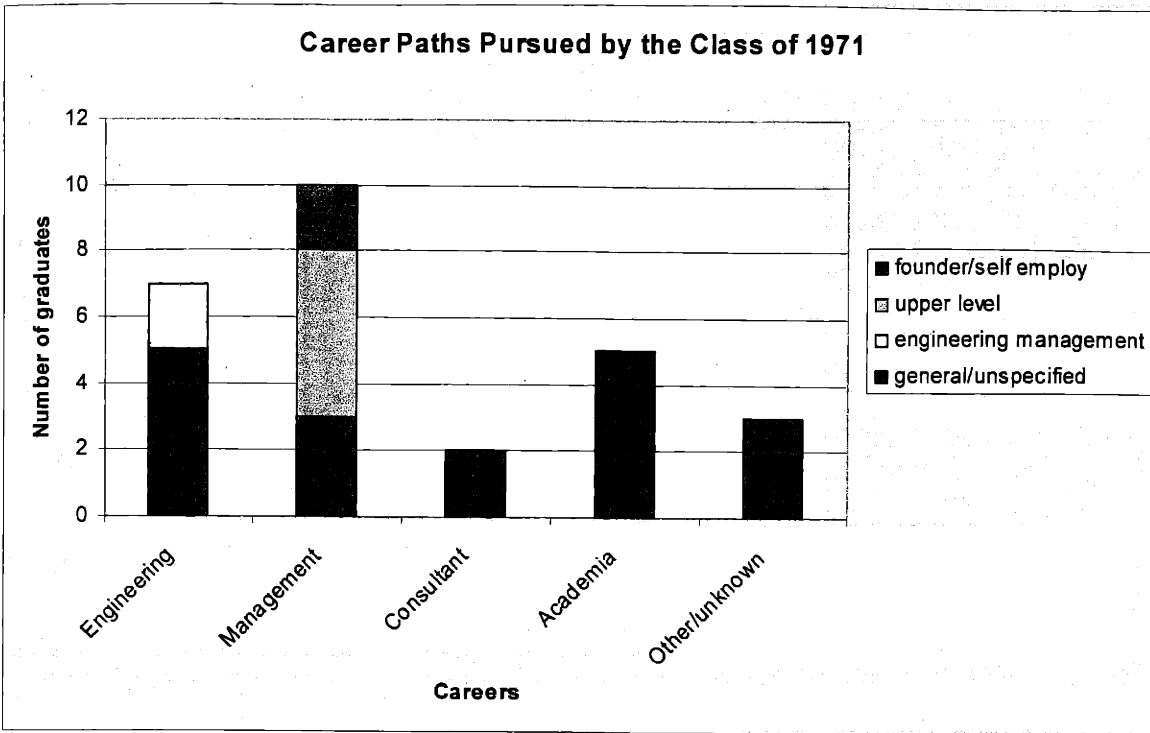


Figure 21 1971 Data Plot, plot of careers for class of 1971

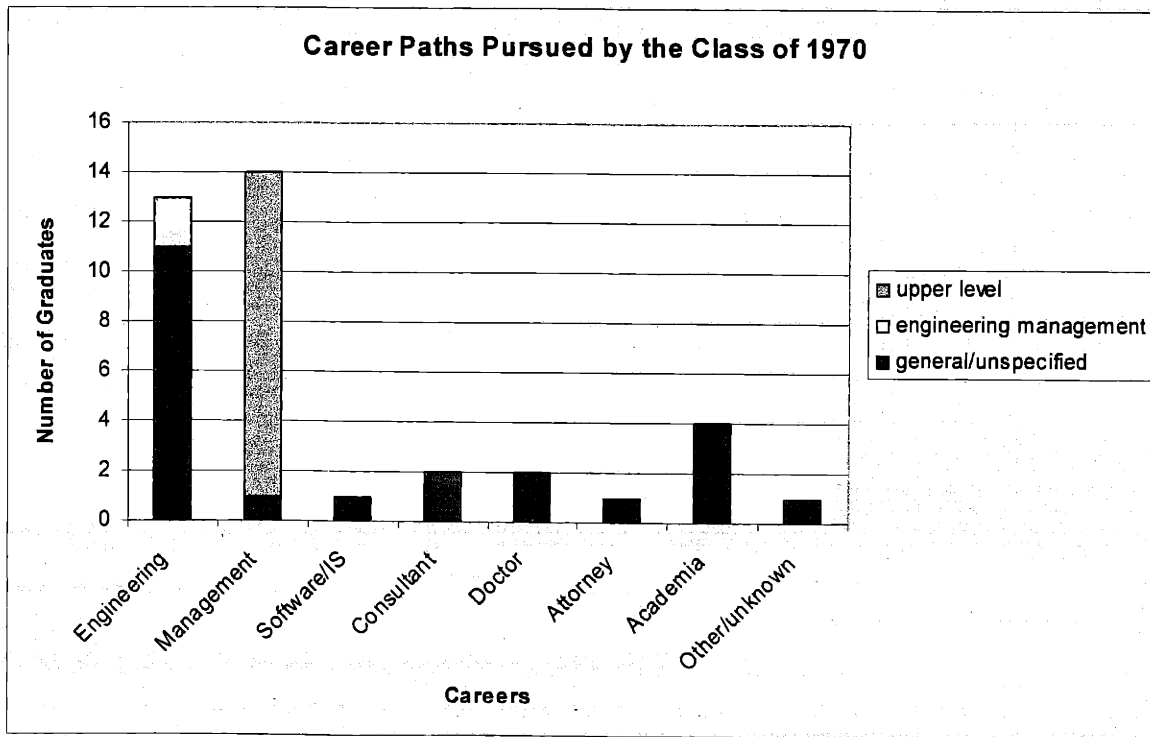


Figure 22 1970 Data Plot, plot of careers for class of 1970

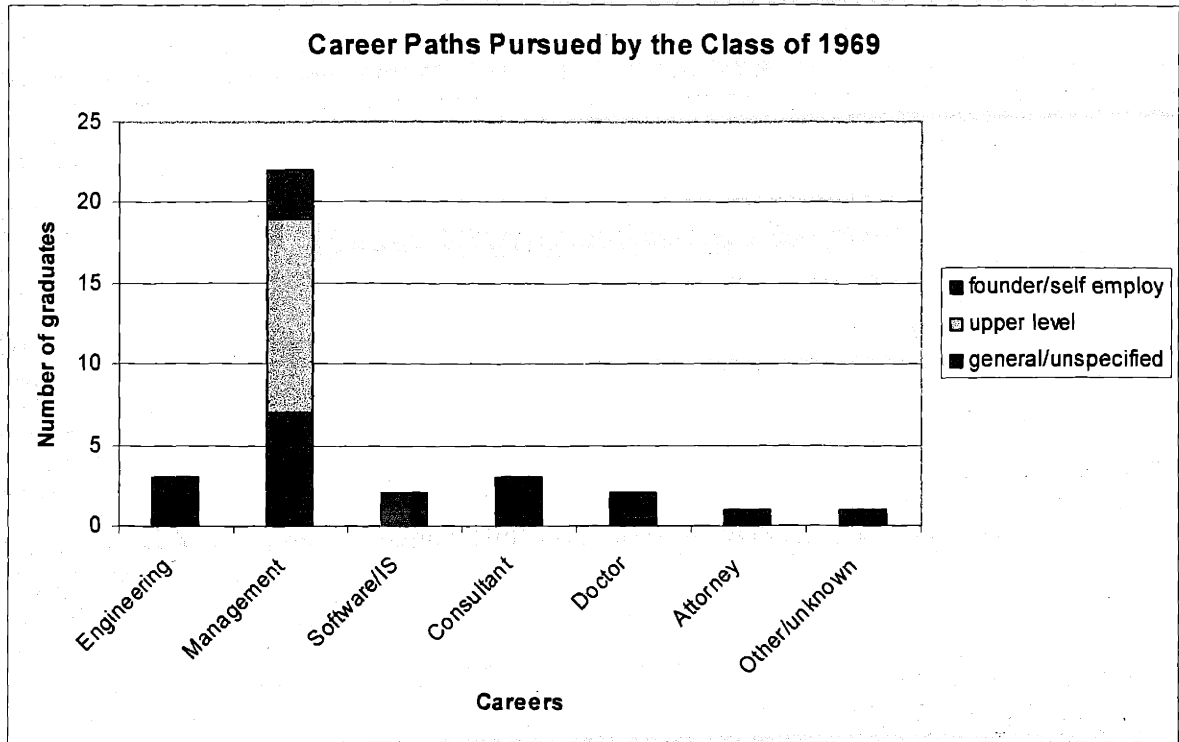


Figure 23 1969 Data Plot, plot of careers for class of 1969

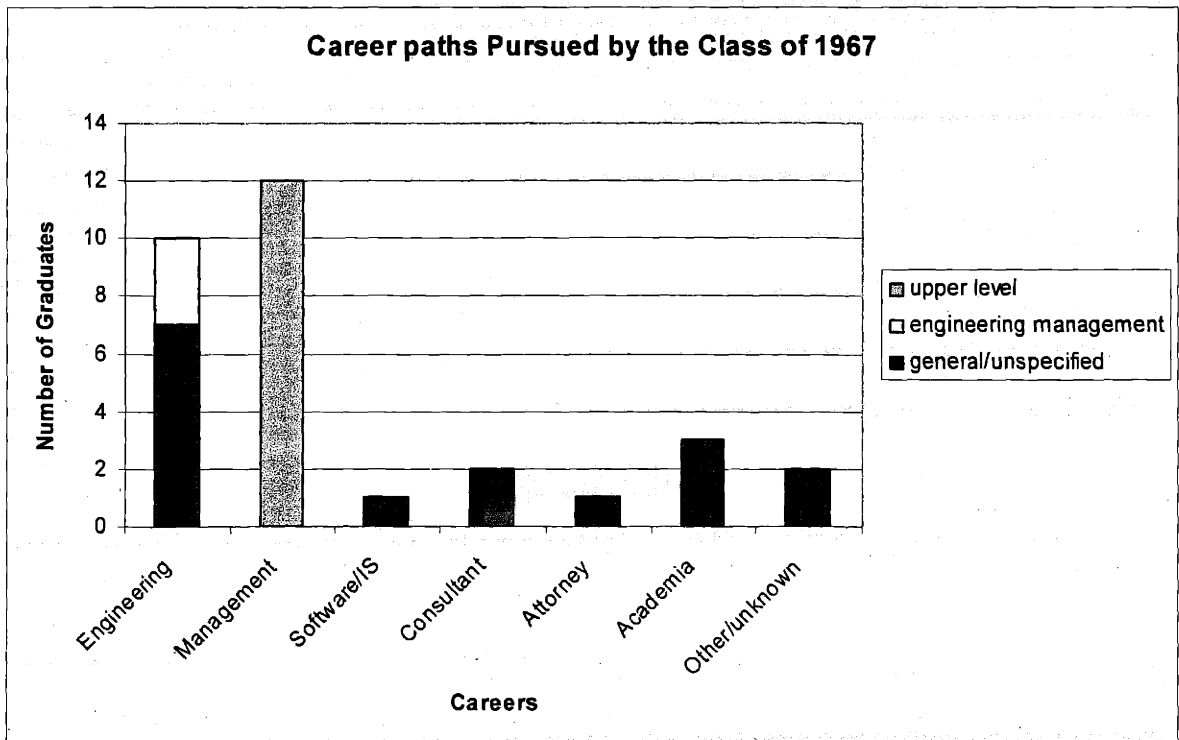


Figure 24 1967 Data Plot, plot of careers for class of 1967

The next set of plots was not included in the analysis done but is interesting for the sake of comparison. They are plots of the projected careers 1 year, 5 years, and 20 years after graduation for the class of 2003. This data was provided by the students themselves in a survey done in 2.009.

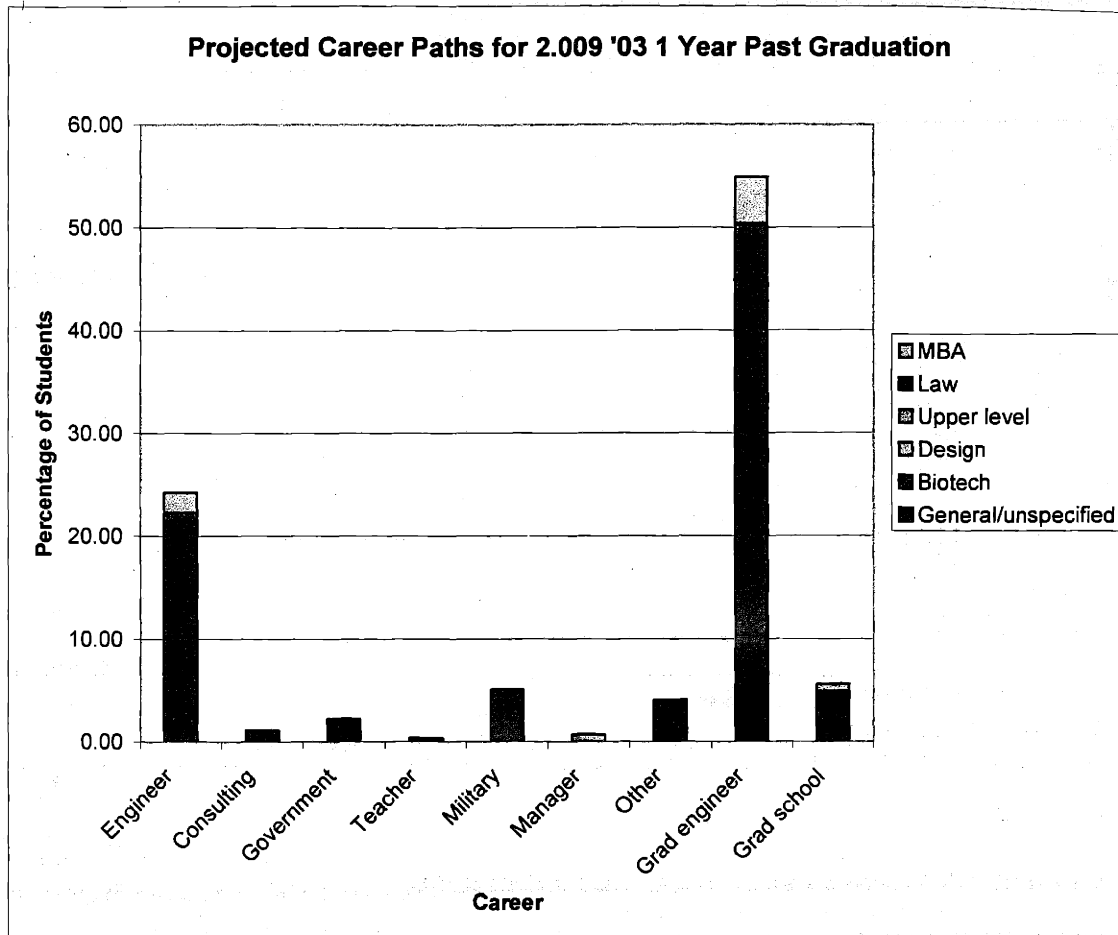


Figure 25 2.009 Data Plot 1, projected careers for 2003 2.009 students 1 year after graduation

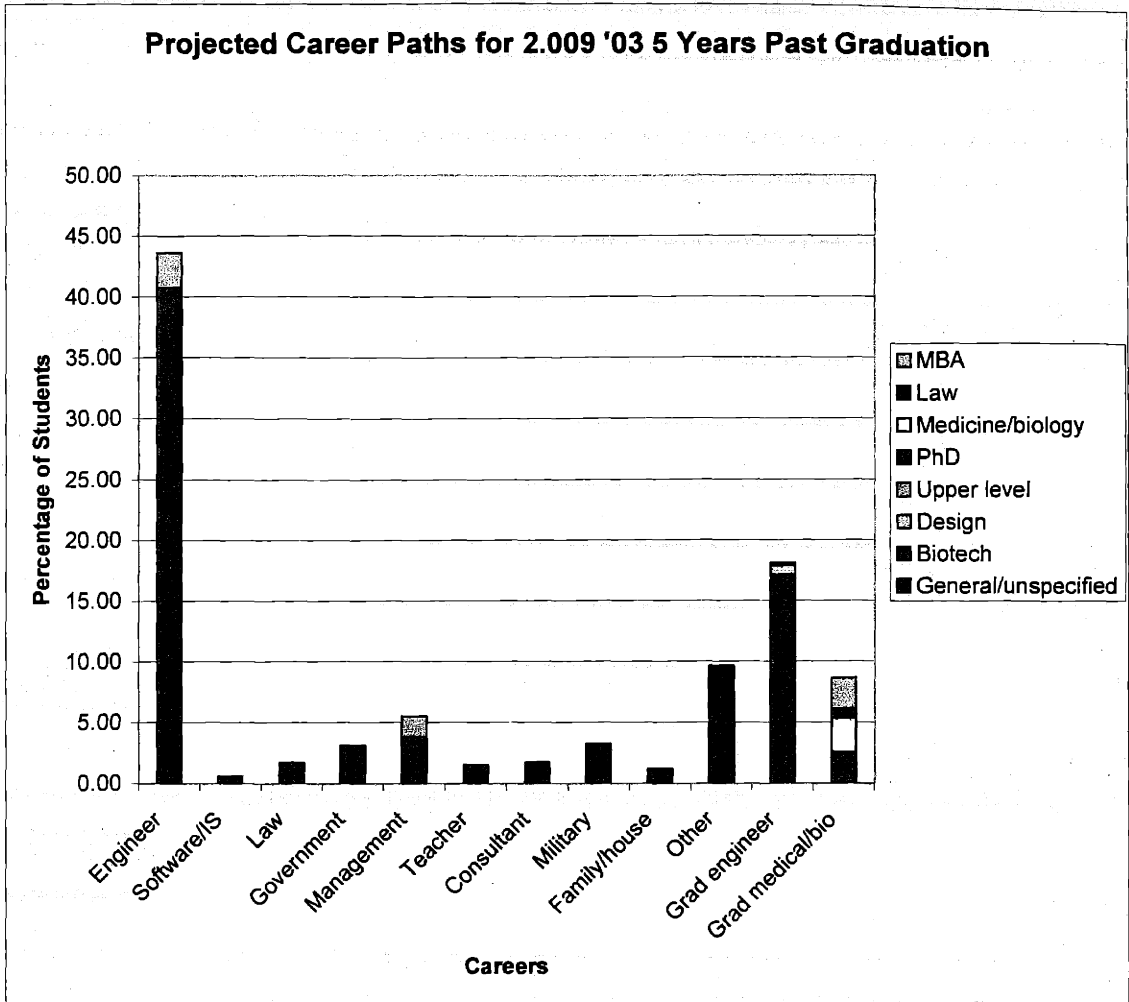


Figure 26 2.009 Data Plot 5, projected careers for 2003 2.009 students 5 years after graduation

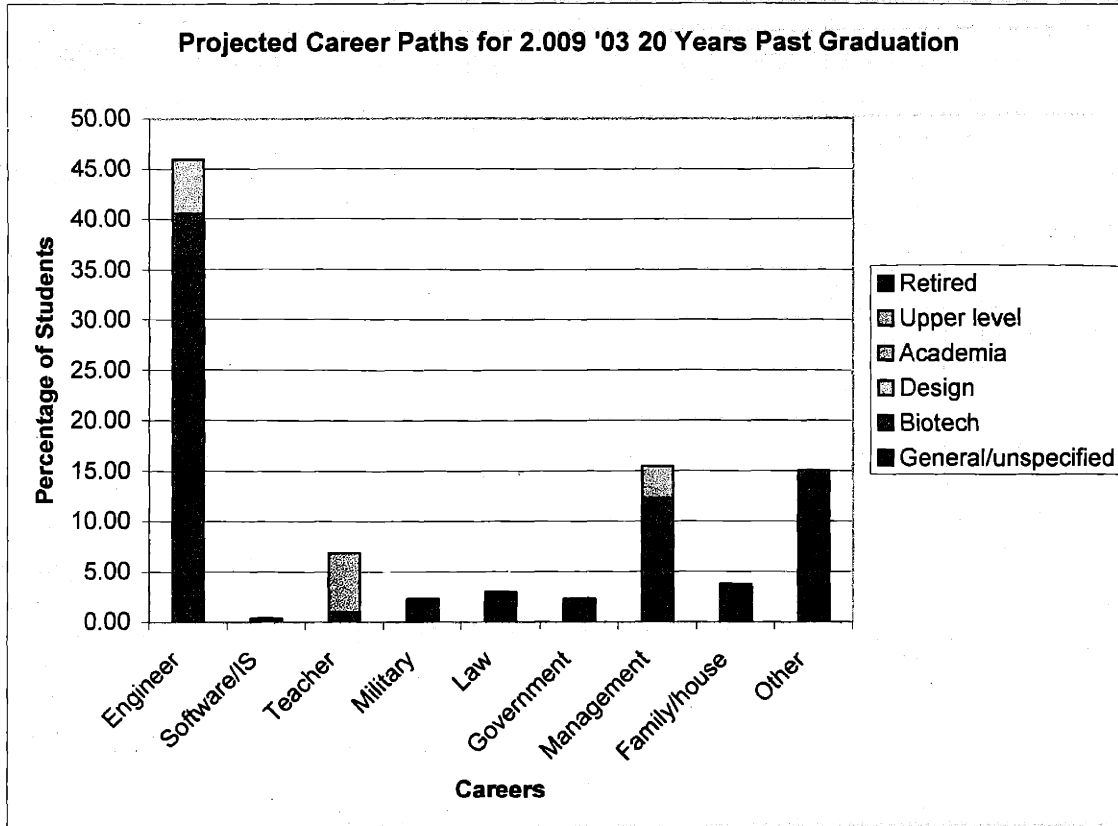


Figure 27 2.009 Data Plot 20, projected careers for 2003 2.009 students 20 years after graduation