Measuring Up:
Analysis and Benchmarking
of WPI and trie Mechanical Engineering Department
by Anthea Taylor

Index

Chapter 1: Introduction

The administration of WPI recently announced the goal of becoming one of the top 50 schools in the country. Both size and specialization may work against that goal, since WPI is a small technical school. It is difficult to compare WPI to schools with a different focus, such as liberal arts, since we have different departments and those departments have different needs and goals. Instead, departments can be compared to their counterparts, and a more comprehensive comparison can be built out of the relevant smaller comparisons.

This IQP is one such small comparison. Its purposes are to analyze quality and resource use in BS, MS and Ph.D. granting Mechanical Engineering Departments in the US, and to benchmark WPFs Mechanical Engineering Department against other departments. To put WPI firmly in the top 50 schools, I will look at what it will take to put it at number 40. Therefore, the focus of this analysis will be the question: "How can WPI become number 40 in rank?" Because of the difficulty in finding information specific to one department, I have also used some data applicable to the whole school, such as library size and endowment, which also relates to the functioning of the department.

In the following chapters, I will describe my methods and conclusions. In Chapter 2, Data Collection, I will describe my sources and the process by which I compiled information on the 141 schools included in this project. In Chapter 3, Figure Captions, I will first describe the analysis of the data. Then I will describe each figure in depth, including an analysis of where WPI stands in relation to the other schools in the study and what needs to change for WPI to become number 40 in rank. In Chapter 4,

Conclusions, I will make an overall analysis of where WPI stands and what it can do to reach number 40 in rank.

Chapter 2: Data Collection

Before starting to collect data, I used Peterson's Guide to Four Year Colleges 1997 and Peterson's Guide to Graduate Programs in Engineering and Applied Sciences, 1997 to select the schools to include in this study. Both Peterson's Guide to Four Year Colleges and Peterson's Guide to Graduate Programs in Engineering and Applied Sciences are published annually by Peterson's, which specializes in college guides, in Princeton, New Jersey.

Peterson's Guide to Four Year Colleges is produced primarily for high school students and their parents as an aid in selecting a college to attend. It contains a large range of information obtained each year from undergraduate institutions in the US and Canada. The institution information is organized into two areas: *College Profiles and Special Announcements* contains concise descriptions of all of the schools included in the volume, while *In-Depth Descriptions of the Colleges* contains more detailed narrative descriptions of several schools. The guide contains a large amount of information on most of the schools, but because the schools are self-reporting, more than basic information was not consistently presented. Despite this inconsistency, I obtained a good deal of information from this source, including the size of the endowment numbers and total number of faculty.

Peterson's Guide to Graduate Programs in Engineering and Applied Sciences is one volume of a set produced for the use of students in selecting a graduate school. I used it in conjunction with Peterson's Four Year Colleges to select the schools for my database. It was also my source for graduate tuition. Section 16, Mechanical Engineering and Mechanics, contained "directories of institutions offering graduate work in

mechanical engineering and mechanics, followed by in-depth entries submitted by institutions that chose to prepare detailed program descriptions." It contains some department specific data, but unfortunately not enough listings included this data for me to use it.

By cross-referencing these two books, I selected a set of 141 schools in the US with both undergraduate and doctoral programs in mechanical engineering. This set includes all schools in the US with programs that offer BS, MS, and PhD. degrees that were listed in both books. I obtained the price of graduate tuition from Peterson's Guide to Graduate Programs in Engineering and Applied Sciences, 1997 and the amount of the endowment from Peterson's Guide to Four Year Colleges. I then found a website called CollegeNet, from which I obtained undergraduate enrollment and tuition.

CollegeNet, www.collegenet.com copyright 1997 Universal Algorithms, is maintained using College Board data. It is a search engine and database designed to help prospective students to find information on colleges, which can be selected by name or several other criteria.

I found information on research and development and library volumes and expenditures in Research-Doctorate Programs in the United States: Continuity and Change. This book is a survey of Research-Doctorate programs in several fields of study, including Mechanical Engineering, published by the National Research Council. It also provided rankings for the schools included in the study based on various criteria. In this study, I use their rankings based on "program effectiveness in educating research scholars and scientists." The data was gathered using surveys to the schools involved.

Research-Doctorate Programs in the United States: Continuity and Change

Marvin L. Goldberger, Brendan A. Maher, Pamela Ebert Flattau, editors

National Academy Press, Washington DC 1995

Finally, I found department specific information in ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges, Copyright 1997

This book is published by the American Society for Engineering Education to provide "a detailed profile of U.S. and Canadian schools offering undergraduate and graduate engineering, as well as engineering technology programs with the intent of preparing prospective students for their future education in engineering." Information contribution is voluntary, so not all of the schools in my database were included. This was my source for the number of department faculty, department undergraduate, graduate and doctoral enrollments and the number of graduate student appointments.

Chapter 3: Figure Captions

To analyze the data, I used the program Grapher 1.76 to produce several scattergraphs. Because the focus of this analysis was the question: "How can WPI become number 40 in rank?" I started by graphing each relevant variable against the rank given by the NRC book Research-Doctorate Programs in the United States: Continuity and Change for "program effectiveness in educating research scholars and scientists." Schools were also ranked on other criteria, but the ranks were fairly consistent in each case. I chose to use the "program effectiveness in educating research scholars and scientists" criteria because of the focus on students, which I see as the most important aspect of an educational facility. I also compared the number of department faculty and student appointments to the department undergraduate enrollment.

Only 107 of my original set of 141 schools were ranked in Research-Doctorate Programs in the United States: Continuity and Change. My information for some of the other variables was also incomplete, so the database for each graph was sorted to exclude null data points.

In this chapter, I describe each graph in depth and analyze WPI's place in relation to three groups of schools. The first group is a set of benchmark schools that the administration currently uses including California Institute of Technology (Caltech), Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, Massachusetts Institute of Technology (MIT), Rennselaer Polytechnic Institute (RPI), and Stevens Institute of Technology. The second group is the set of private schools included in the graph. The third group is the full set of schools included in the graph.

Figure 1 shows NRC ranking vs. Total Faculty. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change. 1992 Appendix P. Total Faculty is the number of faculty reported in the Peterson's Four Year Colleges 1997. For some listings it was stated to be undergraduate faculty, and for some it was listed as total faculty. For this study it was assumed that the two terms represent the same number.

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without a NRC ranking were excluded.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles.

This graph shows very little direct correlation between rank and total number of faculty. Larger schools appear more likely to be well ranked, but there are also well-ranked small schools. WPI, ranked at 77 out of 108 has 259 total faculty. All but one of the benchmark schools have less than 1000 faculty, Case Western has 1936 faculty. The distribution of private and public schools is similar.

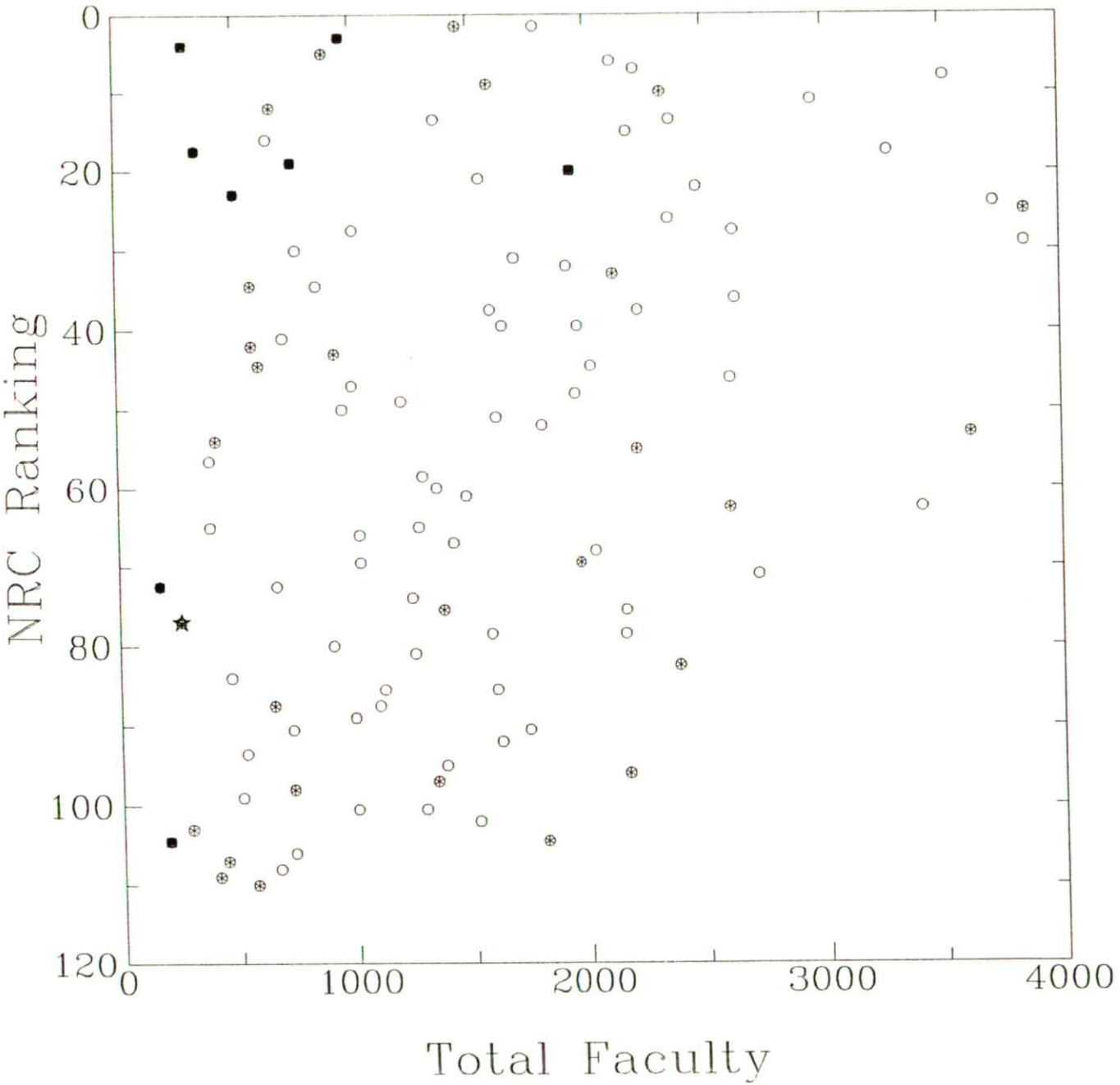

0
20
40
60
80
100
120
NRC Ranking
0
1000
2000
3000
4000
Total Faculty

Figure 1

Figure 2 shows NRC ranking vs. Undergraduate Enrollment. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change, 1992 Appendix P. Undergraduate Enrollment is the total undergraduate enrollment of the school. This variable was obtained from CollegeNet listings at www.collegenet.com on the Internet. For those schools without a listing on CollegeNet, information was taken from the Peterson's Four Year Colleges 1997.

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without a NRC ranking were excluded.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles.

This graph shows very little direct correlation between rank and undergraduate enrollment. The distribution is similar to that in Figure 1, with larger schools tending to be well ranked, but with some small schools also being well ranked. WPI (rank 77) has an undergraduate enrollment of 2554 students. This puts it in the middle of the range of enrollments for the group of benchmark schools. Each group of schools has a similar distribution within its scale.

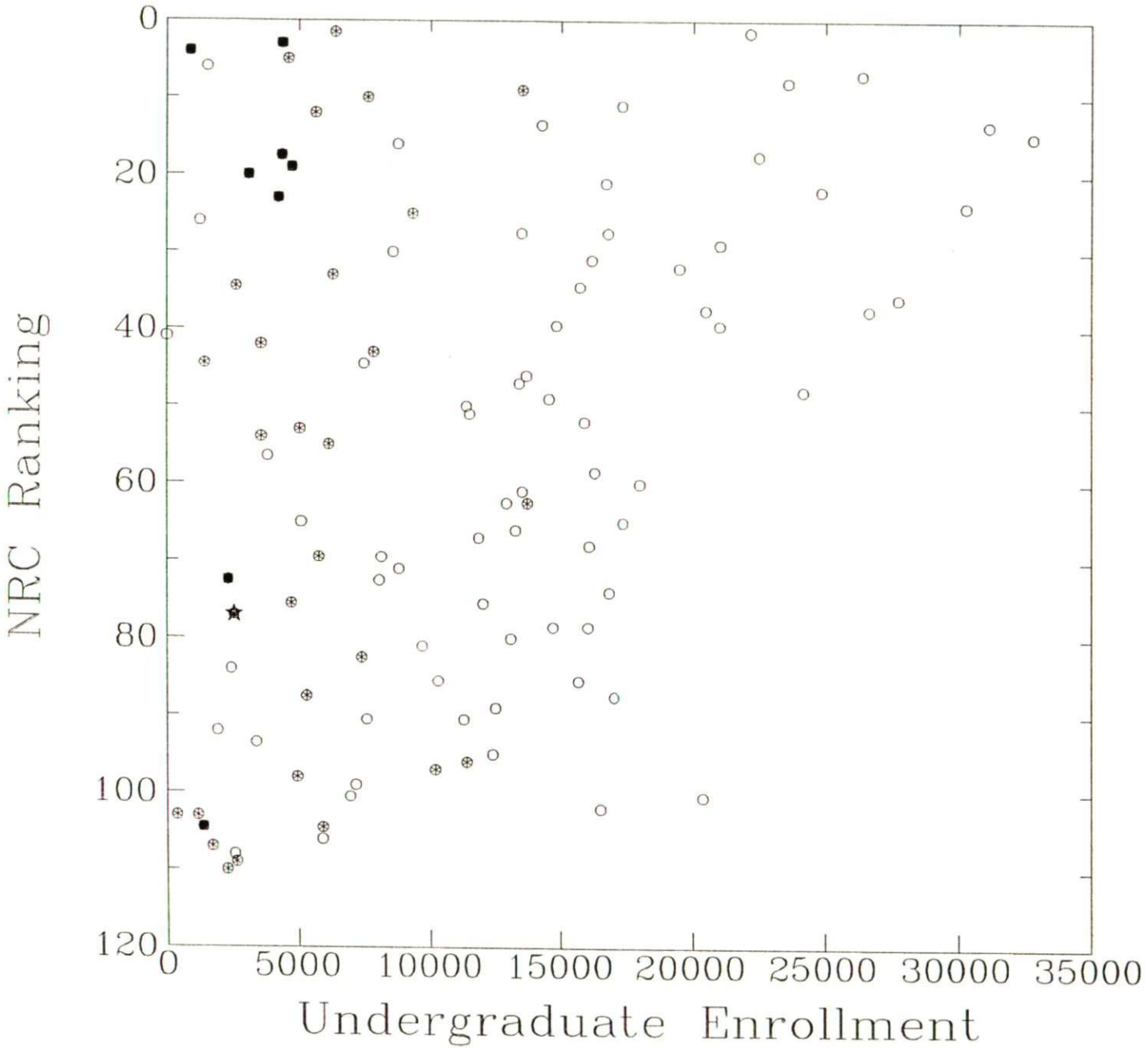

NRC Ranking
0
20
40
60
80
100
120
0
5000
10000
15000
20000
25000
30000
35000
Undergraduate Enrollment

Figure 2

Figure 3 shows NRC ranking vs. Out of State Undergraduate Tuition. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change. 1992 Appendix P. Out of State Undergraduate Tuition is the undergraduate non-resident tuition for the school. This variable was obtained from CollegeNet listings at www.collegenet.com on the Internet. For those schools without a listing on CollegeNet, information was taken from the Peterson's Four Year Colleges 1997.

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without a NRC ranking were excluded. Schools without a NRC ranking were excluded.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles.

This graph shows two distinct bands, one band of private schools beginning around $15,000 per year, and one band of public schools beginning around $5000 per year. Both bands show an evenly distributed range of ranks. Within either band, there is very little direct correlation between rank and tuition. WPI is within the band of private schools with $18,710 per year.

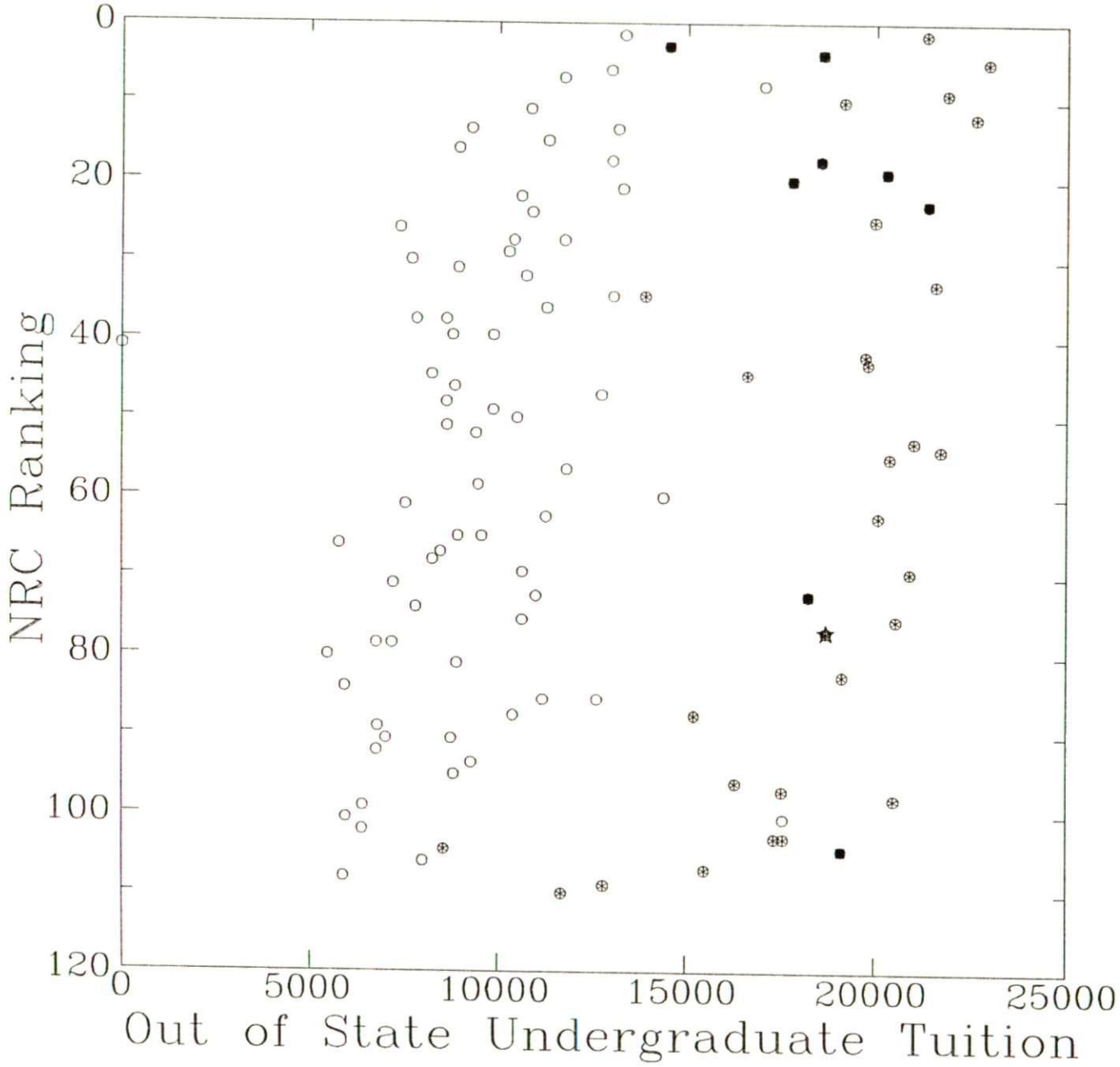

0
20
40
60
80
100
120
NRC Ranking
0
5000
10000
15000
20000
25000
Out of State Undergraduate Tuition

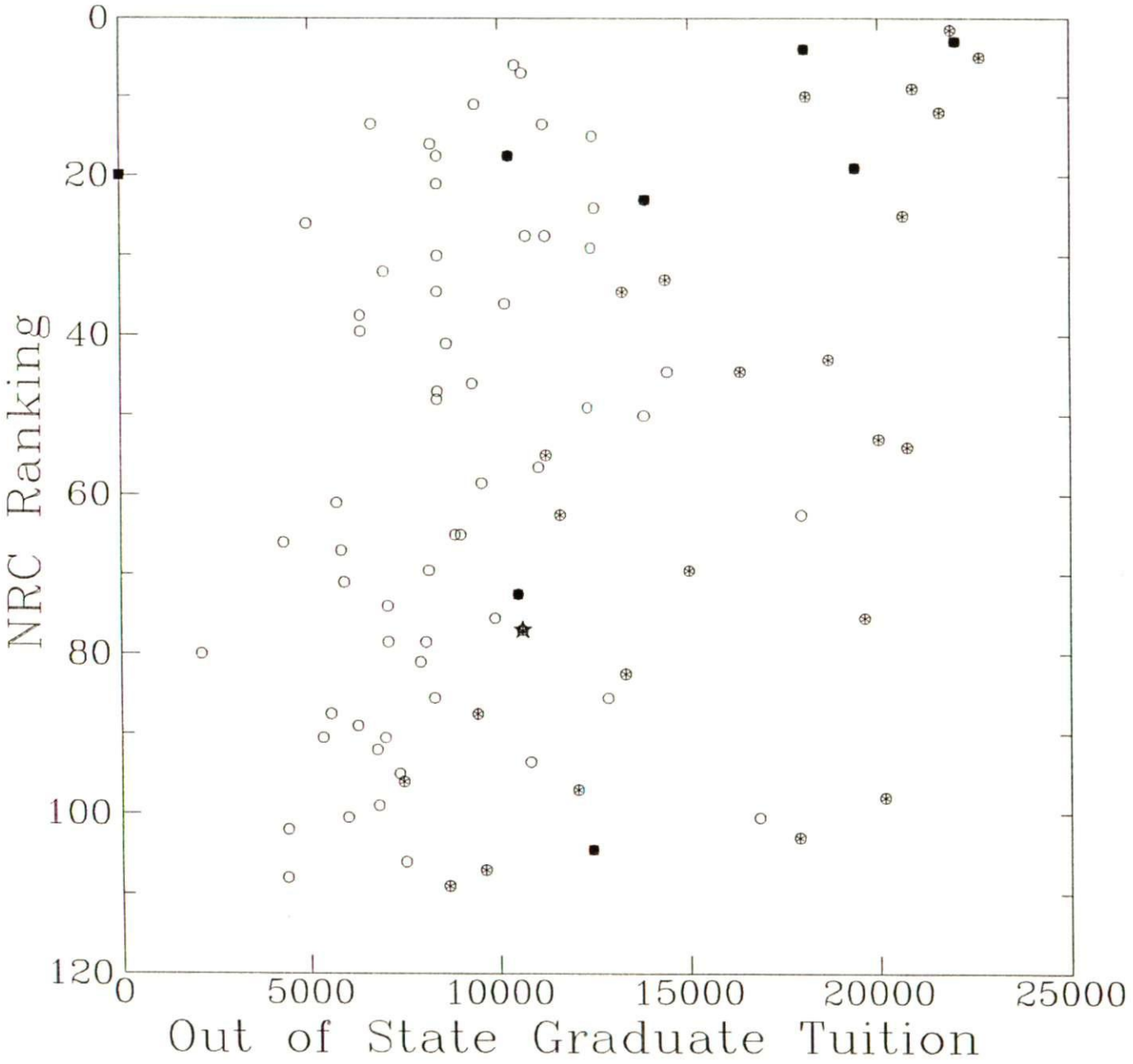
Figure 3

Figure 4 shows NRC ranking vs. Out of State Graduate Tuition. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change. 1992 Appendix P. Graduate Tuition is the graduate tuition for non-residents according to Peterson's Graduate Programs in Engineering and Applied Sciences, 1997. Tuition was listed as either price per semester or price per credit hour. Price per credit hour listings were adjusted assuming 9 credit-hours per semester.

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without a NRC ranking were excluded.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles.

The private scale starts about 5000 to the right of the public scale, around 5500 rather than 500. There appears to be a small correlation for each group of schools between rank and graduate tuition. With $10,620 per year graduate out of state tuition, WPI is at the low end of both the group of benchmark schools and the group of private schools. Although the data points are widely distributed, WPI might want to look at increasing graduate tuition to around $15,000 per year to approach rank 40.


0
20
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NRC Ranking
0
5000
10000
15000
20000
25000
Out of State Graduate Tuition

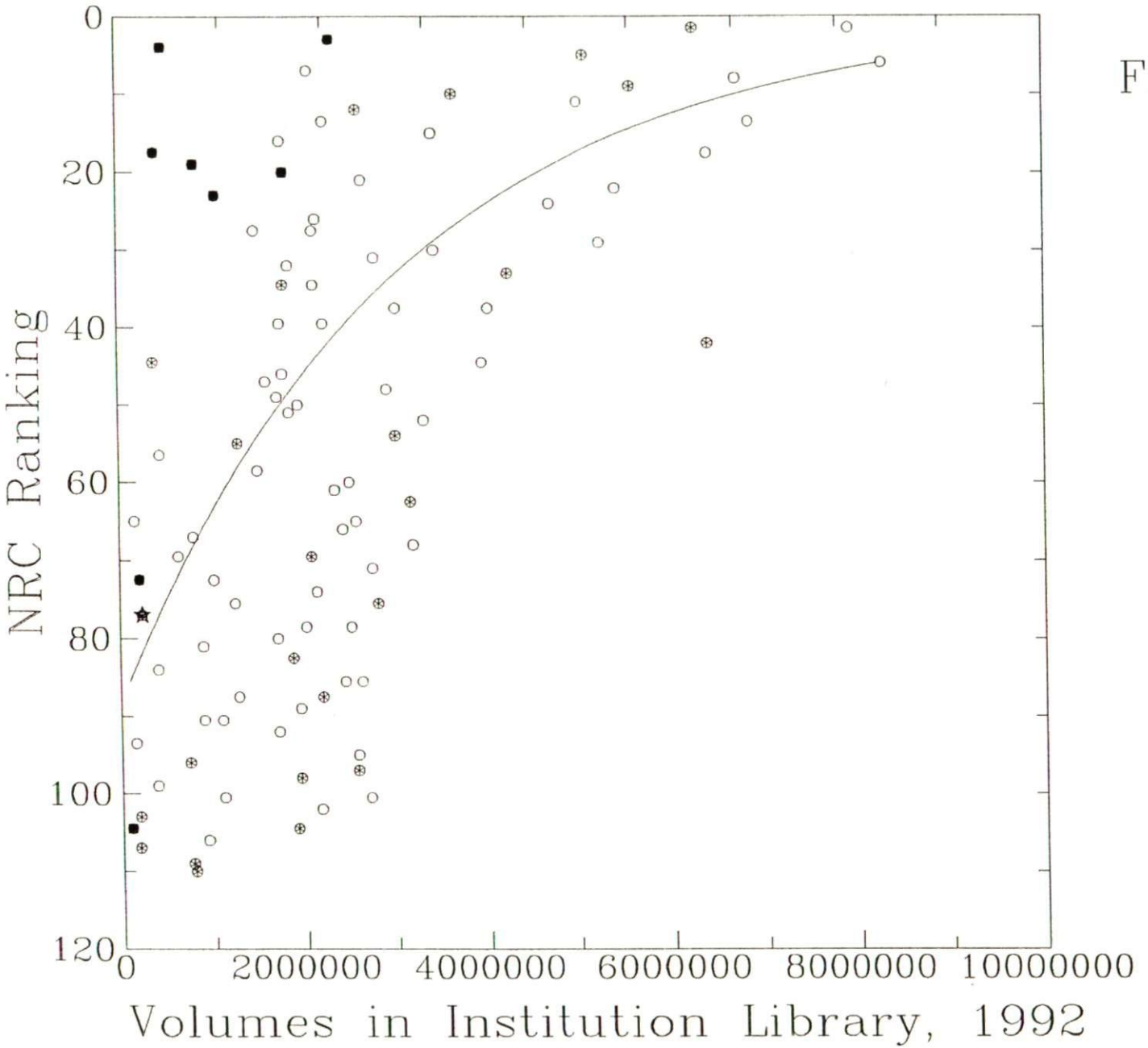
Figure 4

Figure 5 shows NRC Ranking vs. Volumes in Institution Library, 1992. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change. 1992 Appendix P. Volumes in Institution Library, 1992 is the number of volumes in the school's library, as reported in appendix E of Research-Doctorate Programs in the United States. "Total number of printed, typewritten, mimeographed or processed works contained in one binding or portfolio that has been catalogued, classified and made ready for use in 1992=93 academic year. Sources ARL, ACRL, Department of Education"

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without values for either NRC Ranking or Volumes in Institution Library, 1992 were excluded.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles.

This graph shows a positive correlation between rank and number of volumes in the institution library. There is a wide band of schools with less than 3,000,000 volumes and a few high ranking schools with more than 3,000,000 volumes. WPI falls at the low end of the band with 240,416 volumes. Figure 6 will show this graph on a logarithmic scale.


0
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100
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NRC Ranking
0
2000000
4000000
6000000
8000000
10000000
Volumes in Institution Library, 1992

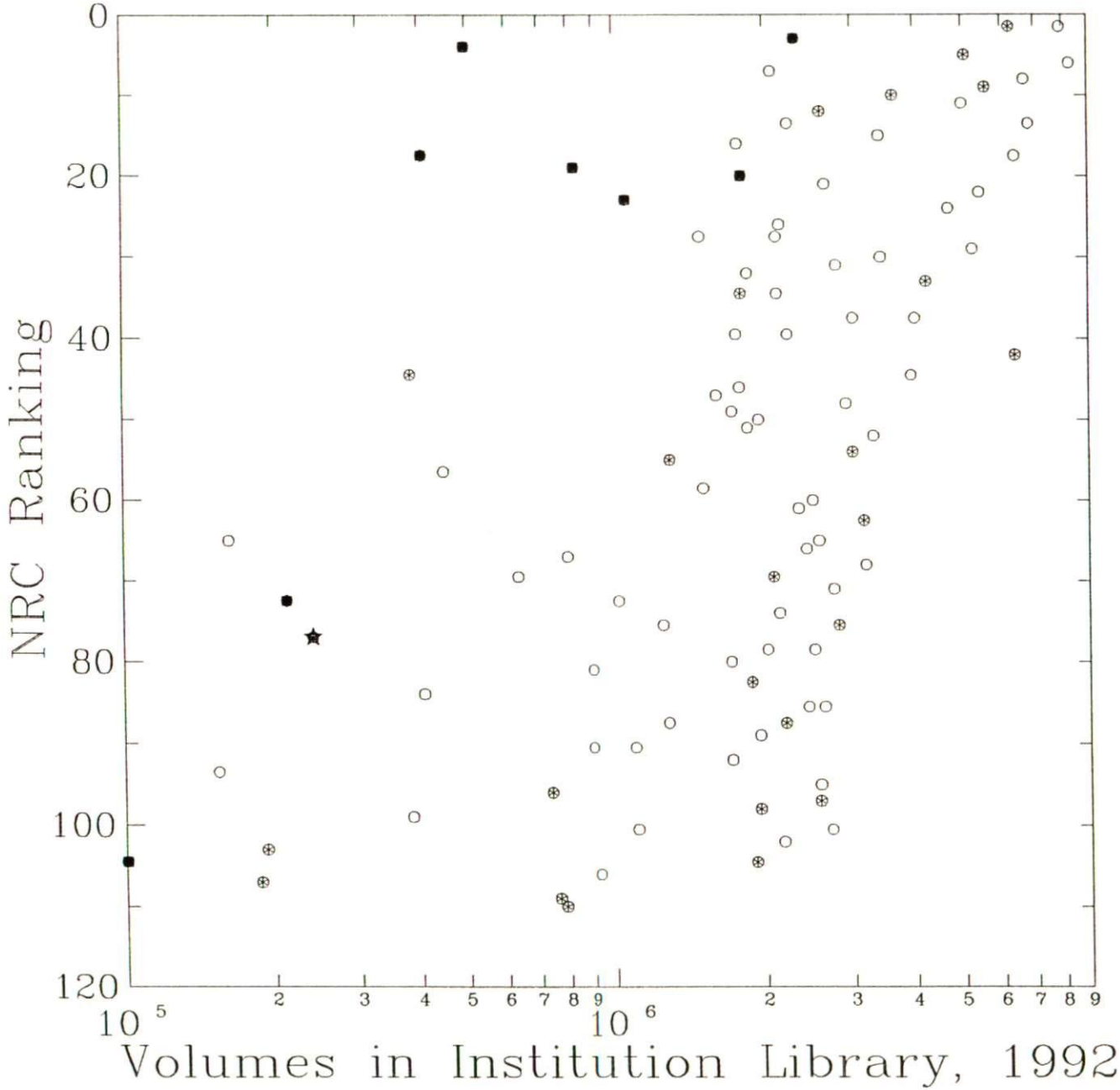
Figure 5

Figure 6 shows NRC Ranking vs. Volumes in Institution Library, 1992: logarithmic scale. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change, 1992 Appendix P. Volumes in Institution Library, 1992 is the number of volumes in the school's library, as reported in appendix E of Research-Doctorate Programs in the United States. "Total number of printed, typewritten, mimeographed or processed works contained in one binding or portfolio that has been catalogued, classified and made ready for use in 1992=93 academic year. Sources ARL, ACRL, Department of Education"

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without values for either NRC Ranking or Volumes in Institution Library, 1992 were excluded.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles. The x-axis is logarithmic.

This graph shows the same band of schools that can be seen in figure 5. The logarithmic scale makes it easier to see that there is a positive correlation within the band between rank and number of volumes in the institution library. With 240,416 volumes, WPI is well below most other schools. The group of benchmark schools is fairly scattered on this graph. The majority of both private and public schools have over 1,000,000 volumes, however. WPI should try to reach this point for a better chance at number 40.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NRC Ranking
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4
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6
7
8
9
Volumes in Institution Library, 1992

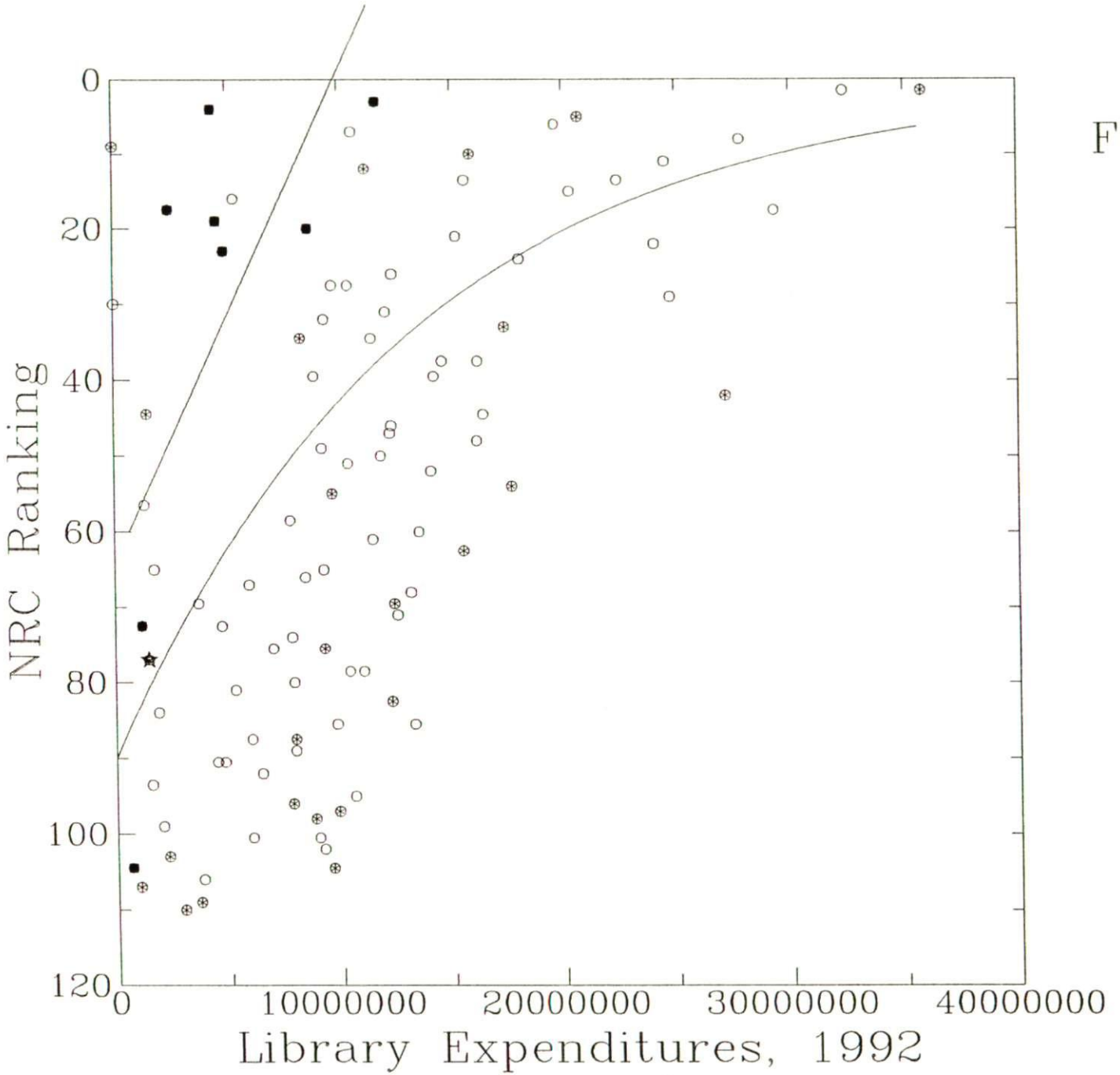
Figure 6

Figure 7 shows NRC Ranking vs. Library Expenditures, 1992. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change. 1992 Appendix P. Library Expenditures, 1992 is the amount of library expenditures, as reported in appendix E of Research-Doctorate Programs in the United States, "total library expenditure of funds from regular institutional budgets and other sources... for the 1992-93 academic year. Sources ARL, ACRL, Department of Education"

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without values for either NRC Ranking or Library Expenditures, 1992 were excluded.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles.

This graph shows a positive correlation between rank and library expenditures. Most schools have less than $20,000,000 in expenditures, and the few schools with larger expenditures are highly ranked. A few schools with low expenditures are also highly ranked. The group of benchmark schools has smaller expenditures than the trend line. According to the trend line for all of the schools, WPI should increase its expenditures from $1,467,000 to around $10,000,000 to be ranked number 40. Based on the group of benchmark schools, however, an increase to around $5,000,000 might be sufficient.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NRC Ranking
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20000000
30000000
40000000
Library Expenditures, 1992

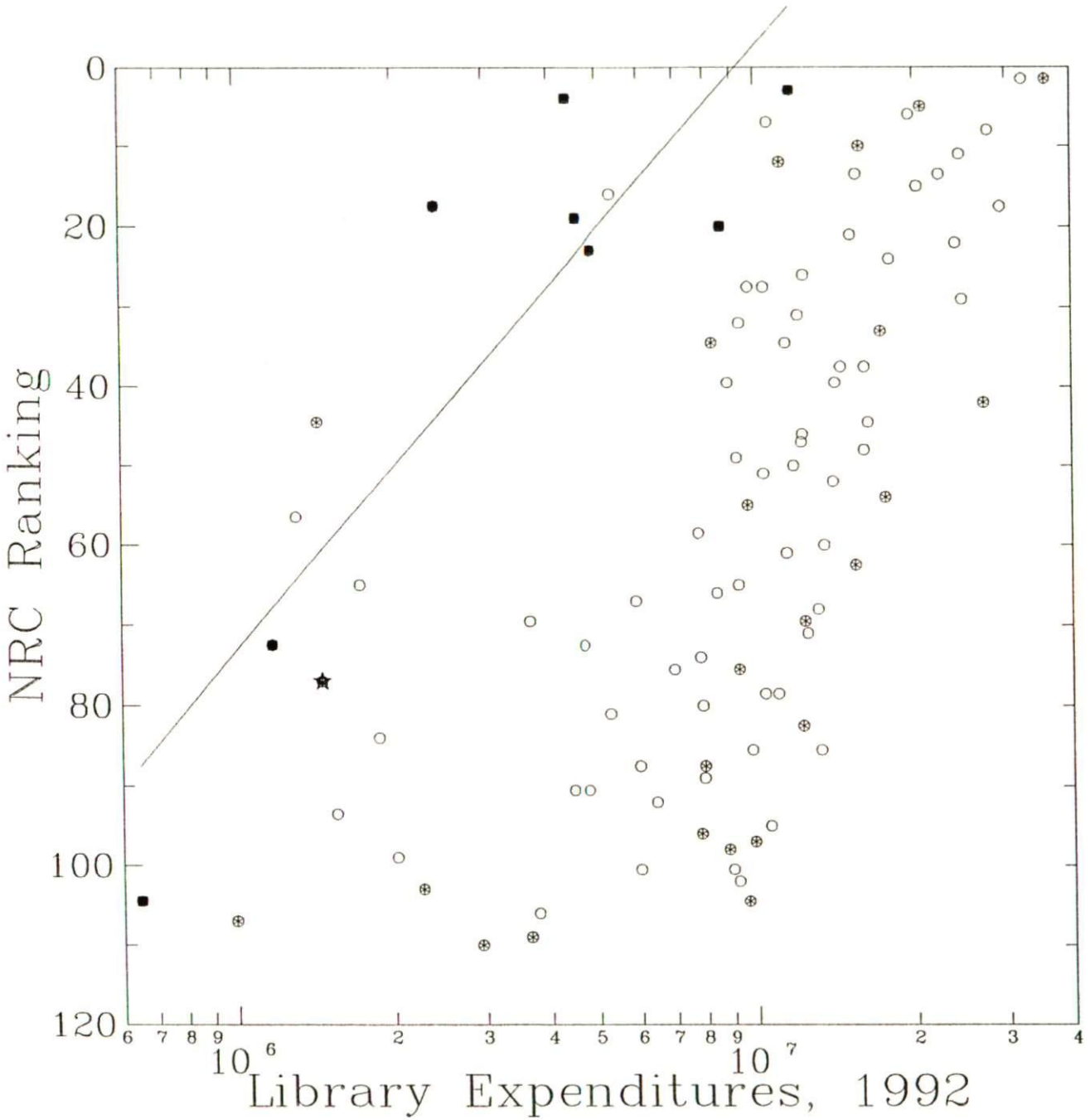
Figure 7

Figure 8 shows NRC Ranking vs. Library Expenditures, 1992: logarithmic scale. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change, 1992 Appendix P. Library Expenditures, 1992 is the amount of library expenditures, as reported in appendix E of Research-Doctorate Programs in the United States, "total library expenditure of funds from regular institutional budgets and other sources... for the 1992-93 academic year. Sources ARL, ACRL, Department of Education"

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without values for either NRC Ranking or Library Expenditures, 1992 were excluded. The outliers Cornell and Rutgers, at $25,860 and $23,604, respectively, were excluded from this graph.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles. The x-axis is logarithmic.

The logarithmic scale shows more clearly the separate band that is formed by the benchmark schools. To achieve rank number 40 in that band, WPI would need to increase its expenditures from $1,467,000 to about $3,000,000, while to achieve number 40 in the band formed by the other schools in the graph, WPI's expenditures would need to increase to between $10,000,000 and $20,000,000.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NRC Ranking
6 7 8 9
10 6
2 3 4 5 6 7 8 9
10 7
2 3 4
Library Expenditures, 1992

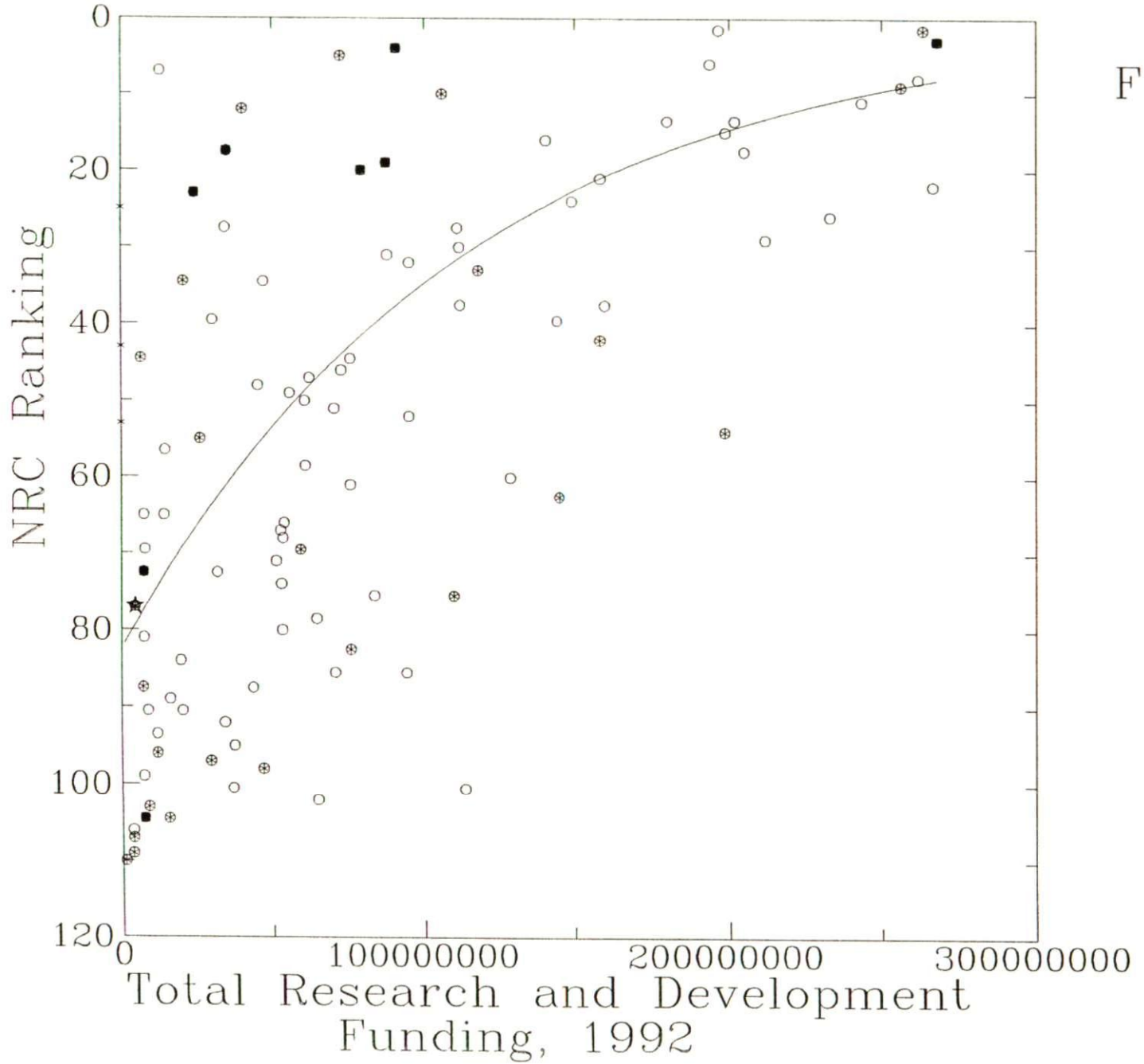
Figure 8

Figure 9 shows NRC Ranking vs. Total Research and Development Funding, 1992. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change. 1992 Appendix P. Total Research and Development Funding, 1992 is the total research and development funding as reported in appendix E of Research-Doctorate Programs in the United States, put out by the National Research Council, "the average annual expenditure for research and development at the institution for the period 1986-92 in thousands of 1988 dollars. Source National Science Foundation"

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without values for either NRC Ranking or Total Research and Development, 1992 were excluded.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles.

This graph shows a positive correlation between rank and R&D. Most of the benchmark schools have smaller R&D funding that the trend line indicates, but with $264,000,000, Stanford is both close to the trend line and an outlier to the group of benchmark schools. At $4,511,000, WPI is close to the bottom of the scale. Figure 10 will show the same data on a logarithmic scale.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100
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NRC Ranking
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100000000
200000000
300000000
Total Research and Development
Funding, 1992

Figure 9

Figure 10 shows NRC Ranking vs. Total Research and Development Funding, 1992: logarithmic scale. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change. 1992 Appendix P. Total Research and Development Funding, 1992 is the total research and development funding as reported in appendix E of Research-Doctorate Programs in the United States, put out by the National Research Council, "the average annual expenditure for research and development at the institution for the period 1986-92 in thousands of 1988 dollars. Source National Science Foundation"

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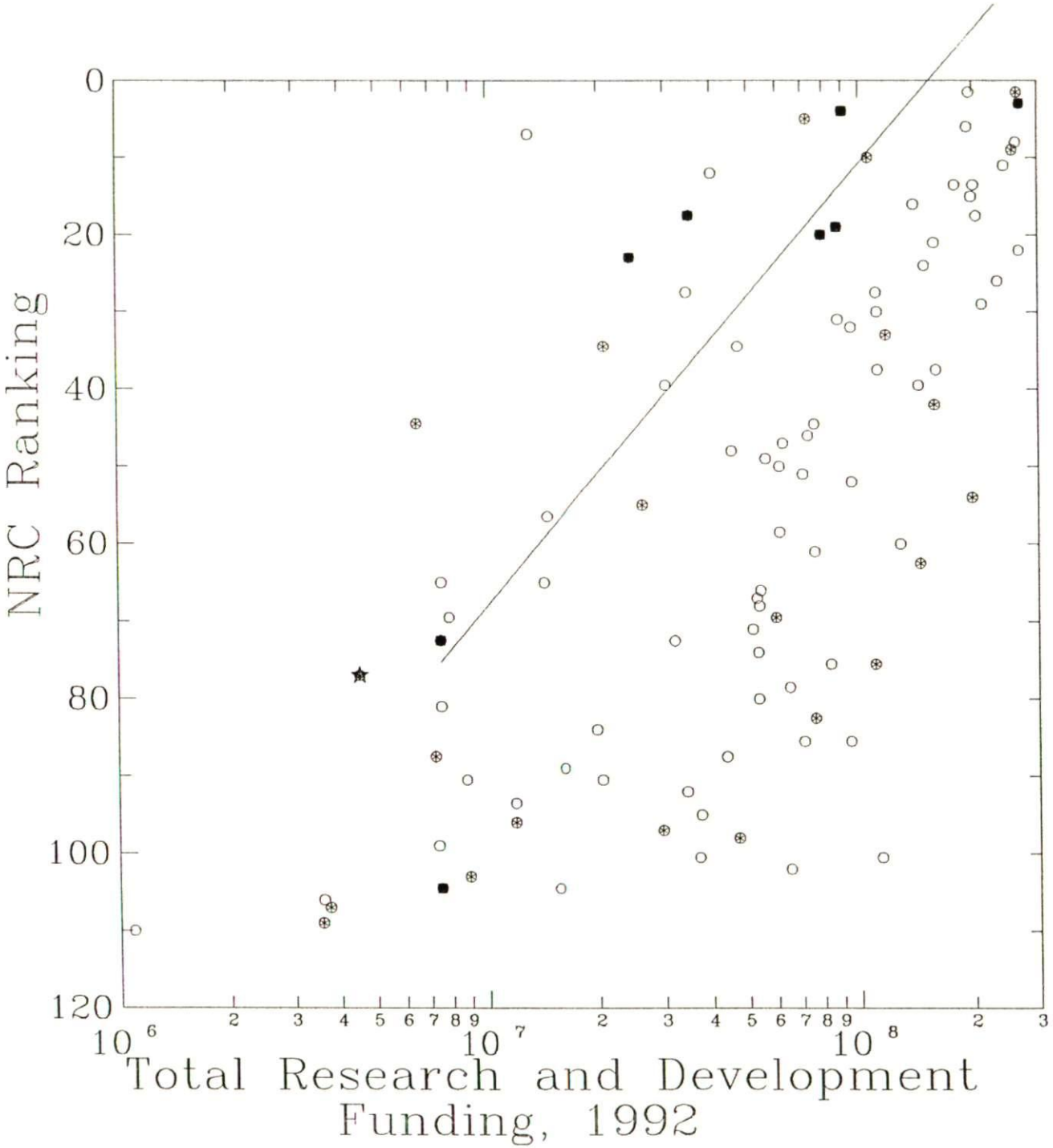
The logarithmic scale shows the positive correlation more clearly than the linear scale in figure 9 does. To reach number 40 in rank, WPI needs to increase its research and development funding from $4,511,000 to around $30,000,000.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80
100
120
NRC Ranking
10 6
2 3 4 5 6 7 8 9
10 7
2 3 4 5 6 7 8 9
10 8
2 3
Total Research and Development
Funding, 1992

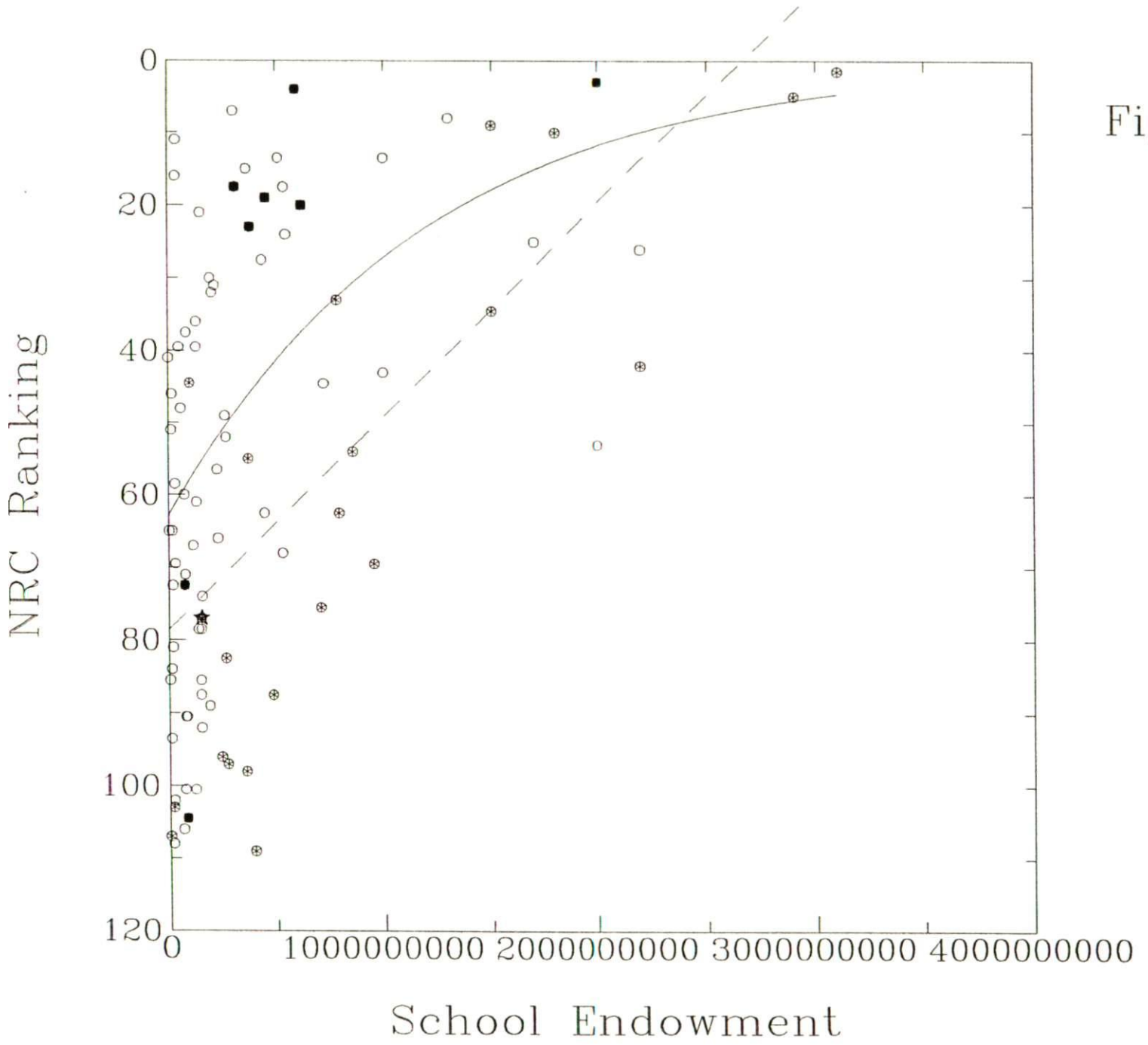
Figure 10

Figure 11 shows NRC Ranking vs. School Endowment. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change, 1992 Appendix P. School Endowment is the school endowment reported in the Peterson's Four Year Colleges 1997 college profiles and special announcements section.

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without values for either NRC Ranking or School Endowment were excluded.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles

This graph shows a positive correlation between rank and endowment size. Most of the schools have endowments of less than $1 billion. The few that have more are well ranked, but some smaller schools are also well ranked. There is a cluster of benchmark schools around $500,000,000. That is also where one trend line crosses rank number 40. WPI's endowment is $150,000,000, and would need to more than triple to reach that goal. Figure 12 will show the same data on a logarithmic scale to show WPI's position more clearly.


0
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40
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120
NRC Ranking
0
1000000000
2000000000
3000000000
4000000000
School Endowment

Figure 11

Figure 12 shows NRC Ranking vs. School Endowment: logarithmic scale

NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change, 1992 Appendix P. School Endowment is the school endowment reported in the Peterson's Four Year Colleges 1997 college profiles and special announcements section.

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This graph shows a very widely distributed positive correlation between NRC Ranking and School Endowment. There also appears to be a band of private schools that shows the same correlation. To be ranked number 40 in this band, WPI should increase its endowment from $150,000,000 to between $200,000,000 and $1,000,000,000. According to the distribution of the full set of schools, however, WPI should already be close to rank number 40.

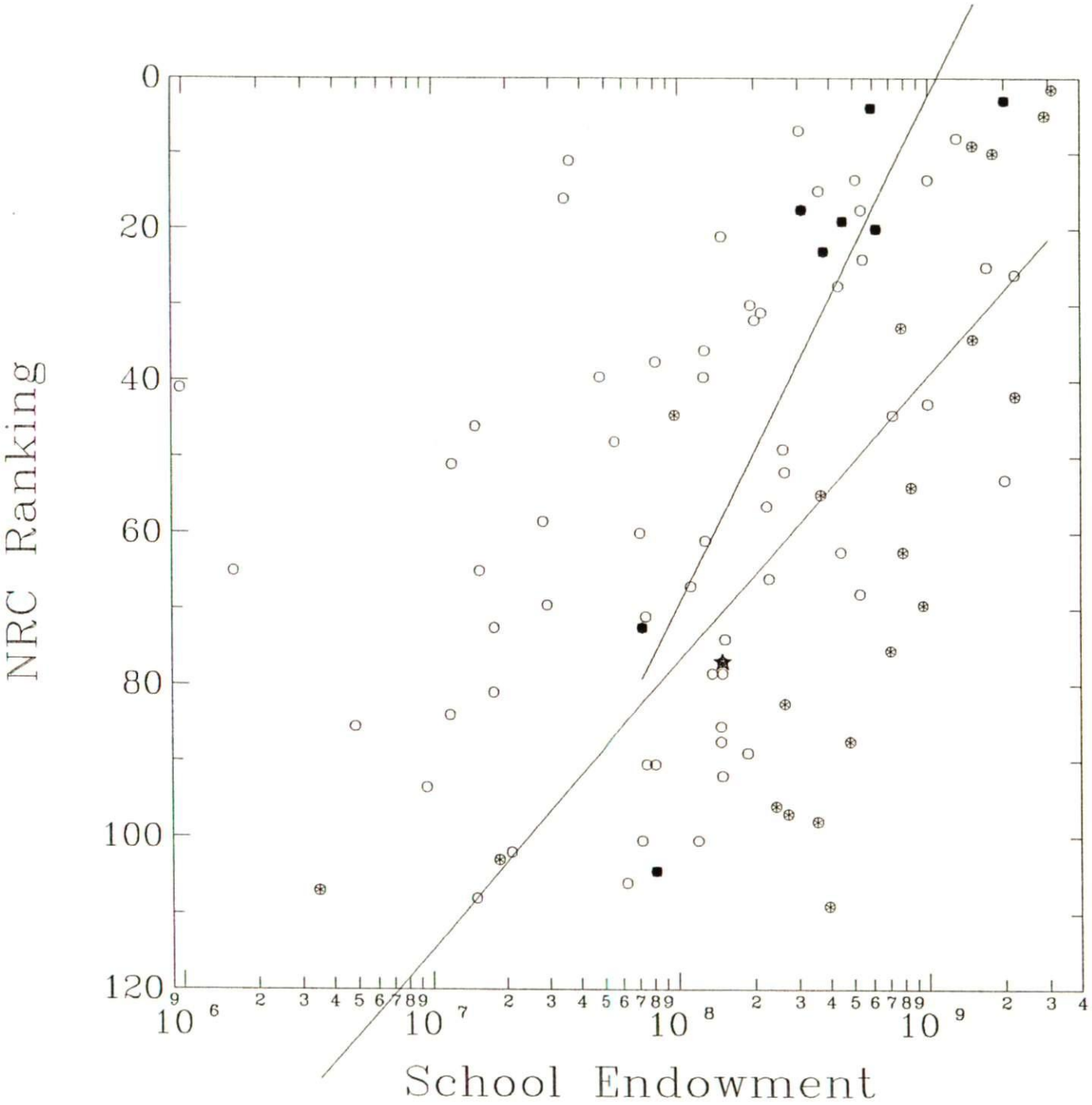
NRC Ranking
0
20
40
60
80
100
120
School Endowment
10 6
10 7
10 8
10 9

Figure 12

Figure 13 shows NRC ranking vs. Mechanical Engineering Department Faculty. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change, 1992 Appendix P. Mechanical Engineering Department Faculty is the school's total number of mechanical engineering department faculty for fall of 1995 as reported in the ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges.

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without a NRC ranking or a count of Mechanical Engineering Department Faculty were excluded.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles.

This graph shows a slight positive correlation between rank and department faculty, more pronounced among the public schools. The public schools tend to have more department faculty than the private schools in this graph. WPI and the group of benchmark schools are on the larger end of the scale of private schools. Figure 14 will show the distribution of private schools more closely.

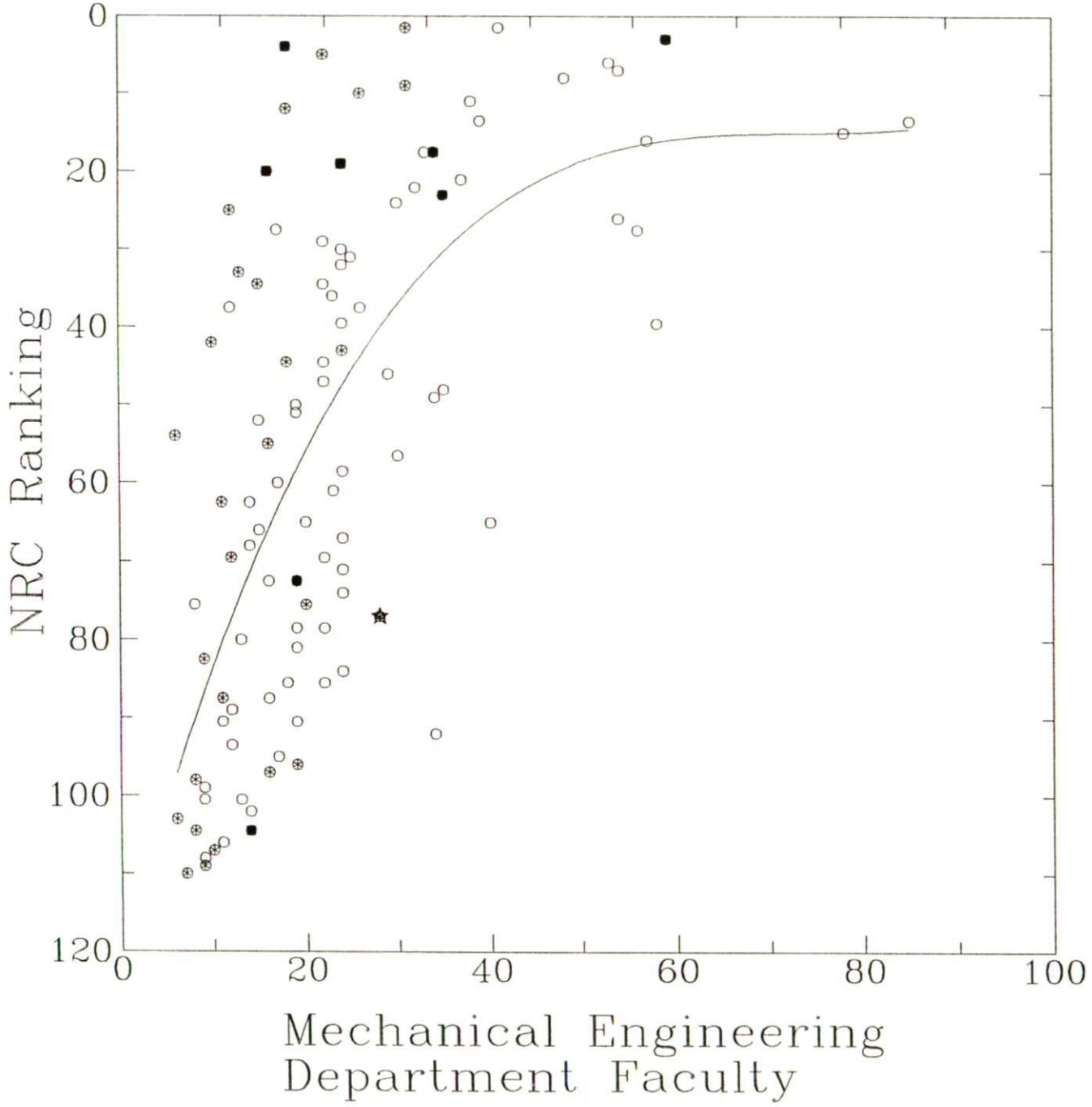
0
20
40
60
80
100
120
NRC Ranking
0
20
40
60
80
100
Mechanical Engineering
Department Faculty

Figure 13

Figure 14 shows NRC Ranking vs. Mechanical Engineering Department Faculty for Private Schools. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change. 1992 Appendix P. Mechanical Engineering Department Faculty is the school's total mechanical engineering department faculty for fall of 1995 as reported in the ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges.

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. MIT was an outlier at 59 faculty and is also excluded from this graph. Public schools and schools without values for either NRC Ranking or Mechanical Engineering Department Faculty were also excluded.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as empty circles.

This graph shows a widely distributed positive correlation between rank and department faculty. At 77, WPI has a lower rank than might be expected from the number of ME department faculty (28). Based on the trend line for private schools, 28 department faculty should put WPI at about # 40 in rank.

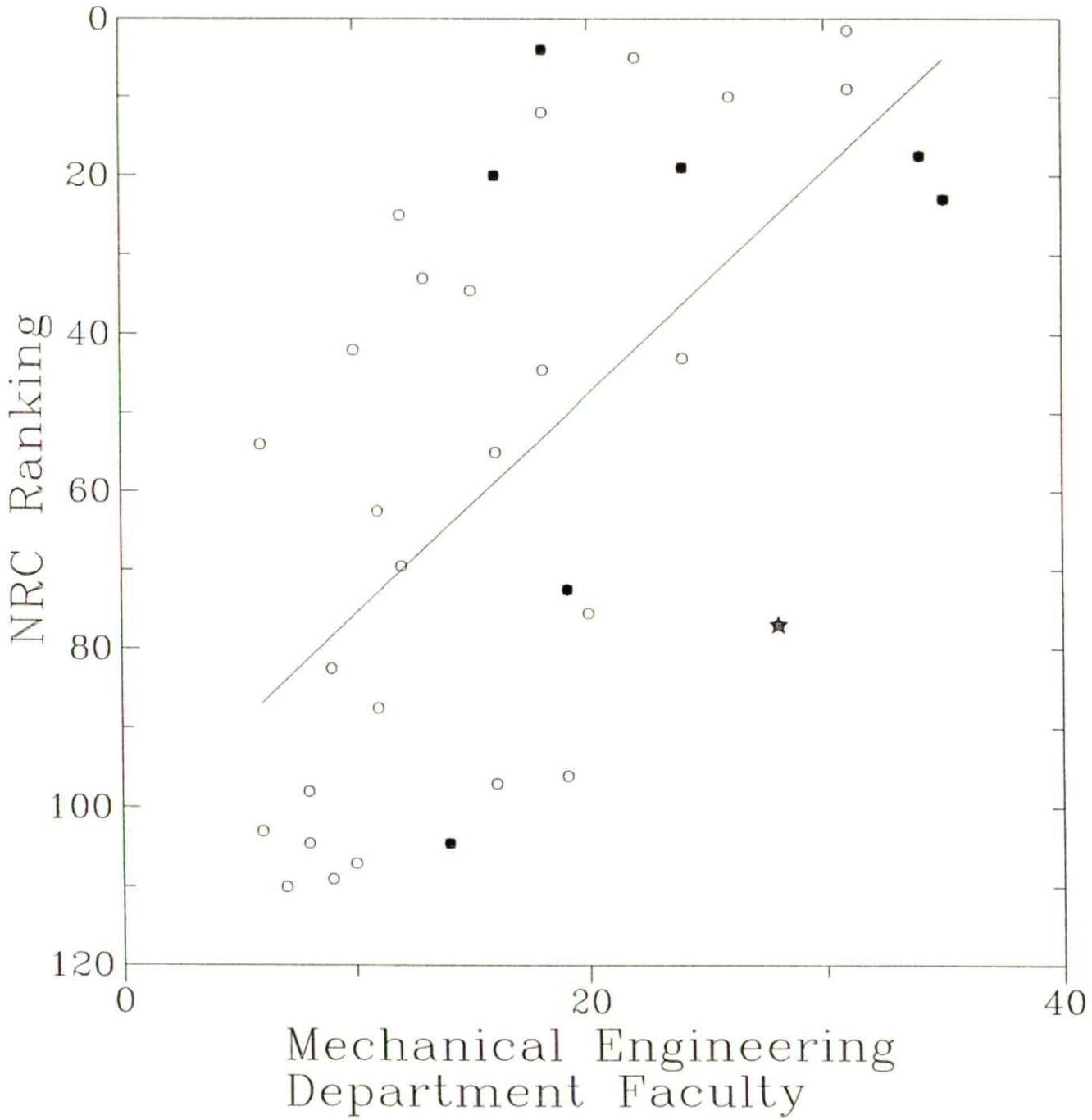
0
20
40
60
80
100
120
NRC Ranking
0
20
40
Mechanical Engineering
Department Faculty

Figure 14

Figure 15 shows NRC Ranking vs. Mechanical Engineering Department Undergraduate Enrollment. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change. 1992 Appendix P. Mechanical Engineering Department Undergraduate Enrollment is the school's mechanical engineering department undergraduate enrollment according to the ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges.

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without values for either NRC Ranking or Mechanical Engineering Department Undergraduate Enrollment were excluded.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles.

Public schools show a widely distributed positive correlation between rank and ME department undergraduate enrollment. Private schools, however show little or no correlation between rank and ME department undergraduate enrollment. For this graph, WPI is an outlier, ranked 77 with 628 students. Most schools with as large or larger ME department undergraduate enrollments are much better ranked than WPI. Several smaller schools are also better ranked. Figure 16 shows WPI's position in relation to other private schools more clearly.

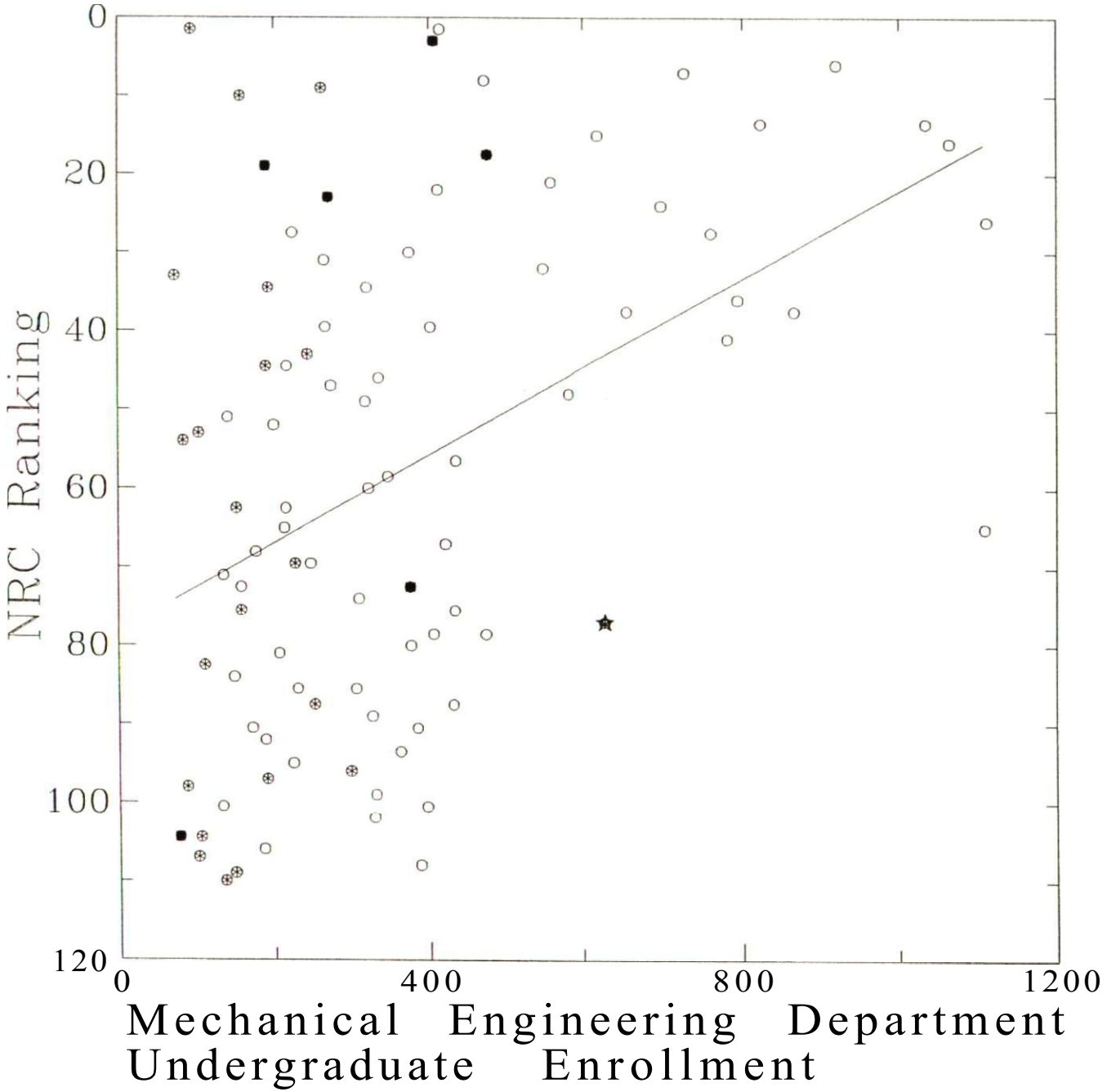
0
20
40
60
80
100
120
NRC Ranking
0
400
800
1200
Mechanical Engineering Department
Undergraduate Enrollment

Figure 15

Figure 16 shows NRC Ranking vs. Mechanical Engineering Department Undergraduate Enrollment for Private Schools. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change, 1992 Appendix P. Mechanical Engineering Department Undergraduate Enrollment is the school's mechanical engineering department undergraduate enrollment according to the ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges.

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Public schools and schools without values for either NRC Ranking or Mechanical Engineering Department Undergraduate Enrollment were excluded.

WPI is shown as a solid star. The benchmark schools Carnegie-Mellon, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as empty circles.

This graph shows no correlation between rank and department undergraduate enrollment. It does show, however, that WPI has the largest ME department undergraduate enrollment by a large margin.

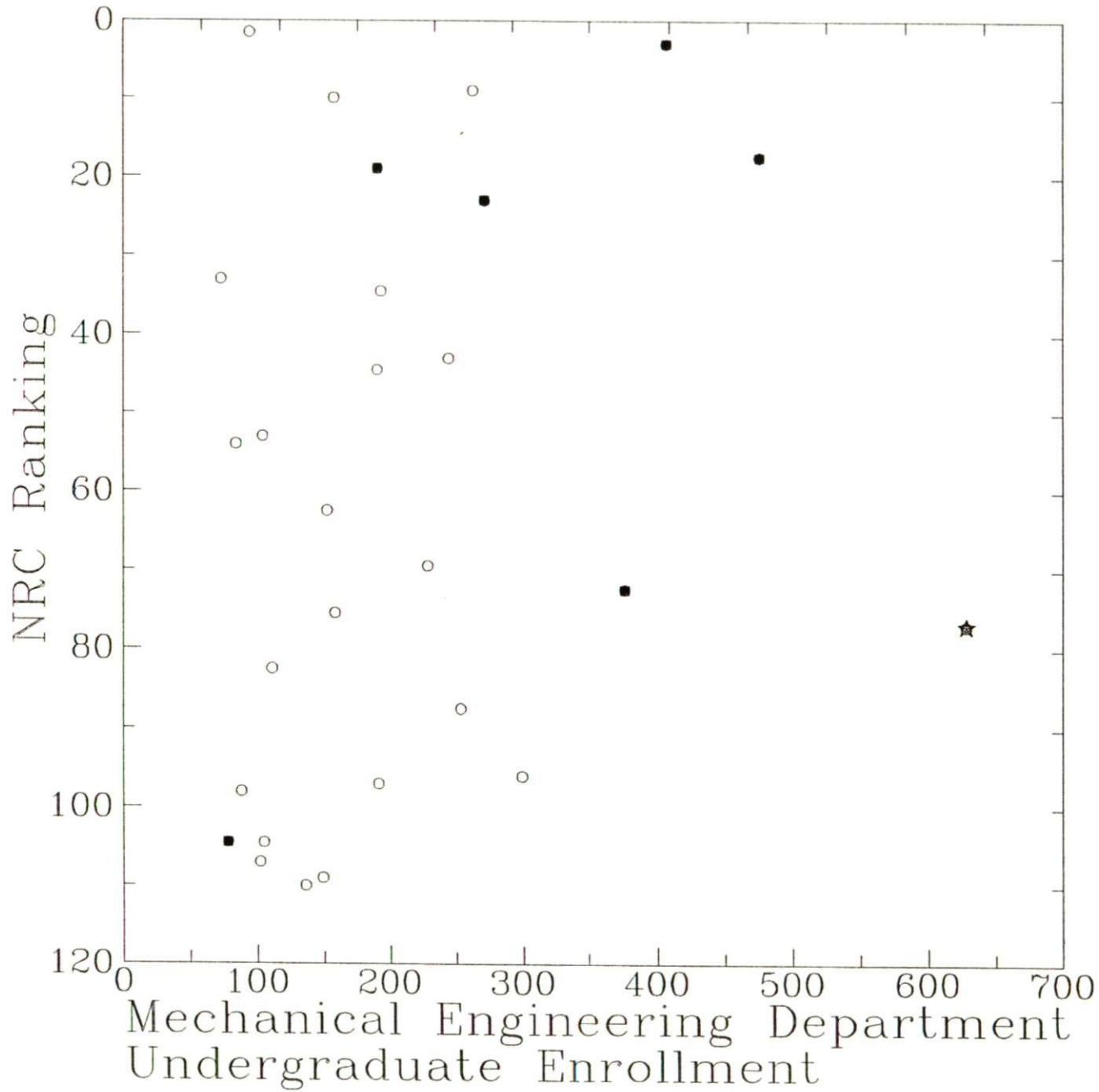
0
20
40
60
80
100
120
NRC Ranking
0
100
200
300
400
500
600
700
Mechanical Engineering Department
Undergraduate Enrollment

Figure 16

Figure 17 shows NRC ranking vs. Mechanical Engineering Department Graduate Enrollment. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change, 1992 Appendix P. Mechanical Engineering Department Graduate Enrollment is the total number of Masters and Doctorate students enrolled in the department as listed in ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges.

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without values for either NRC Ranking or Mechanical Engineering Department Graduate Enrollment were excluded.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles. The trend line is an exponential best fit.

This graph shows a strong positive correlation between rank and graduate department enrollment. Almost no really large schools are poorly ranked. Within the range of 0-200 graduate students, however, the correlation largely disappears. With 81 graduate students enrolled in the ME department, WPI falls well within this range, as do most of the private schools. RPI, MIT and Stanford are outliers at 289, 417 and 434 graduate students respectively.

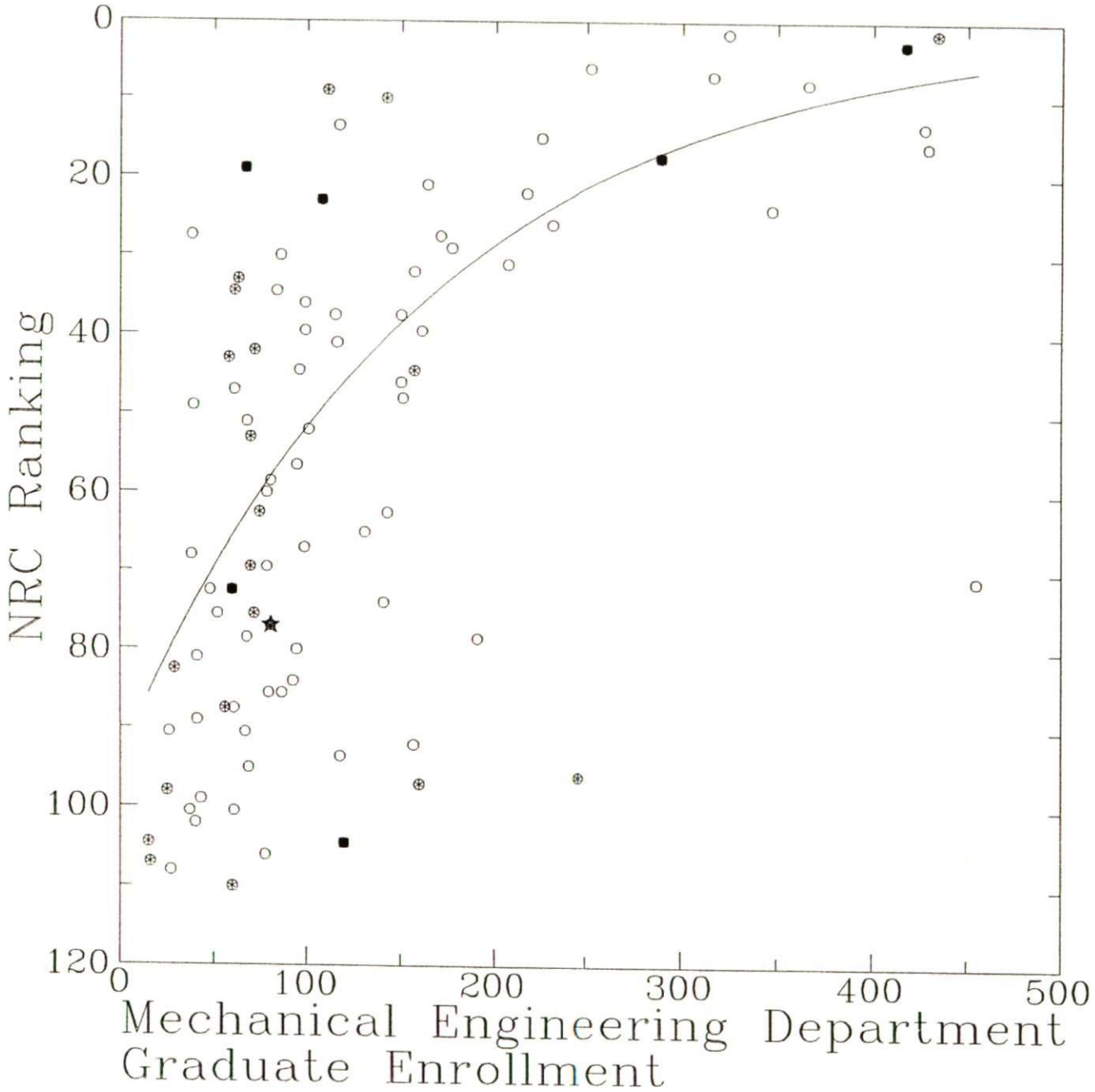
0
20
40
60
80
100
120
NRC Ranking
0
100
200
300
400
500
Mechanical Engineering Department
Graduate Enrollment

Figure 17

Figure 18 shows NRC Ranking vs. Mechanical Engineering Department Ph.D. Enrollment. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change. 1992 Appendix P. Mechanical Engineering Department Ph.D. Enrollment is the mechanical engineering department Doctoral enrollment according to the ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges.

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without values for either NRC Ranking or Mechanical Engineering Department Ph.D. Enrollment were excluded.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles. The trend **line is an exponential** best fit.

This graph shows a definite positive correlation between rank and ME department Ph.D. enrollment. With 9 ME Ph.D. students, WPI is nearly at the bottom of the scale. To reach number 40 in rank, WPI would need to increase the number of ME Ph.D. students to 50 or 60 according to the trend line.

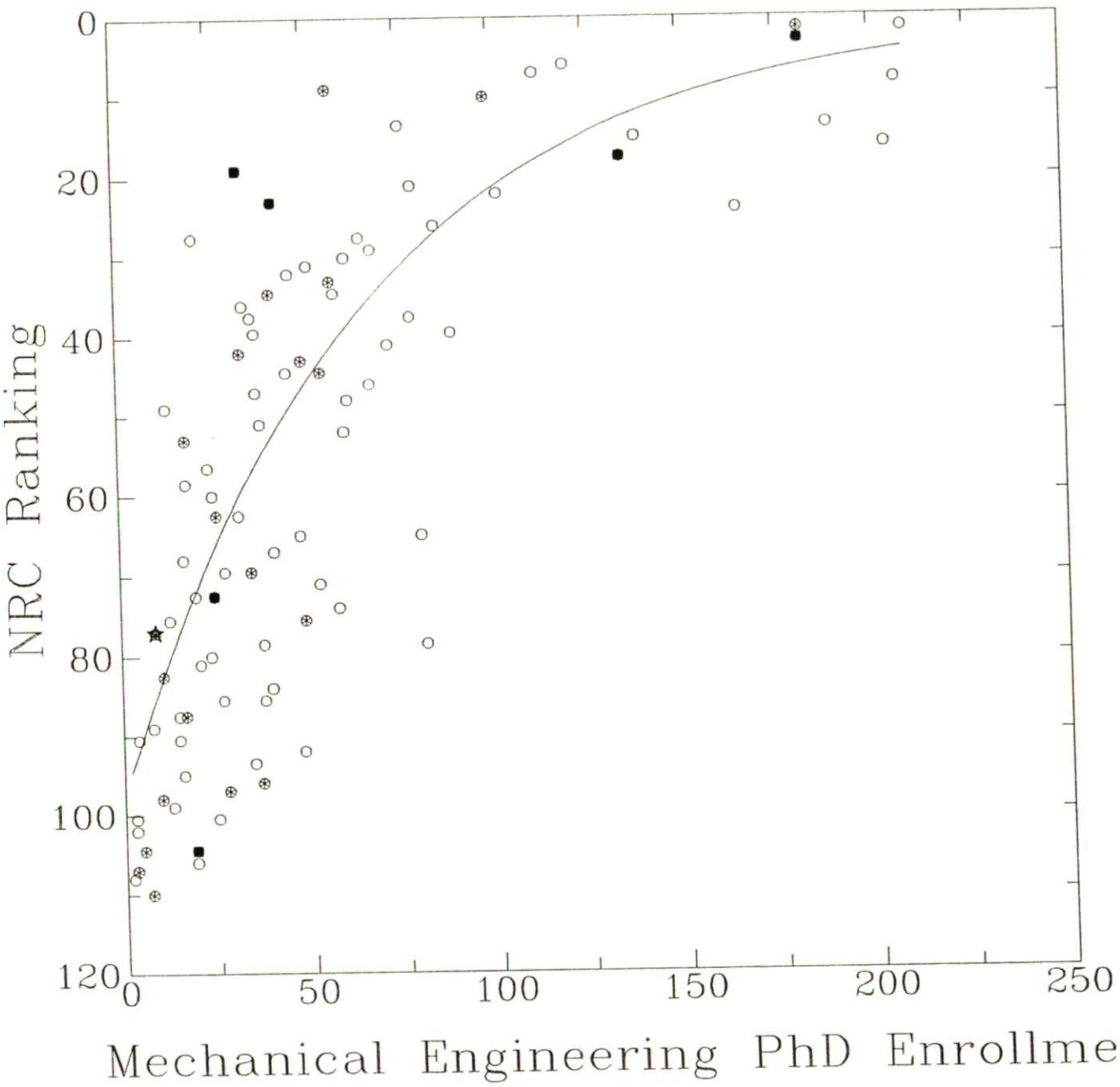
0
20
40
60
80
100
120
NRC Ranking
0
50
100
150
200
250
Mechanical Engineering PhD Enrollment

Figure 18

Figure 19 shows NRC Ranking vs. Mechanical Engineering Department Student Appointments. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change. 1992 Appendix P. Student Appointments is the number of student appointments (RA or TA) in the Mechanical Engineering Department for fall of 1995, as reported in the ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges.

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without values for either NRC Ranking or Student Appointments were excluded.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles.

This graph shows a large band of schools between 0 and 100 ME graduate student appointments, with WPI at 33. A few other schools have more appointments. The largest is UMass, Lowell, with 381 appointments. The only private schools with more than 100 ME graduate student appointments are MIT and Stanford, with 381 and 322 appointments, respectively. Figure 20 shows the band of schools between 0 and 100 appointments more closely.

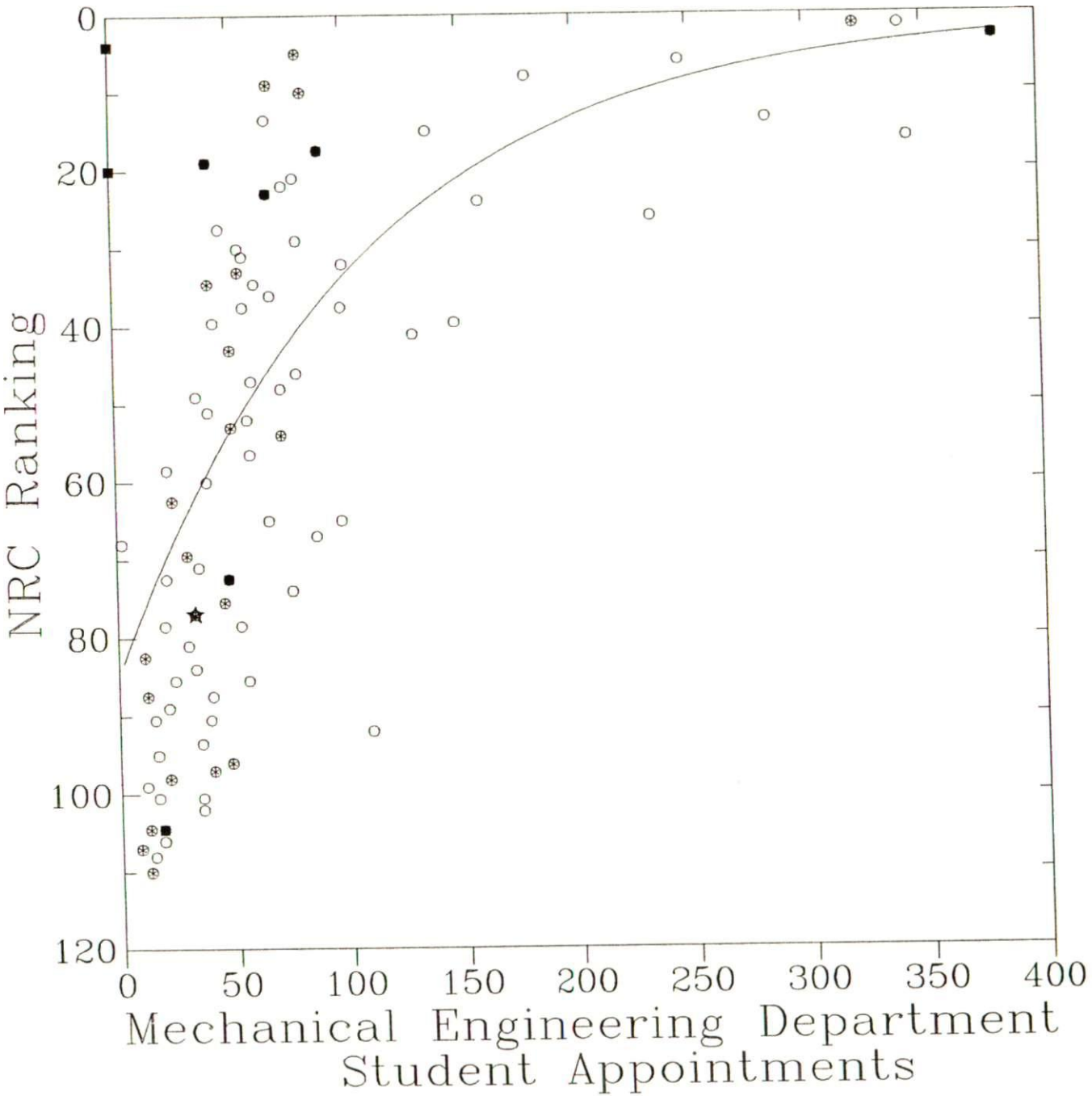
0
20
40
60
80
100
120
NRC Ranking
0
50
100
150
200
250
300
350
400
Mechanical Engineering Department
Student Appointments

Figure 19

Figure 20 shows NRC Ranking vs. Mechanical Engineering Department Student Appointments: Data clipped at x=100. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change, 1992 Appendix P. Student Appointments is the number of student appointments (RA or TA) in the Mechanical Engineering Department for fall of 1995 as reported in the ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges.

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without values for either NRC Ranking or Student Appointments were excluded. Schools with more than 100 appointments were excluded, including MIT and Stanford.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, **RPI, and Stevens Institute** of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles.

This graph shows a strong positive correlation between rank and ME graduate student appointments. WPI is on the trend line with rank 77 and 33 appointments. According to the trend line, WPI should increase the ME graduate student appointments to around 60 or 70 in order to reach number 40 in rank.

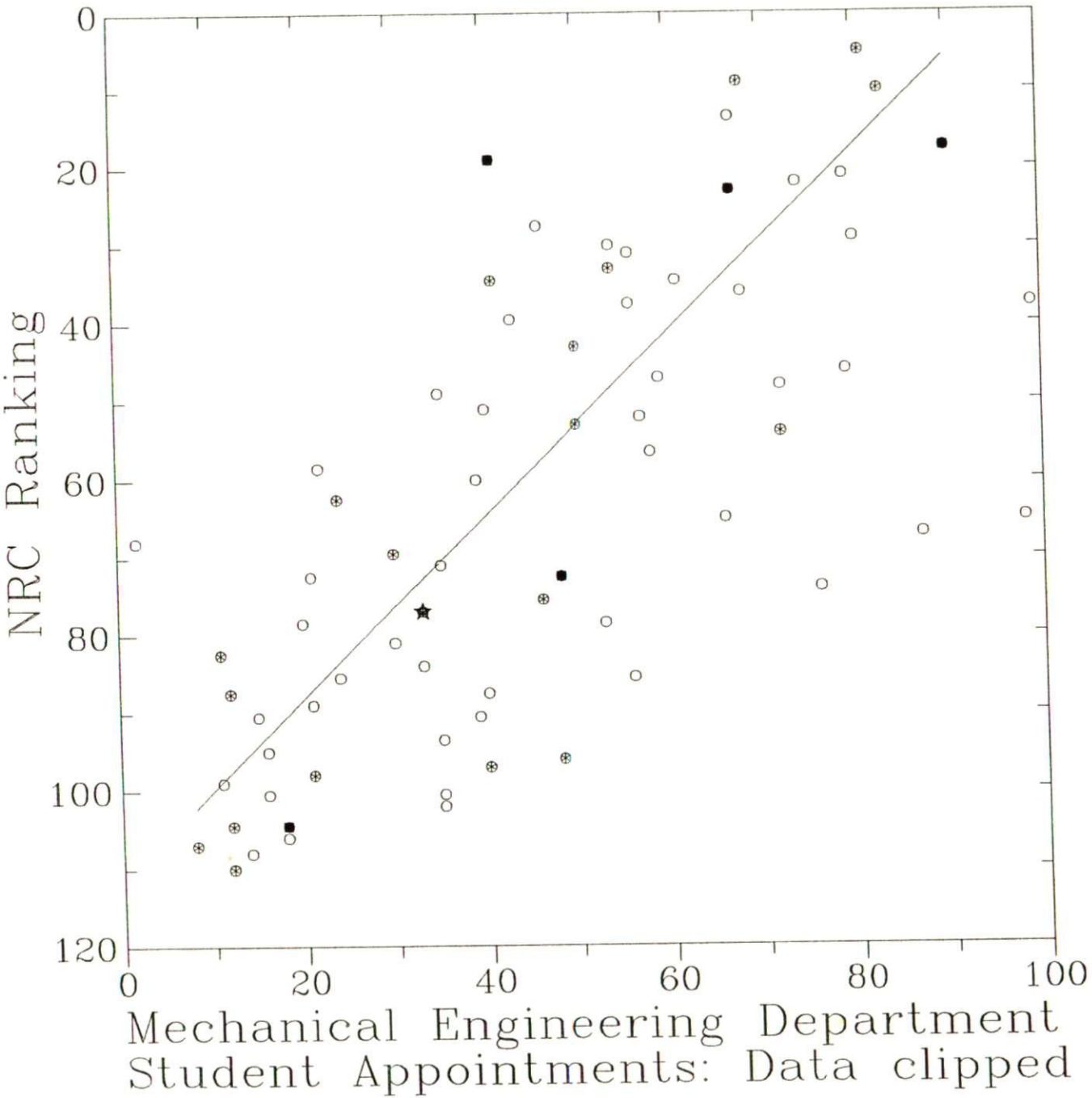
0
20
40
60
80
100
120
NRC Ranking
0
20
40
60
80
100
Mechanical Engineering Department
Student Appointments: Data clipped at 100

Figure 20

Figure 21 shows NRC Ranking vs. Mechanical Engineering Department Faculty and Student Appointments. NRC ranking is the "program effectiveness in educating research scholars and scientists" according to the National Research Council's National Survey of Graduate Faculty. This set of rankings is printed in the NRC's publication Research-Doctorate Programs in the United States: Continuity and Change. 1992. Appendix P. Mechanical Engineering Department Faculty & Student Appointments is the total mechanical engineering department faculty for fall of 1995 as reported in the ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges plus the number of student appointments (RA or TA) in the Mechanical Engineering Department for fall of 1995 as reported in the ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges.

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without a NRC ranking were excluded.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles.

This graph shows a positive correlation between rank and ME department faculty and graduate student appointments. Schools with a large number of ME department faculty and appointments are well ranked, but some schools with smaller numbers are also well ranked. According to the trend line, WPI should be ranked at around number 50 or 60.

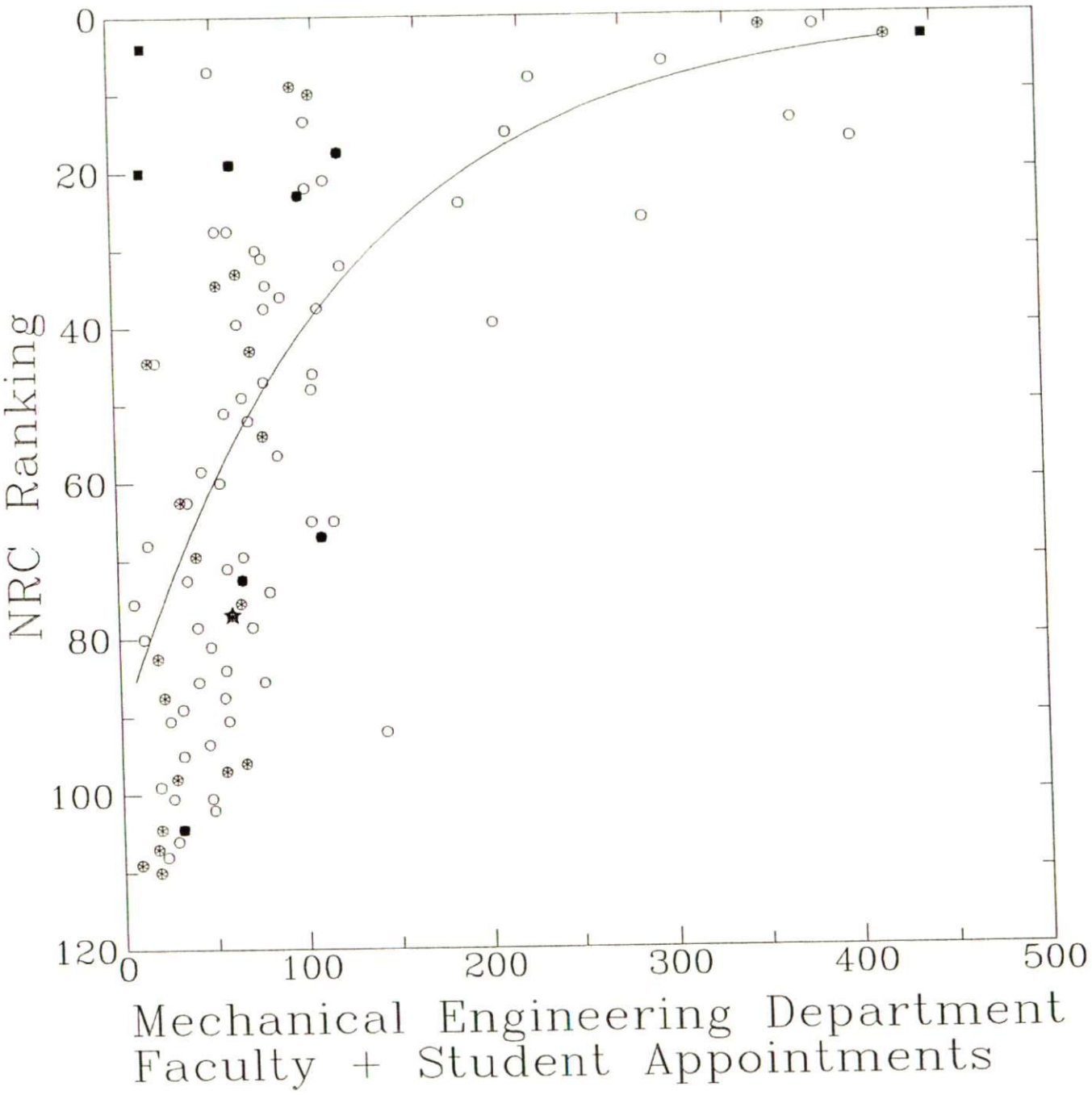
0
20
40
60
80
100
120
NRC Ranking
0
100
200
300
400
500
Mechanical Engineering Department
Faculty + Student Appointments

Figure 21

Figure 22 shows Mechanical Engineering Department Undergraduate Enrollment vs. Mechanical Engineering Department Faculty. Mechanical Engineering Department Undergraduate Enrollment is the school's mechanical engineering department undergraduate enrollment according to the ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges. Mechanical Engineering Department Faculty is the school's total mechanical engineering department faculty for fall of 1995 as reported in the ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges. Private and public control was listed in Peterson's Four Year Colleges 1997.

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without values for either Mechanical Engineering Department Undergraduate Enrollment or Mechanical Engineering Department Faculty were excluded.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles.

This graph shows a positive correlation between ME department undergraduate enrollment and ME department faculty. With 628 undergraduate ME students and 28 ME faculty, WPI is set apart from the group of private schools. Only 11 schools in the graph have more than 600 ME undergraduate students, and of those, only WPI is a private school. According to the trend line for the entire group of schools, an ME department with 600 students should have around 45 faculty. The trend line for private schools shows closer to 60 faculty for 600 students.

Mechanical Engineering Department
Undergraduate Enrollment
0
200
400
600
800
1000
1200
0
20
40
60
80
100
Mechanical Engineering
Department Faculty

Figure 22

Figure 23 shows Mechanical Engineering Department Undergraduate Enrollment vs. Mechanical Engineering Department Faculty & Student Appointments. Mechanical Engineering Department Undergraduate Enrollment is the school's mechanical engineering department undergraduate enrollment according to the ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges. Mechanical Engineering Department Faculty & Student Appointments is the total mechanical engineering department faculty for fall of 1995 as reported in the ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges plus the number of student appointments (RA or TA) in the Mechanical Engineering Department for fall of 1995 as reported in the ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges.

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without values for Mechanical Engineering Department Undergraduate Enrollment, Mechanical Engineering Department Faculty, or Student Appointments were excluded. Schools without a NRC ranking were excluded.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles.

This graph shows a large band of schools with less than 150 total ME faculty and appointments. Several schools have a larger number, but show no correlation between ME department undergraduate enrollment and ME department faculty and appointments.

Below 150, however, a positive correlation between those two variables can be seen. WPI has 628 ME undergraduate students and its total of department faculty and appointments is 61. As in Figure 22, this sets WPI apart from the group of private schools. For 628 students, WPI should have closer to 100 department faculty and appointments. Figure 24 will show the group of schools below 150 department and faculty more closely.

Mechanical Engineering Department
Undergraduate Enrollment
0
200
400
600
800
1000
1200
0
100
200
300
400
500
Mechanical Engineering Department
Faculty + Student Appointments

Figure 23

Figure 24 shows Mechanical Engineering Department Undergraduate Enrollment vs. Mechanical Engineering Department Faculty & Student Appointments: data clipped at 150. Mechanical Engineering Department Undergraduate Enrollment is the school's mechanical engineering department undergraduate enrollment according to the ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges. Mechanical Engineering Department Faculty & Student Appointments is the total mechanical engineering department faculty for fall of 1995 as reported in the ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges plus the number of student appointments (RA or TA) in the Mechanical Engineering Department for fall of 1995 as reported in the ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges.

The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997. Schools without values for Mechanical Engineering Department Undergraduate Enrollment, Mechanical Engineering Department Faculty, or Student Appointments were excluded.

WPI is shown as a solid star. The benchmark schools Caltech, Carnegie-Mellon, Case Western, Clarkson University, Lehigh University, MIT, RPI, and Stevens Institute of Technology are shown as solid squares. Private schools are shown as partially filled circles, and public schools are shown as empty circles.

This graph shows the group of schools from Figure 23 with less than 150 ME department faculty and graduate student appointments. There is a definite correlation between ME department undergraduate enrollment and ME department faculty and graduate student appointments. The group of benchmark schools shows a clear trend line

that WPI can use as a guideline. For the number of department faculty and appointments, the number of department undergraduate students should be around 200, while for the number of ME department undergraduate students, WPI should have more than 150 ME department faculty and appointments.

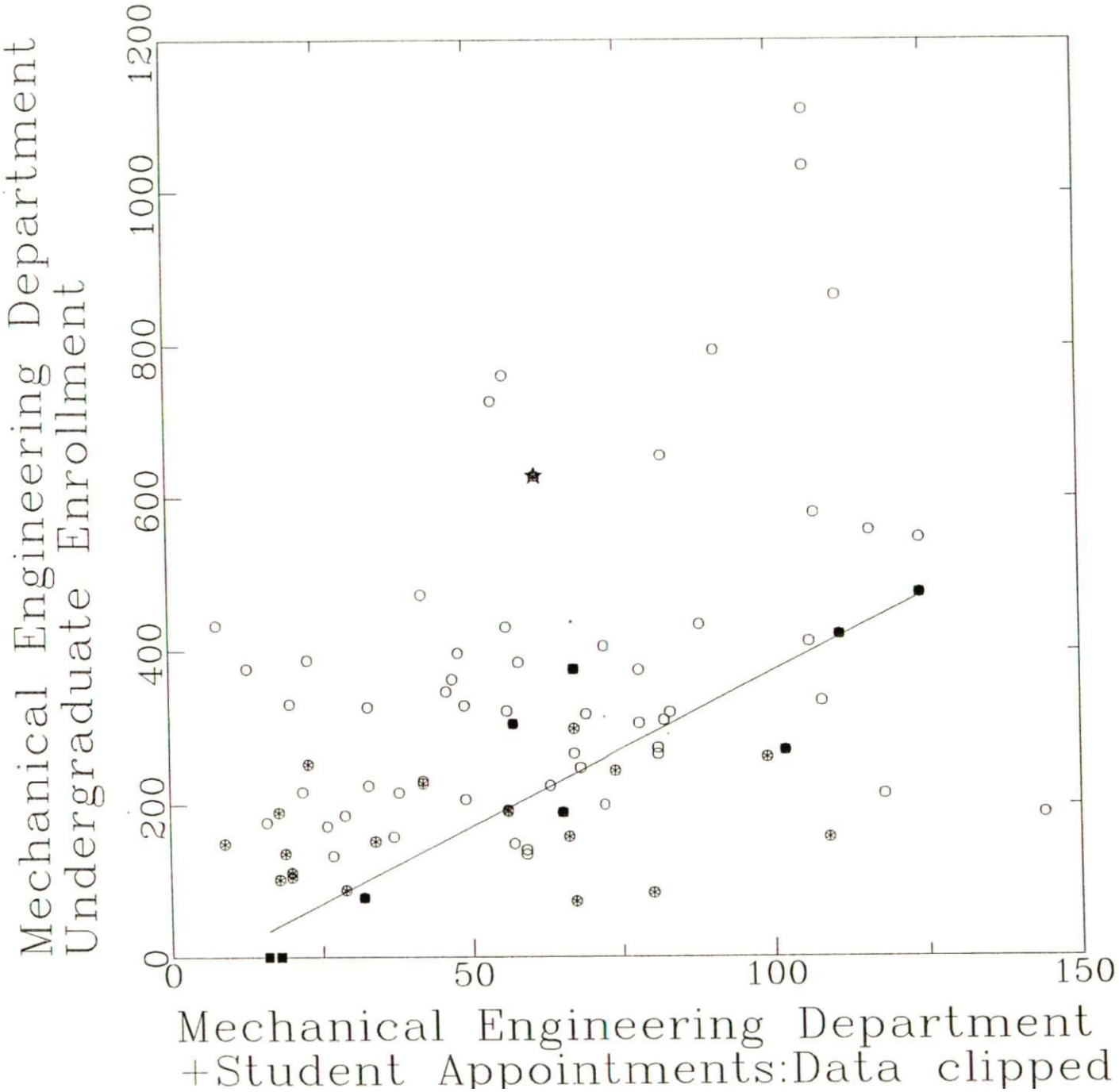
Mechanical Engineering Department
Undergraduate Enrollment
0
200
400
600
800
1000
1200
0
50
100
150
Mechanical Engineering Department Faculty
+Student Appointments:Data clipped at 150

Figure 24

Chapter 4: Conclusions

Figures 1-12 show school information graphed against school rank. The first three figures show that the total number of institution faculty, undergraduate enrollment, and out of state undergraduate tuition have little or no direct correlation to ranking. Figures 4-12, however, do show positive correlations, so the changes necessary for WPI to reach number 40 in rank can be extrapolated according to each individual variable. According to these figures, there are several things for WPI to do in order to reach rank number 40:

- increase the graduate out of state tuition from $ 10,620 per year to around $ 15,000 per year
- increase the number of library volumes from 240,416 to at least 1,000,000 volumes
- increase the library expenditures from $1,467,000 to at least $3,000,000
- increase the research and development funding from $4,511,000 to around $30,000,000
- increase the endowment from $ 150,000,000 to around 500,000,000

Figures 13-21 show department-specific information graphed against school rank. There is a positive correlation between rank and each of these department-specific variables, but for each variable there are a few schools with low values that are well ranked. This means that while large values tend to result in better ranks, they are not essential. According to several of these figures, WPI should already be ranked better than 77. It has a large number of ME department faculty compared to other private schools, an extremely large ME department undergraduate enrollment, and an ME department

graduate enrollment comparable to other private schools. WPI's values for two variables, however, do need improvement:

- increase ME Ph.D. enrollment to 50 or 60 students
- increase ME graduate student appointments to 60 or 70

Figures 22-24 each compare two department- specific variables. Figure 22 shows that WPI's ME undergraduate student to faculty ratio (628/28) is far from the trend line for other private schools. According to that trend line, a department with 600 students should have around 60 faculty, double WPI's current count. Figures 23 and 24 show ME department undergraduate student enrollment against the count of ME department faculty and graduate student appointments, to allow for the influence of teaching and research assistants on undergraduate education. According to the distribution of other private schools, and in particular the group of benchmark schools, a department with 600 undergraduate students should have a count of at least 150 department faculty and student appointments, almost 3 times WPI's count of 61 department faculty and appointments.

I investigated the plausibility of some of the changes listed above. First, I met with Helen Shuster, the Director of the Gordon Library. She agreed that the library needs a larger collection, and explained that the current library building cannot hold the entire current collection, some of which is kept in storage in another building. Part of the library building houses the WPI Mass Academy, an advanced program for high school students, so if that program were moved, there would be more room for books. Unfortunately, even that extra space would not house 1,000,000 volumes. In 1993, the library consulted an architect on the possibility of renovating the Mass Academy space to be a part of the library, and the estimate was for about $5,000,000 (library expenditures in 1992 were

$1,467,000). To build or renovate a new library building would presumably cost much more. WPI needs to examine the options available for library expansion and options for increasing library funding to accomplish an expansion. A library expansion will likely be difficult to achieve, but because WPI's library is extremely small in comparison to the other schools in my study, I think it is important.

I also talked with Pamela St.Louis, Administrative Assistant to the Mechanical Engineering Department, about the possibility of increasing the ME department's Ph.D. enrollment, number of graduate student appointments and number of faculty. Increasing the PhD. enrollment would require increasing the number of fellowships and improving the research laboratories and the course selection available, Increasing the number of faculty would require a strong group of graduate students to help them with research and improved research and laboratory space.

The fact that in several cases schools with small values for a variable are still well ranked may provide a solution to the dilemma of not enough money in the department. It seems likely that these small, good schools achieve that state by being balanced. **Figures** 22-24 show that the WPI ME department has a disproportionate number of undergraduate students. There are two ways to deal with this problem: Either increase the number of faculty and resources, or decrease the number of students. Decreasing ME undergraduate enrollment to around 300 would bring WPI in line with the trend displayed in figure 24.

There is no effective simplistic solution because many different variables interact to make WPI what it is. Simplistic solutions are useful for surveying the options available, but more involved analysis and planning are always necessary to produce an effective solution.

Appendix: Tables

These tables show all of the schools and variables included in this study.

"School Name" is the full school name as listed in Peterson's Graduate Programs in Engineering and Applied Sciences, 1997. The schools selected were all of those in the US with Mechanical Engineering departments offering Bachelors, Masters and Doctoral degrees, as listed in Peterson's Graduate Programs in Engineering and Applied Sciences, 1997 and Peterson's Four Year Colleges 1997. There are a total of 141 schools in the study.

"State" is the postal abbreviation for the state in which the school is located.

"public/private" shows whether the school is public(1) or private(O). The schools were sorted according to whether they are private or public based on information from Peterson's Four Year Colleges 1997.

"NRC Ranking" is the National Research Council's ranking of'"program effectiveness in educating research scholars and scientists' Source: NRC National Survey of Graduate Faculty" found in appendix P of Research-Doctorate Programs in the United States. Some of the schools in this study were not included in the NRC study, and therefore have no ranking.

"Graduate Tuition Out of State" is the listing of the graduate tuition for non-residents according to the Peterson's Graduate Programs in Engineering and Applied Sciences, 1997. Tuition was listed either as price per semester or price per credit hour, so the price per credit hour listings were adjusted assuming 9 credit hours per semester.

"Graduate Tuition In State" is the listing of graduate tuition for residents according to the Peterson's Graduate Programs in Engineering and Applied Sciences, 1997. Tuition was listed either as price per semester or price per credit hour, so the price per credit hour listings were adjusted assuming 9 credit hours per semester.

"Undergraduate Tuition Out of State" is the undergraduate non-resident tuition. This information was obtained primarily from the CollegeNet site and supplemented with information from Peterson's Four Year Colleges 1997. CollegeNet, www.collegenet.com copyright 1997 Universal Algorithms, is a search engine and database maintained using College Board data.

"Undergraduate Tuition In State" is the undergraduate tuition for state residents. This information was also obtained primarily from the CollegeNet site and supplemented from Peterson's Four Year Colleges 1997. CollegeNet, www.collegenet.com copyright 1997 Universal Algorithms, is a search engine and database maintained using College Board data.

"Endowment" is the school endowment reported in the Peterson's Four Year Colleges 1997 college profiles and special announcements section.

"Total Research & Development" is the total research and development funding as reported in appendix E of Research-Doctorate Programs in the United States, put out by the National Research Council. It is "the average annual expenditure for research and development at the institution for the period 1986-92 in thousands of 1988 dollars. Source National Science Foundation"

"Volumes in Library" is the number of volumes in the school's library, as reported in appendix E of Research-Doctorate Programs in the United States. It is the "Total number of printed, typewritten, mimeographed or processed works contained in one binding or portfolio that has been catalogued, classified and made ready for use in 1992=93 academic year. Sources ARL, ACRL, Department of Education"

"Library Expenditures" is the amount of library expenditures, as reported in appendix E of Research-Doctorate Programs in the United States. It is the "total library expenditure of funds from regular institutional budgets and other sources... for the 1992-93 academic year. Sources ARL, ACRL, Department of Education"

"Undergraduate Enrollment" is the undergraduate enrollment of the school. This variable was obtained from CollegeNet listings at www.collegenet.com on the internet. For those schools without a listing on CollegeNet, information was taken from the Peterson's Four Year Colleges 1997.

"Total Faculty" is the number of faculty reported in Peterson's Four Year Colleges 1997. For some listings it was stated to be undergraduate faculty, and for **some** it was listed as total faculty. It was assumed that the two terms represent the same number.

"Undergraduate ME Enrollment" is the Mechanical Engineering Department undergraduate enrollment for fall of 1995 according to ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges.

"Graduate ME Enrollment" is the Mechanical Engineering Department graduate enrollment for fall of 1995 according to ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges.

"Doctoral Enrollment" is the Mechanical Engineering Department Doctoral enrollment for fall of 1995 according to ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges.

"Student Appointments" is the number of student appointments (RA and TA) in the Mechanical Engineering Department for fall of 1995 as reported in ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges.

"Department Faculty" is the Mechanical Engineering Department faculty for fall of 1995 as reported in ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges.

"Department Faculty & Appointments" is Mechanical Engineering Department faculty plus student appointments (TA and RA) for fall of 1995 as reported in ASEE 1995-1996 Profiles of Engineering & Engineering Technology Colleges.

School Name	State	public/ private	NRC Ranking	Graduate Out of State	Tuition In State	Undergraduate Out of State	Tuition In State	School Endowment	Total Research & Development	Volumes in Library	Library Expenditures
Arizona State University	AZ	1	48	8378	2010	8640	1988	56000000	45382000	2922157	16106000
Auburn University	AL	1	74	7065	2355	7830	7830	1.54E+08	53253000	2140856	7817000
Boston University	MA	0		20570	20570	21970	21970	3.90E+08	61848000	1895723	10802000
Brigham Young University	UT	1		4470	2980	2630	2630		10884000	2262029	11540000
Brown University	RI	1	12	21592	21592	22592	22592	789254	40215000	2606259	11215000
California Institute of Technology	CA	0	4	18060	18060	18600	18600	5.92E+08	90574000	498812	4347000
Carnegie Mellon University	PA	0	19	19400	19400	20275	20275	4.54E+08	87390000	828109	4533000
Case Western Reserve University	OH	1	20			17800	17800	6.20E+08	79286000	1802042	8625000
City College of the City University of New York	NY	1		7600	4350	6905	3305				
Clarkson University	NY	0	72.5	5256	5256	18250	18250	72500000	7471000	213130	1176000
Clemson University	SC	1	67	5844	2922	8486	3062	1.13E+08	52938000	797997	5912000
Colorado State University	CO	1	58.5	9556	2562	9480	2258	28400000	61164000	1505169	7769000
Columbia University	NY	0	42			19730	19730	2.20E+09	1.58E+08	6386712	27158000
Cornell University	NY	0	9	20900	20900	21840	21840	1.50E+09	2.56E+08	5579629	25860
Dartmouth College	NH	0		29128	29128	22896	22896	9.02E+08	36245000	1992074	10155000
Drexel University	PA	0		4725	4725	14228	14228		16653000	493537	2329000
Duke University	NC	0	33	14400	14400	21550	21550	7.82E+08	1.18E+08	4234985	17347000
Florida Agricultural and Mechanical University	FL	1		3592	1062	7994	1318				
Florida Atlantic University	FL	1		7002	2142	7939	1318		3832000	592131	3690000
Florida Institute of Technology	FL	0	107	4812	4812	15510	15510	3500000	3727000	187294	993000
Florida International University	FL	1		9463	2812	7951	1318	13800000			
Florida State University	FL	1		3501	1062	7904	1318		47941000	2028509	8755000
The George Washington University	DC	1	55	5625	5625	20370	20370	3.70E+08	26221000	1291356	9665000
Georgia Institute of Technology	GA	1	16	8223	2220	8961	2241	34700000	1.40E+08	1771934	5327000
Howard University	DC	0	104.5			8580	8580		15578000	1905110	9600000
Illinois Institute of Technology	IL	1	44.5	16350	16350	16620	16620	97500000	6479000	383803	1446000
Indiana State University of Science and Technology	IN	1	41	8636	2934			974950			
Johns Hopkins University	MD	0	54	20740	20740	21700	21700	8.55E+08	1.99E+08	3012364	17624000
Kansas State University	KS	1	87.5	2780	846	10400	10400	1.48E+08	43713000	1276462	5989000
Lehigh University	PA	0	23	6939	6939	21350	21350	3.80E+08	24364000	1059491	4872000
Louisiana State University and Agricultural and Mechanical College	LA	1	100.5	5996	2696	5963	2663	72000000	1.13E+08	2709757	8967000

School Name	State	public/ private	NRC Ranking	Graduate Out of State	Tuition In State	Undergraduate Out of State	Tuition In State	School Endowment	Total Research & Development	Volumes in Library	Library Expenditures
Louisiana Tech University	LA	1		4353	2358	5367	2367	18400000			
Marquette University	WI	0		4185	4185	15160	15160	1.42E+08			
Massachusetts Institute of Technology	MA	0	3	22000	22000	14500	14500	2.00E+09	2.68E+08	2320524	11703000
Michigan State University	MI	1	36	10182	5034	11280	4230	1.28E+08			
Michigan Technological University	MI	1	65	8995	3959	9576	3936	1600000	14211000	162857	1734000
Montana State University, Bozeman	MT	1	108	4393	1413	5896	2172	15100000			
New Jersey Institute of Technology	NJ	1	93.5	10824	7824	9302	4958	9500000	11860000	154257	1557000
New Mexico State University	NM	1		7344	2352	7152	7152		61122000	924614	4396000
North Carolina Agricultural and Technical State University	NC	1		8028	874	8028	900	3500000			
North Carolina State University	NC	1	27.5	10738	2206	10414	1428		1.11E+08	1485041	10414000
North Dakota State University	ND	1		6394	2520	5970	2236		17522000	455338	2350000
Northeastern University	MA	0	96	3735	3735	16320	16320	2.44E+08	11863000	738193	7805000
Northwestern University	IL	0	10	18108	18108	19152	19152	1.80E+09	1.06E+08	3642790	15857000
Ohio State University	OH	1	24	12585	4695	10896	10896	5.48E+08	1.49E+08	4693081	18021000
Oklahoma State University	OK	1	80	1053	666	5475	1695		53479000	1705986	7893000
Old Dominion University	VA	1	69.5	4077	1589	10650	4110	29500000	7862000	634435	3669000
Oregon State University	OR	1	75.5	9891	5796	10644	2694		83712000	1246307	6975000
Pennsylvania State University, University Park Campus	PA	1	15	12516	6078	11310	5258	3.64E+08	1.99E+08	3421370	20340000
Polytechnic University, Brooklyn Campus	NY	1	103	17890	17890	17585	17585	18700000	8900000	192738	2271000
Polytechnic University, Farmingdale Campus	NY	1	103	17890	17890	17350	17350	18700000	8900000	192738	2271000
Portland State University	OR	1		9795	5700	10260	2694	595975	3085000	930693	5150000
Princeton University	NJ	0	5	22640	22640	22920	22920	2.90E+09	72497000	5081114	20714000
Purdue University	IN	1	7	10636	3208	11720	3500	3.04E+08	13010000	2076302	10628000
Rennselaer Polytechnic Institute	NY	0	17.5	5139	5139	18555	18555	3.11E+08	34988000	407421	2426000
Rice University	TX	0	34.5	13300	13300	13900	13900	1.50E+09	20804000	1794602	8284000
Rutgers, The State University of New Jersey, New Brunswick	NJ	1	30	8406	5734	7707	3786	1.94E+08	1.12E+08	3441294	23604
SantaClara University	CA	0		3654	3654	16455	16455	1.81E+08			
Southern Methodist University	TX	0	87.5	9432	9432	15228	15228	4.83E+08	7232000	2197215	7953000
Stanford University	CA	0	1.5	21885	21885	21300	21300	3.10E+09	2.64E+08	6250671	35801000

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University of Illinois at Chicago	IL	1	46	9316	3300	8868	2956	15000000	72828000	1782637	12311000
University of Illinois at Urbana-Champaign	IL	1	6	10444	4090	12990	12990		1.94E+08	8281456	19668000
University of Iowa	IO	1	52			9422	2566	2.65E+08	95103000	3317265	14060000
University of Kansas	KS	1	68			8270	1965	5.31E+08	53684000	3193850	13131000
University of Kentucky	KY	1	78.5	8076	2916	7200	2400	1.37E+08	64867000	2515874	11018000
University of Maryland, Baltimore County	MD	1		3744	2079	8192	3740	2400000	4428000	567159	3158000
University of Maryland, College Park	MD	1	39.5	6375	4250	9873	3744	48200000	1.44E+08	2231552	14212000
University of Massachusetts, Amherst	MA	1	65	8842	2778	8952	2004	15600000	7493000	2575292	9260000
University of Massachusetts, Lowell	MA	1				7347	1700		10144000	391058	2669000
The University of Memphis	TN	1		7010	2674	6568	1972				
University of Miami	FL	0	82.5	6678	6648	19140	19140	2.65E+08	76000000	1875556	12266000
University of Michigan	MI	1	8			17040	5546	1300000	2.62E+08	6699359	27843000
University of Minnesota, Twin Cities Campus	MN	1	11	9390	4680	10841	3794	36400000	2.43E+08	5008637	24534000
University of Missouri, Columbia	MO	1	85.5	8291	3020	11187	3744	1.48E+08	70733000	2630419	9800000
University of Missouri, Rolla	MO	1	56.5	11054	3677	11816	3744	2.25E+08	14531000	447229	1313000
University of Nebraska, Lincoln	NE	1	102	2205	810	6398	2355	21000000	64939000	2164254	9194000
University of Nevada, LasVegas	NV	1		783	783	7430	1995	24000000			
University of Nevada, Reno	NV	1		5100	5100	7430	1995		19724000	861089	6165000
University of New Mexico	NM	1		8024	2247	8174	8174	1.75E+08		1904107	13392000
University of North Carolina at Charlotte	NC	1		8028	874	8028	900	23400000			
University of Notre Dame	IN	0	43	18700	18700	19800	19800	9.97E+08			
University of Oklahoma	OK	1	66	4320	1332	5785	1745	2.30E+08	54147000	2430404	8430000
University of Pennsylvania	PA	1	25	20644	20644	19970	19970	1.70E+09			
University of Pittsburg	PA	1	62.5	17964	8808	11270	5184	4.45E+08			
University of Rhode Island	RI	1	72.5			11010	3302	17900000	31891000	1019029	4706000
University of Rochester	NY	0	75.5	19630	19630	20540	20540	7.06E+08	1.10E+08	2812892	9278000
University of South Carolina	SC	1	95	7368	3630	8840	3434		37359000	2576311	10588000
University of South Florida	FL	1		3528	1089	8003	1318		47642000	880261	5133000
University of Southern California	CA	0	62.5	5805	5805	20078	20078	7.91E+08	1.45E+08	3168969	15479000
University of Tennessee, Knoxville	TN	1	78.5	7080	2744	6779	2096	1.50E+08		2021903	10396000
University of Texas at Arlington	TX	1	81	7930	2626	8927	8927	17800000	7497000	897292	5283000
University of Texas at Austin	TX	1	13.5	6672	1536	9286	9286	5.13E+08	1.80E+08	6835983	22429000

School Name	State	public/ private	NRC Ranking	Graduate Out of State	Tuition In State	Undergraduate Out of State	Tuition In State	School Endowment	Total Research & Development	Volumes in Library	Library Expenditures
University of Tulsa	OK	0	109	4329	4329	12850	12850	3.96E+08	3563000	762925	3651000
University of Utah	UT	1	61	5731	1898	7550	2153	1.29E+08	75855000	2345111	11459000
University of Vermont	VT	1	100.5	16824	6732	17580	7032	1.20E+08	36906000	1105649	5984000
University of Virginia	VA	1	44.5	14444	4658	8254	2312	7.22E+08	75793000	3948504	16392000
University of Washington	WA	1	29	12475	5044	10278	2988		2.12E+08	5248347	24754000
University of Wisconsin, Madison	WI	1	22			10599	2860		2.67E+08	5424299	24065000
University of Wyoming	WY	1	90.5	6993	2259	7032	1944	81400000	20412000	1096703	4793000
Utah State University	UT	1		6942	2262	6207	1767	28600000	62700000	1177282	4524000
Vanderbilt University	TN	0	69.5	14994	14994	20900	20900	9.52E+08	59646000	2085652	12400000
Virginia Polytechnic Institute and State University	VA	1	32	6986	4754	10739	4087	2.01E+08	95071000	1849994	9350000
Washington State University	WA	1	49	12368	4936	9870	2989	2.61E+08	55965000	1717764	9208000
Washington University	MO	0	53	20000	20000	21000	21000	2.00E+09			
Wayne State University	MI	1	71	2961	1377	7230	3240	74900000	51512000	2752167	12532000
West Virginia University	WV	1	92	6774	1820	6784	2192	1.50E+08	34269000	1706768	6437000
Western Michigan University	MI	1		2949	1377	7520	2963	39100000	3107000	1104251	5798000
Wichita State University	KS	1	106	7516	2600	8018	1857	62400000	3586000	926431	3785000
Worcester Polytechnic Institute	MA	1	77	10620	10620	18710	18710	150000000	4511000	240416	1467000
Yale University	CT	0		20300	20300	23100	23100	4.00E+09	1.58E+08	9327219	33176000

School Name	Undergraduate Enrollment	Total Faculty	Undergraduate ME Enrollment	Graduate ME Enrollment	Doctoral Enrollment	Student Appointments	Department Faculty	Department Faculty &Appointments
Arizona State University	24159	1947	580	151	61	72	35	107
Auburn University	16817	1244	310	141	58	76	24	100
Boston University	14609	2680	305	49	24	33	24	57
Brigham Young University	26523	1736					18	18
Brown University	5625	660					18	18
California Institute of Technology	882	295						
Carnegie Mellon University	4737	747	190	67	33	41	24	65
Case Western Reserve University	3108	1936					16	16
City College of the City University of New York	10636	1007	275					
Clarkson University	2319	170	376	60	25	48	19	67
Clemson University	11828	1419	421	99	41	87	24	111
Colorado State University	16272	1291	347	81	18	22	24	46
Columbia University	3573	571		72	33		10	10
Cornell University	13512	1586	262	111	57	68	31	99
Dartmouth College	4285	488	315	84	41	70		70
Drexel University	5122	665	59	99	37	46		46
Duke University	6272	2122	73	63	57	54	13	67
Florida Agricultural and Mechanical University	8126	678	368	86	32	34		34
Florida Atlantic University	7210	688	101	49	24			
Florida Institute of Technology	1710	441	102	16	3	8	10	18
Florida International University	11065	1198	264	67	13	42		42
Florida State University	19874	1671	368	86	32	34		34
The George Washington University	6120	2215					16	16
Georgia Institute of Technology	8743	644	1064	429	204	344	57	401
Howard University	5906	1808	105	15	5	12	8	20
Illinois Institute of Technology	1424	600	190	157	54		18	18
Indiana State University of Science and Technology		703	781	116	72	130		130
Johns Hopkins University	3589	413	84			72	6	78
Kansas State University	17014	1102	431	61	15	40	16	56
Lehigh University	4229	504	271	108	42	67	35	102
Louisiana State University and Agricultural and Mechanical College	20374	1291	397	61	25	35	13	48

School Name								
Louisiana Tech University	6190	456						
Marquette University	6730	1011	341	91	27	18		18
Massachusetts Institute of Technology	4373	960	406	417	182	381	59	440
Michigan State University	27762	2630	794	99	34	68	23	91
Michigan Technological University	5089	386	1108	131	48	66	40	106
Montana State University, Bozeman	2567	663	388	27	2	14	9	23
New Jersey Institute of Technology	3413	530	363	118	35	35	12	47
New Mexico State University	8916	664	367	46	14	16		16
North Carolina Agricultural and Technical State University	5862	668	258	12	7	15		15
North Carolina State University	16772	2623	761	171	65		56	56
North Dakota State University	7505	497	382	35	21	60		60
Northeastern University	11387	2169	299	246	37	48	19	67
Northwestern University	7609	2330	157	142	99	83	26	109
Ohio State University	30258	3724	698	347	165	159	30	189
Oklahoma State University	13063	905	377	95	24		13	13
Old Dominion University	8122	1025	248	79	28	24	22	46
Oregon State University	12000	2164	433	52	13		8	8
Pennsylvania State University, University Park Campus	32790	2186	619	225	139	137	78	215
Polytechnic University, Brooklyn Campus	1164	293						
Polytechnic University, Farmingdale Campus	361	293					6	6
Portland State University	6458	672	108	18	0	7		7
Princeton University	4593	886				81	22	103
Purdue University	26396	2220	727	316	112		54	54
Rennselaer Polytechnic Institute	4360	342	475	289	135	90	34	124
Rice University	2625	570	193	61	41	41	15	56
Rutgers, The State University of New Jersey, New Brunswick	8546	763	375	86	61	54	24	78
SantaClara University	4103	555	99	50	0	7		7
Southern Methodist University	5297	649	253	56	17	12	11	23
Stanford University	6354	1455	94	434	182	322	31	353

School Name	Undergraduate Enrollment	Total Faculty	Undergraduate ME Enrollment	Graduate ME Enrollment	Doctoral Enrollment	Student Appointments	Department Faculty	Department Faculty &Appointments
State University of New York at Binghamton	9273	690	42	54	19	21		21
State University of New York at Buffalo	16150	1693	266	207	51	56	25	81
State University of New York at Stony Brook	11486	1607	141	68	38	40	19	59
Stevens Institute of Technology	1363	195	78	120	19	18	14	32
Syracuse University	10180	1343	191	160	28	40	16	56
Tennessee Technological University	7158	509	331	43	13	11	9	20
Texas A&M University	1241	2358	1111	231	85	234	54	288
Texas Tech University	18060	954	432	23	8			
Tufts University	4504	1093	143					
Tulane University	4952	728	88	25	10	21	8	29
University of Akron	11261	1737	385	67	15	39	19	58
The University of Alabama	12486	995	327	41	8	21	12	33
The University of Alabama at Huntsville	2444	469	149	93	40	33	24	57
University of Arizona	20477	1588	655	150	78	56	26	82
University of California, Berkeley	22130	1787	414	324	209	341	41	382
University of California, Davis	16697	1548	557	164	79	79	37	116
University of California, Irvine	13390	997	274	61	37	59	22	81
University of California, Los Angeles	22468	3275					33	33
University of California, SanDiego	14263	1359	1034	117	76	67	39	106
University of California, SantaBarbara	15703	849	320	84	58	61	22	83
University of Central Florida	15039	1278	394	89	21	23		23
University of Cincinnati	11363	953					19	19
University of Colorado at Boulder	18039	1350	322	79	25	39	17	56
University of Connecticut	10278	1123	231	80	38	24	18	42
University of Dayton	5899	781	273	98	34	18		18
University of Deleware	13476	1009	225	38	21	46	17	63
University of Detroit Mercy	2270	566	136	60	7	12	7	19
University of Florida	26663	2225	866	115	36	99	12	111
University of Hawaii at Manoa	10098	1454	141	26	7			
University of Houston	14817	1960	267	99	37	43	24	67
University of Idaho	7107	625	247	84	10	19		19

School Name	Undergraduate Enrollment	Total Faculty	Undergraduate ME Enrollment	Graduate ME Enrollment	Doctoral Enrollment	Student Appointments	Department Faculty	Department Faculty &Appointments
University of Illinois at Chicago	13667	2606	335	150	67	79	29	108
University of Illinois at Urbana-Champaign	1531	2119	920	252	120	247	53	300
University of Iowa	15878	1803	200	101	60	57	15	72
University of Kansas	16061	2035	177	38	17	2	14	16
University of Kentucky	14690	2160	406	68	38	53	19	72
University of Maryland, Baltimore County	6175	696	165	51	40			
University of Maryland, College Park	20995	1638	402	161	89	148	58	206
University of Massachusetts, Amherst	17386	1273	214	131	80	98	20	118
University of Massachusetts, Lowell	5418	615	406	417	182	381		381
The University of Memphis	10281	1162	212	24	7	20		20
University of Miami	7372	2386	111	29	11	11	9	20
University of Miichigan	23575	3520	471	366	207	180	48	228
University of Minnesota, Twin Cities Campus	17347	2953					38	38
University of Missouri, Columbia	15651	1599	306	87	27	56	22	78
University of Missouri, Rolla	3828	386	434	95	24	58	30	88
University of Nebraska, Lincoln	16499	1516	329	40	3	35	14	49
University of Nevada, LasVegas	8827	1138	88	32	5	18		18
University of Nevada, Reno	6045	616	192	25	4	7		7
University of New Mexico	10676	2006	251	95	25	41		41
University of North Carolina at Charlotte	9666	893	253	61	6	64		64
University of Notre Dame	7830	924	244	58	49	50	24	74
University of Oklahoma	13250	1022					15	15
University of Pennsylvania	9303	3853					12	12
University of Pittsburg	12901	3410	216	143	32	24	14	38
University of Rhode Island	8036	665	158	48	20	21	16	37
University of Rochester	4727	1376	158	72	49	46	20	66
University of South Carolina	12379	1379	225	69	16	16	17	33
University of South Florida	15461	1652	78	43	6	19		19
University of Southern California	13716	2601	152	75	26	24	11	35
University of Tennessee, Knoxville	16005	1579	473	191	81	20	22	42
University of Texas at Arlington	9671	1253	207	41	21	30	19	49
University of Texas at Austin	31121	2367	823	427	189	284	85	369

School Name	Undergraduate Enrollment	Total Faculty	Undergraduate ME Enrollment	Graduate ME Enrollment	Doctoral Enrollment	Student Appointments	Department Faculty	Department Faculty &Appointments
University of Tulsa	2649	405	149				9	9
University of Utah	13509	1475					23	23
University of Vermont	6945	1002	133	37	3	16	9	25
University of Virginia	7461	2022	217	96	45		22	22
University of Washington	21002	3852		177	68	80	22	102
University of Wisconsin, Madison	24844	2475	412	217	102	74	32	106
University of Wyoming	7574	726	172	26	4	15	11	26
Utah State University	11444	809	281	21	3			
Vanderbilt University	5748	1968	228	70	35	30	12	42
Virginia Polytechnic Institute and State University	19496	1915	547	157	46	100	24	124
Washington State University	14541	1206	318	39	13	35	34	69
Washington University	5033	3619	104	70	18	50		50
Wayne State University	8787	2716	135	455	53	35	24	59
West Virginia University	1927	1617	189	157	48	110	34	144
Western Michigan University	15438	1199	554	33	3	9		9
Wichita State University	5890	728	186	78	19	18	11	29
Worcester Polytechnic Institute	2554	259	628	81	9	33	28	61
Yale University	5312	2802						