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ABSTRACT

This report presents a statistical profile of 57,837 persons representing a national sample from the field of computer science. Data were obtained from the 1978 Survey of Natural and Social Scientists and Engineers sponsored by National Science Foundation and conducted by the Bureau of the Census. Categories considered include: (1) composition; (2) education and training; (3) professional experience and growth of the field; (4) labor force participation; and (5) income. Among the findings reported are those indicating that: about 85 percent of the computer specialists represented in the national sample were male; the median age was 38 years; the overwhelming majority were white (97 percent); computer specialists were more likely to hold a bachelor's than a master's or doctorate degree in 1978; the median number of years of professional experience for the sample was 14 years; in February 1978, 96 percent of the computer specialists were in the labor force; of those not in the labor force, 22 percent were retired; and the median basic salary in February 1978 of the computer specialists employed full-time was \$25,867. Supporting documentation (including questionnaire used and information on response rates) is included in appendices. (JN)

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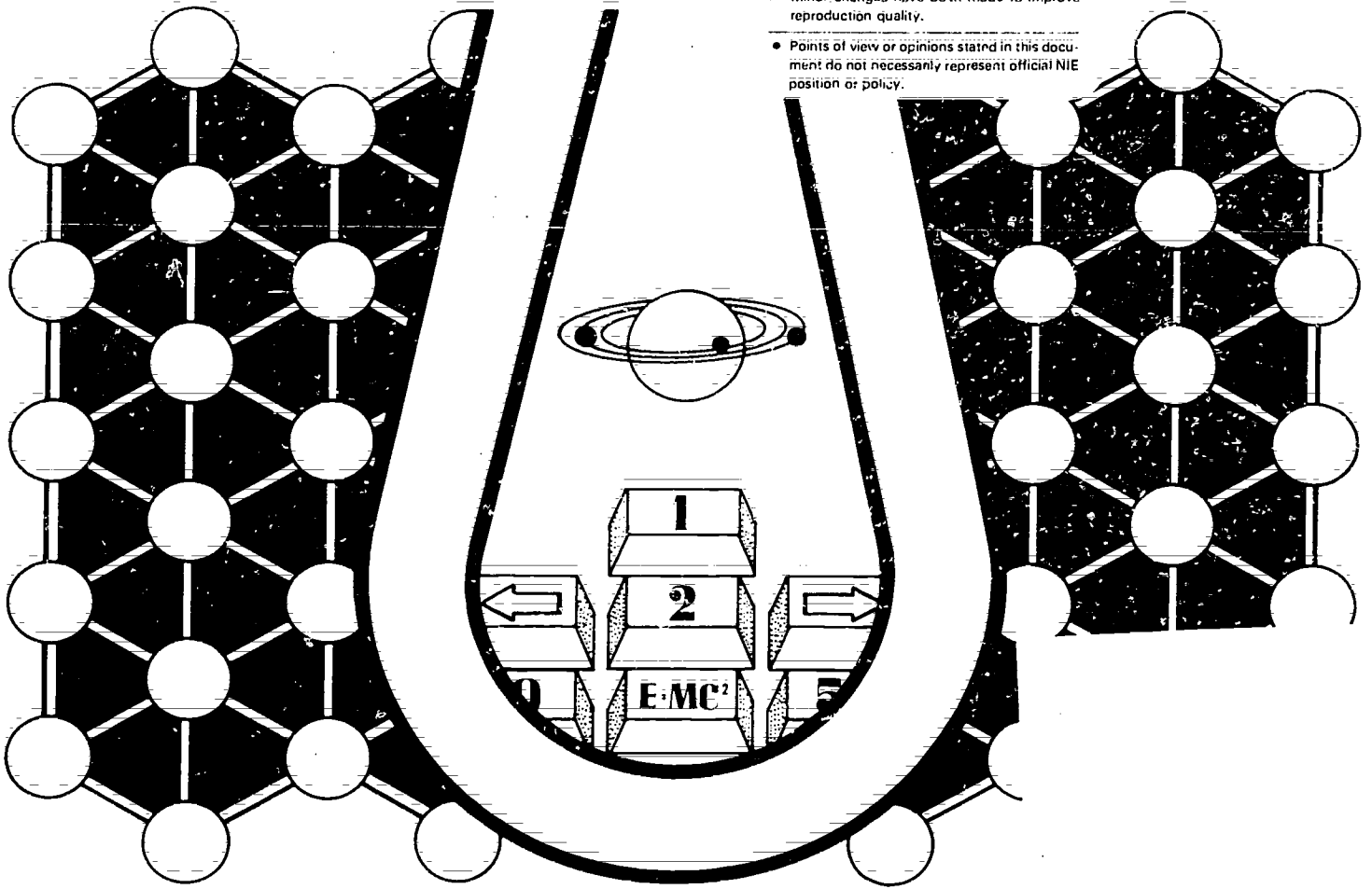
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Special Studies  
Series P-23, No. 134  
Issued April 1984

Selected  
Characteristics of  
Persons in  
**Computer  
Specialties:**

1978

by  
Thomas J. Palumbo

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At the Bureau of the Census, Anita Chiera and Jane Ingold, both of Labor Force Statistics Branch, Population Division, had primary responsibility in planning and conducting the survey. The systems and processing procedures and programs were developed by Ann M. Gifford and Patricia E. Marks, of Population Division. Statistical assistance was provided by Sharon A. Schoch. Overall direction was provided by Gordon Green, Assistant Division Chief (Socio-economic Statistics Programs), Population Division, and Paula J. Schneider, then Chief, Labor Force Statistics Branch, Population Division.

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 SYMBOLS USED IN TABLES

- Represents zero.
  - X Not applicable.
  - Z Less than 0.05 percent.
  - \* Based on fewer than 20 sample cases.
  - 27+ The median fell in the category 27 weeks or more.
-

## Related Materials

Statistics from a related survey, the 1972 Professional, Technical, and Scientific Manpower Survey, are found in U.S. Bureau of the Census, Technical Paper No. 33, *Characteristics of Persons in Engineering and Scientific Occupations: 1972*, and U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 45, *Persons in Engineering, Scientific, and Technical Occupations: 1970 and 1972*.

The Census Bureau report based on the results of the 1974 National Survey of Scientists and Engineers is U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 53, *Selected Characteristics of Persons in Fields of Science or Engineering: 1974*. The Census Bureau report based on the 1976 survey is U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 76, *Selected Characteristics of Persons in Fields of Science or Engineering: 1976*. This is the sixth report in a series of reports based on the 1978 survey; the first report in the Series was U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 108, *Selected Characteristics of Persons in Physical Science: 1978*.

For a list of the National Science Foundation reports based on the above-mentioned 1972 and 1974 surveys, see National Science Foundation, *Characteristics of the National Sample of Scientists and Engineers 1974, Part III* (NSF 76-330); and National Science Foundation, *U.S. Scientists and Engineers: 1974* (NSF 76-329). Two National Science Foundation reports based on the results of the 1976 National Survey of Natural and Social Scientists and Engineers are Science Resources Studies Highlights, *National Sample of Scientists and Engineers: Changes in Employment, 1972-1974 and 1974-1976* (NSF 77-322); and *Characteristics of Experienced Scientists and Engineers, 1976* (NSF 78-305). A National Science Foundation report containing results from the 1978 survey, along with other data from the Manpower Characteristics System, is *U.S. Scientists and Engineers 1978* (NSF 90-304).

# Selected Characteristics of Persons in Computer Specialties: 1978

## INTRODUCTION

The statistics in this report are based on the 1978 survey in a series of biennial surveys known as the National Sample of Scientists and Engineers. The series was sponsored by the National Science Foundation and conducted by the Bureau of the Census. The series began with the 1972 Professional, Technical, and Scientific Survey, with followup surveys of persons from the 1972 survey conducted in 1974, 1976, and 1978. All persons in the national sample were experienced workers, who either had jobs in 1970 or were looking for jobs; new entrants into the labor force since 1970 were not included. Almost all the sample persons were 30 years old and over. In addition, the fields of science and engineering in the national sample were limited to persons who met strict educational, occupational, and professional qualifications. For these reasons, persons in the 1978 National Sample represented approximately 1.5 million scientists and engineers, only a part of the Nation's total scientific and engineering work force (the Department of Labor estimated that, based on occupational qualifications alone, there were 2.4 million scientists and engineers in the United States in 1978).<sup>1</sup>

This report is the sixth in a series of reports based on the 1978 survey. Profiled here are the 57,837 persons represented in the national sample's field of computer specialists.

## COMPOSITION (Table 1)

About 85 percent of the computer specialists represented in the national sample were male. The median age in 1978 of the computer specialists in the national sample was 38 years.

The geographical distribution in 1978 of computer specialists was more concentrated in the Northeast and West and less concentrated in North Central and South regions than the general population of the United States 25 years old and over. Around 31 percent of the computer specialists resided in the Northeast, 21 percent in the West, 20 percent in the North Central, and 28 percent in the South.<sup>2</sup> For the general

<sup>1</sup>U.S. Department of Labor, Bureau of Labor Statistics, *Employment and Earnings*, Vol. 26, No. 1, January 1979.

<sup>2</sup>The apparent difference between the 21 percent and 20 percent is not statistically significant; there is some evidence that the 31 percent is statistically significant from 28 percent.

population of the United States 25 years old and over, estimates from the Current Population Survey indicate that, in March 1978, 32 percent of the population resided in the South, 26 percent in the North Central, 18 percent in the West, and 24 percent in the Northeast (figure 1).<sup>3</sup>

The overwhelming majority of computer specialists were White (97 percent). Small percentages of the computer specialists were Asian-American and Black. In addition, only about 1 percent of the computer specialists indicated that their ethnic heritage was Hispanic.

The fields of science or engineering (S/E) in the national sample were much more strictly defined categories than occupations. In general, to be classified into a specific field, a person had to have at least two of the following three characteristics: (1) employment in one of a set of specified occupations, (2) an academic degree among a set of specified academic disciplines, and (3) self-identification within a set of specified professions. Because of these criteria, it was possible for employed persons in each field to be distributed among a spectrum of occupations. Most employed members of the computer specialists group, not surprisingly, were in computer science occupations (97 percent); about 51 percent were employed as computer systems analysts, and 32 percent were involved in other computer fields. Owing to the definition of the computer science field, only about 1 percent of the computer specialists included in this study still remained as computer programmers.

## EDUCATION AND TRAINING (Table 2)

Computer specialists were more likely to hold a bachelor's degree than a master's or doctorate degree in 1978. Three-fifths of the group held bachelor's degrees, but fewer than one-third held master's degrees and under 10 percent held doctorates (figure 2).

About 24 percent of the computer specialists held their highest degree in mathematical science, 19 percent majored in business and commerce, and 17 percent in engineering.<sup>4</sup> Only 12 percent majored in computer science and systems analysis.

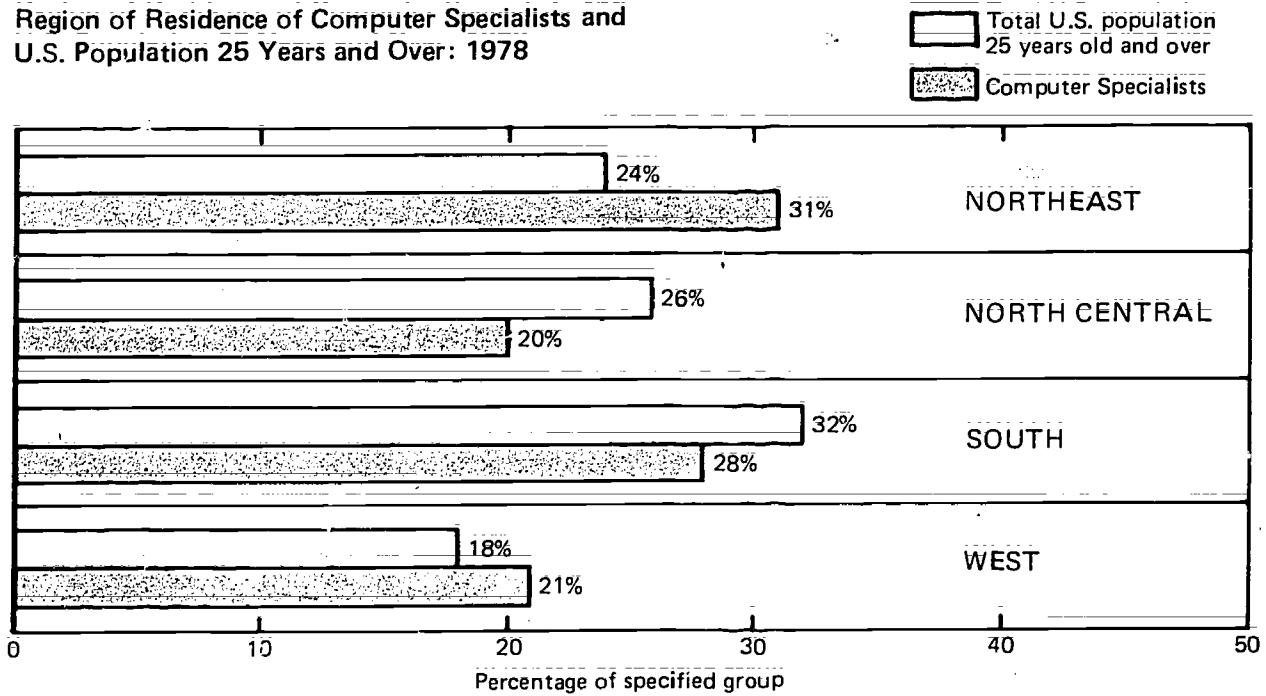
Supplementary training programs (such as on-the-job training and employer training programs) gave computer

<sup>3</sup>Current Population Reports, Series P-20, No. 331, *Geographical Mobility: March 1975 to March 1978*.

<sup>4</sup>The apparent difference between the 19 percent and 17 percent is not statistically significant.

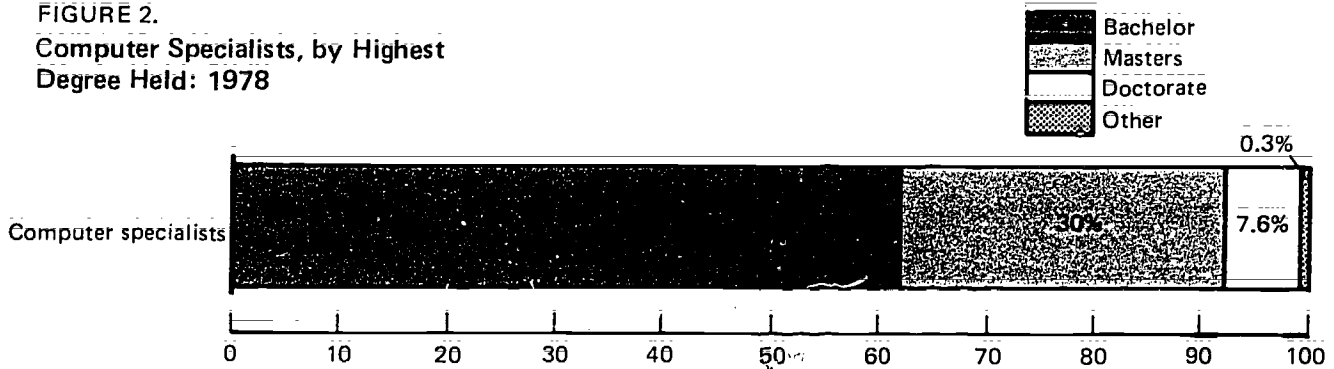


**FIGURE 1.**  
**Region of Residence of Computer Specialists and**  
**U.S. Population 25 Years and Over: 1978**



Source: Table 1 and Current Population Reports, Series P-20, No. 331, Geographical Mobility: March 1975 to March 1978.

**FIGURE 2.**  
**Computer Specialists, by Highest**  
**Degree Held: 1978**



Source: Table 2.

**Table A. Field of Science or Engineering in 1978, by Field of Science or Engineering in 1976**

Numbers in thousands

Field of science or engineering in 1976	Total in national sample in 1978	In field of science or engineering in 1978				Not in S E field in 1978
		Total	Computer specialists	Other S E field		
				Total	Engineer	
Total national sample in 1976.....	1,350	1,139	58	1,080	722	211
In S E field in 1976.....	1,119	1,029	47	982	660	90
Computer specialists.....	57	48	42	6	4	9
Other S E field.....	1,062	981	5	976	655	81
Engineering.....	707	660	3	657	649	47
Not in S E field in 1976.....	173	64	8	56	32	109
Did not report in 1976.....	57	45	3	42	30	12
<b>PERCENT DISTRIBUTION</b>						
Total national sample in 1976.....	100.0	100.0	100.0	100.0	100.0	100.0
In S E field in 1976.....	82.9	90.4	81.5	90.9	91.4	42.6
Computer specialists.....	4.2	4.2	72.3	0.6	0.6	4.3
Other S E field.....	78.7	86.2	9.2	90.3	90.7	38.3
Engineering.....	52.4	58.0	5.8	60.8	90.0	22.3
Not in S E field in 1976.....	12.8	5.6	13.6	5.2	4.4	51.7
Did not report in 1976.....	4.2	4.0	4.9	3.9	4.2	5.7
Total national sample in 1976.....	100.0	84.3	4.3	80.0	53.5	15.6
In S E field in 1976.....	100.0	84.2	73.7	10.5	7.0	15.8
Computer specialists.....	100.0	92.4	0.5	91.9	61.7	7.6
Other S E field.....	100.0	93.4	0.4	92.9	91.8	6.6
Engineering.....	100.0	37.0	4.6	32.4	18.5	63.0
Not in S E field in 1976.....	100.0	78.9	5.3	73.7	52.6	21.1
Did not report in 1976.....	100.0					

Source: Table 3 and unpublished data from the 1978 National Sample of Scientists and Engineers.

specialists the opportunity to maintain or improve their academic skills. About 67 percent took advantage of these programs in 1977.<sup>5</sup>

### PROFESSIONAL EXPERIENCE AND GROWTH OF THE FIELD (Table 3)

Most of these computer specialists have been involved in professional work, though not necessarily as computer specialists, for a number of years. About 95 percent of the group had more than 5 years of professional experience, 73 percent had over 10 years, and 14 percent had more than 20 years. The median number of years of professional experience for the group was 14 years.

The figures in the lower percent distribution of table A illustrate the interfield mobility between 1976 and 1978 of persons in the national sample. Among persons who were in the computer specialists field in 1976, 74 percent were computer specialists in 1978; almost 11 percent were in other S/E fields, such as engineering (7 percent); and 16 percent were outside S/E fields altogether. The upper percent distribution of table A shows the 1978 fields, particularly computer specialists, in terms of their 1976 components.

<sup>5</sup>Note that the categories of supplemental training are not mutually exclusive; the same person may have received more than one kind of supplemental training.

About 44 percent of the computer specialists employed in both February 1978 and February 1976 changed jobs<sup>6</sup> during the 2-year period; among these job changers, 51 percent changed their detailed occupation at the time that they changed jobs. Of those employed in February 1978 and January 1974, 61 percent<sup>7</sup> changed jobs during the 4-year period; of these, 56<sup>7</sup> percent changed detailed occupations as well. Finally, of those employed in February 1978 and January 1972, 71 percent had a different job at the end of the 6-year period than at the beginning; of these, 52<sup>8</sup> percent changed detailed occupations (figure 3).

### LABOR FORCE PARTICIPATION (Table 4)

In February 1978, 96 percent of the computer specialists were in the labor force. Of those not in the labor force, 22 percent were retired.

The unemployment rate (the number unemployed as a percent of those in the labor force) for computer specialists was

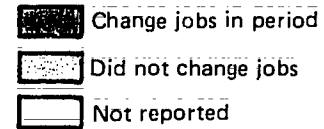
<sup>6</sup>That is, changed employers or remained with the same employer, but had a significant change in their duties, level of responsibility, or occupation.

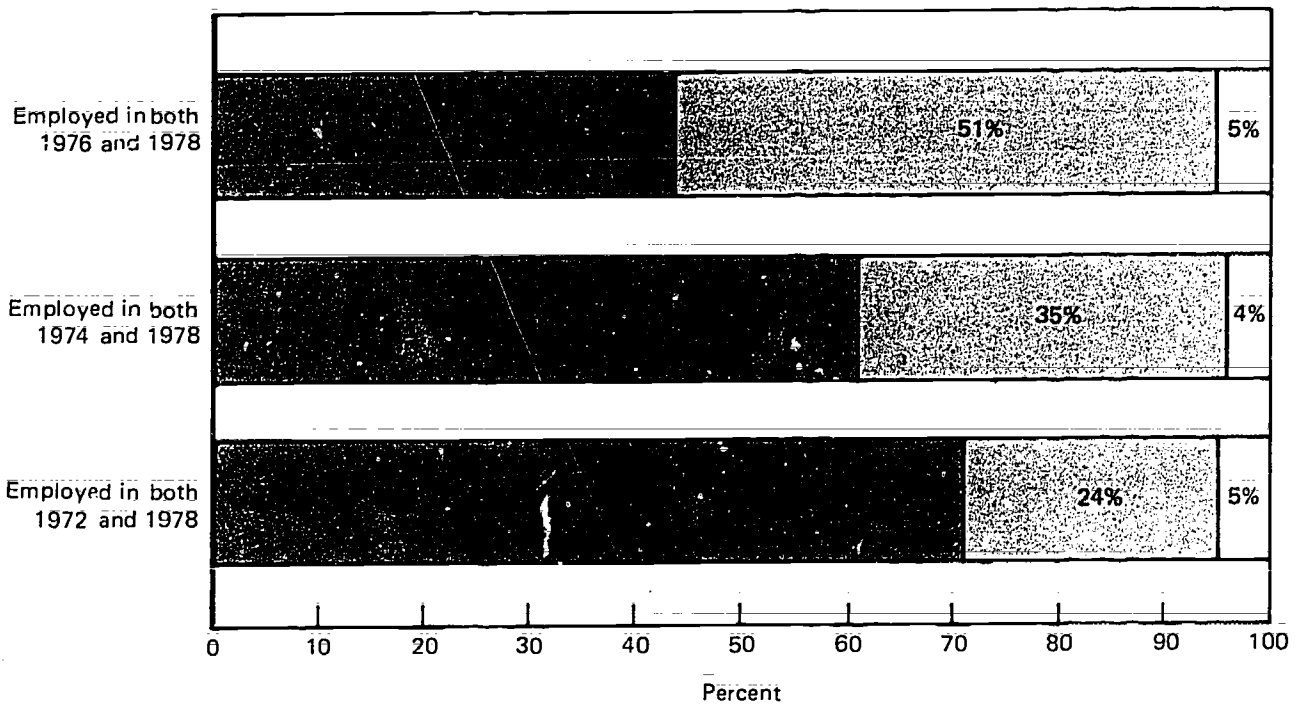
<sup>7</sup>There is some evidence that this 56-percent figure is statistically different from the 51-percent figure in the previous sentence.

<sup>8</sup>There is some evidence that this 52-percent figure is statistically different from the 56-percent figure in the previous statement. However, there is no statistical difference between this 52-percent figure and the 51-percent figure shown above in the first sentence of this paragraph.

FIGURE 3.

## Job Changes of Computer Specialists Between Specified Time Periods


 Change jobs in period  
 Did not change jobs  
 Not reported



Source: Table 3.

about 1 percent in February 1978 (table B). The national unemployment rate of male professional, technical, and kindred workers 25 years and older in February 1978 (not seasonally adjusted) was 1.5 percent.<sup>9</sup>

**Table B. Employment Status of Computer Specialists in February 1978**

Employment status	Computer specialists	
	Number	Percent
Total in labor force in February 1978.....	55,473	100.0
Employed.....	54,994	99.1
Unemployed.....	479	0.9

Source: Table 4.

Around 3 percent of the computer specialists experienced unemployment in 1977. Unemployed computer specialists spent a median of 7 weeks jobseeking; about 21 percent of the unemployed searched for 27 weeks or more.

<sup>9</sup>U.S. Department of Labor, Bureau of Labor Statistics, unpublished Current Population Survey data.

Almost all of the employed computer specialists (98 percent) worked at fulltime jobs in 1978 (table C).

Almost 96 percent of the computer specialists who worked part-time in February 1978 were not seeking full-time work (table C).

Over 98 percent of the computer specialists employed full-time were working in scientific or engineering positions.

Most employed computer specialists were in three major industry groups in 1978: manufacturing (44 percent), especially of electronic machinery and other computer equipment (24 percent); services, except education and health (15 percent); and public administration (9 percent).

The major types of employers of computer specialists in February 1978 were business or industry (76 percent) and government (12 percent). A notable 7 percent of the employed computer specialists worked for the Federal Government.

Not surprisingly, the largest proportion (41 percent) of the computer specialists reported computer applications as their primary work activity. About 22 percent of the computer specialists were primarily involved in management and administration and about 15 percent in research and development.

The computer specialists in the national sample were asked to choose, from among a list of topics of critical

national interest, the problem to which they devoted the most professional time. About 12 percent selected national defense, 6 percent education, and 5 percent energy and fuel.<sup>10</sup> Over 61 percent of the computer specialists either did not report a national interest topic or indicated that the inquiry was not applicable to them.

The Federal Government supported or sponsored at least some of the work of 28 percent of the employed computer specialists in February 1978. The Department of Defense funded the largest proportion of employed computer specialists (about 15 percent).

**Table C. Full- and Part-Time Work Status of Computer Specialists in 1978 Employed in February 1978**

Full part-time work status	Computer specialists	
	Number	Percent
Total employed in February 1978.....	54,994	100.0
Full time.....	54,164	98.5
Part time.....	759	1.4
Seeking full-time work:	35	0.1
Not seeking full-time work.....	725	1.3
Seeking not reported...	-	-
Full or part time not reported:.....	71	0.1

- Represents zero.

Source: Table 4.

<sup>10</sup>The apparent difference between the 6 percent and 5 percent is not statistically significant.

## INCOME (Table 5)

The median basic annual salary in February 1978 of the computer specialists employed full time in February 1978 was \$25,867. The median earnings in 1977, as estimated from the CPS,<sup>11</sup> for male professional, technical, and kindred workers, 14 years old and over, who worked year round full time, was \$18,224; the comparable figure for women was \$11,995. Male year-round full-time workers 25 years old and over with 4 or more years of college (regardless of occupation) had mean earnings in 1977 of \$21,441; those with 5 or more years of college had mean earnings of \$25,782. It should be noted that the CPS figures are not strictly comparable with those for computer specialists in the national sample.<sup>12</sup>

Results from the 1976 survey of the National Sample of Scientists and Engineers showed a median basic annual salary in February 1976 of computer specialists employed full time in February 1976 of \$21,583. Thus, the median basic annual salary of full-time employed computer specialists rose by \$4,284 between February 1976 and February 1978. However, when the 1976 and 1978 basic annual salaries are expressed in constant 1977 dollars, the increase is approximately \$1,566 or about 3.2 percent per year.<sup>13</sup>

<sup>11</sup>U.S. Department of Commerce, Bureau of the Census, Current Population Reports, *Money Income in 1977 of Families and Persons in the United States*, Series P-60, No. 118.

<sup>12</sup>The CPS concepts "earnings" includes more sources of remuneration than does the National Sample concept of "basic annual salary;" there are also other differences between the National Sample's basic annual salary concept and the CPS earnings concept, including differences in reference periods and data collection procedures. CPS figures for 1977 are cited because 1977 is the full year most nearly comparable with the reference year for the National Sample question on basic annual salary.

<sup>13</sup>The 1976-1978 comparisons in terms of constant 1977 dollars must be approached cautiously. Problems are introduced into the comparisons by, among other things, the way the basic annual salary data are defined and collected, the differences between the nonresponse adjustment procedures of the 1976 and 1978 surveys, and the difficulty of establishing appropriate time periods for the constant dollar computation.

**Table 1. Occupation, Professional Identification, and Selected Characteristics of Computer Specialists: 1978**

(Detail may not add to total because of rounding. For meaning of symbols, see text)

Occupation, professional identification, and selected characteristics	Computer specialists		Occupation, professional identification, and selected characteristics	Computer specialists	
	Number	Percent		Number	Percent
Total.....	57,837	100.0	<b>OCCUPATION IN 1978</b>		
Male.....	49,371	85.4	Electrical and electronic.....	134	0.2
Female.....	8,466	14.6	Industrial.....	-	-
Under 30 years.....	381	0.7	Mechanical.....	-	-
30 to 34 years.....	15,307	26.5	Metallurgical and materials.....	-	-
35 to 39 years.....	18,968	32.8	Mining, petroleum, and geological....	-	-
40 to 44 years.....	9,482	16.4	Nuclear.....	-	-
45 to 49 years.....	7,507	13.0	Environmental and sanitary.....	-	-
50 to 54 years.....	3,559	6.2	Operations research/systems.....	-	-
55 to 59 years.....	1,765	3.1	Other engineering fields.....	-	-
60 to 64 years.....	641	1.1	Mathematicians and statisticians, total	64	0.1
65 to 69 years.....	114	0.2	Mathematicians.....	17	(Z)
70 years and over.....	113	0.2	Statisticians.....	-	-
Median age.....	38	(X)	Actuaries.....	-	-
			Operations research.....	47	(Z)
<b>RESIDENCE IN 1978</b>			Life scientists.....	-	-
Total.....	57,837	100.0	Agricultural scientists.....	-	-
United States.....	57,454	99.3	Biological scientists.....	-	-
Northeast.....	17,719	30.6	Biochemists.....	-	-
New England.....	4,882	8.4	Biophysicists.....	-	-
Middle Atlantic.....	12,837	22.2	Medical scientists.....	-	-
North Central.....	11,682	20.2	Other life scientists.....	-	-
East North Central.....	8,147	14.1	Physical scientists, total.....	-	-
West North Central.....	3,535	6.1	Chemists.....	-	-
South.....	15,993	27.7	Physicists and astronomers.....	-	-
South Atlantic.....	9,742	16.8	Other physical scientists.....	-	-
East South Central.....	1,897	3.3	Environmental scientists, total.....	-	-
West South Central.....	4,355	7.5	Earth scientists.....	-	-
West.....	12,060	20.9	Atmospheric scientists.....	-	-
Mountain.....	2,251	3.9	Oceanographers.....	-	-
Pacific.....	9,809	17.0	Psychologists.....	-	-
Outlying Areas.....	22	(Z)	Social scientists, total.....	-	-
Foreign countries.....	361	0.6	Economists.....	-	-
Not reported.....	-	-	Sociologists and anthropologists.....	-	-
			Other social scientists.....	-	-
<b>RACE</b>			Health occupations.....	-	-
Total.....	57,837	100.0	Physician or surgeon.....	-	-
White.....	56,021	96.9	Dental technician.....	-	-
Black.....	691	1.2	Medical technician.....	-	-
American Indian.....	33	(Z)	Other health occupations.....	-	-
Chinese, Japanese, Korean.....	984	1.7	Technicians and technologists, except	-	-
All other races.....	108	0.2	medical.....	-	-
			Teachers <sup>1</sup> .....	-	-
<b>HISPANIC HERITAGE</b>			Administrators and managers.....	1,583	2.9
Total.....	57,837	100.0	Other occupations.....	17	(Z)
Hispanic.....	749	1.3	Not reported.....	-	-
Not Hispanic.....	55,717	96.3			
Not reported.....	1,371	2.4	<b>PROFESSIONAL IDENTIFICATION IN 1978</b>		
			Total.....	57,837	100.0
<b>OCCUPATION IN 1978</b>			Computer specialists.....	55,476	95.9
Total employed in February 1978...	54,994	100.0	Engineers.....	190	0.3
Computer specialists, total.....	53,196	96.7	Mathematicians and statisticians.....	81	0.1
Computer systems analysts.....	27,842	50.6	Life scientists.....	16	(Z)
Computer scientists.....	7,475	13.6	Physical scientists.....	15	(Z)
Computer programmers.....	351	0.6	Environmental scientists.....	36	(Z)
Other computer fields.....	17,528	31.9	Psychologists.....	-	-
Engineers, total.....	134	0.2	Social scientists.....	17	(Z)
Aeronautical and astronautical.....	-	-	Health occupations.....	-	-
Agricultural.....	-	-	Technicians, except medical.....	14	(Z)
Chemical.....	-	-	Teachers.....	22	(Z)
Civil and architectural.....	-	-	Administrators.....	1,379	2.4
			All other occupations.....	18	(Z)

<sup>1</sup>College or university teachers of science or engineering are excluded from teachers and included in occupation corresponding to subject taught.

**Table 2. Selected Educational Characteristics of Computer Specialists: 1978**

(Detail may not add to total because of rounding. For meaning of symbols, see text)

Selected educational characteristics	Computer specialists		Selected educational characteristics	Computer specialists	
	Number	Percent		Number	Percent
<b>HIGHEST DEGREE HELD</b>			<b>MAJOR FIELD OF STUDY FOR HIGHEST DEGREE HELD--CONTINUED</b>		
Total.....	57,837	100.0	Earth, space, and marine sciences.....	585	1.0
With a degree.....	57,837	100.0	Psychology.....	765	1.3
Associate.....	-	-	Economics.....	2,064	3.6
Bachelor's.....	35,865	62.0	Sociology and anthropology.....	626	1.1
Master's.....	17,424	30.1	Other social sciences.....	1,357	2.3
Doctorate.....	4,370	7.6	Business and commerce.....	11,086	19.2
Professional/medical.....	179	0.3	All other fields.....	5,417	9.4
Other.....	-	-	All fields below BA.....	302	0.5
No degree.....	-	-	Field not reported.....	509	0.9
Not reported.....	-	-			
<b>MAJOR FIELD OF STUDY FOR HIGHEST DEGREE HELD</b>			<b>SUPPLEMENTAL TRAINING IN 1977<sup>1</sup></b>		
Total.....	57,837	100.0	Total.....	57,837	100.0
Computer science and systems analysis...	7,195	12.4	With supplemental training in 1977.....	38,605	66.7
Engineering.....	9,579	16.6	On-the-job training.....	25,224	43.6
Mathematical sciences.....	13,806	23.9	Military training applicable to civilian occupations.....	376	0.7
Agricultural sciences.....	172	0.3	Extension or correspondence courses...	1,981	3.4
Biological sciences.....	645	1.1	Employer training programs.....	22,049	38.1
Medical sciences.....	541	0.9	Adult education center.....	3,871	6.7
Chemistry.....	819	1.4	Other training.....	10,034	17.3
Physics and astronomy.....	2,368	4.1	No supplemental training in 1977.....	14,823	25.6
			Not reported.....	4,409	7.6

<sup>1</sup>Sum of types of training may exceed total with training because of multiple response.

**Table 3. Years of Professional Experience, Field of Science or Engineering in 1976, and Job Mobility of Computer Specialists: 1978**

(Detail may not add to total because of rounding. For meaning of symbols, see text)

Professional experience, field in 1976, and job mobility	Computer specialists		Professional experience, field in 1976, and job mobility	Computer specialists	
	Number	Percent		Number	Percent
<b>YEARS OF PROFESSIONAL EXPERIENCE</b>			<b>FIELD OF SCIENCE OR ENGINEERING IN 1976--Continued</b>		
Total.....	57,837	100.0	Psychologists.....	-	-
<b>with years of professional experience reported.....</b>	56,780	98.2	Social scientists.....	338	0.6
Less than 1 year.....	394	0.7	Economists.....	141	0.2
1 to 5 years.....	1,250	2.2	Sociologists and anthropologists.....	92	0.2
6 to 10 years.....	13,095	22.6	Other social scientists.....	105	0.2
11 to 15 years.....	21,045	36.4	Not in a field in 1976.....	7,851	13.6
16 to 20 years.....	12,824	22.2	Did not report in 1976.....	2,851	4.9
21 to 25 years.....	4,747	8.2			
26 to 30 years.....	2,676	4.6	<b>JOB MOBILITY</b>		
31 to 35 years.....	400	0.7	Total employed in February 1978..	54,494	100.0
36 to 40 years.....	290	0.5	Employed in February 1976.....	51,062	92.8
41 years or more.....	58	0.1	Job changed since 1976.....	22,506	40.9
Median years of professional experience.....	14	(X)	Occupation change.....	11,534	21.0
Years of professional experience not reported.....	1,057	1.8	No occupation change.....	10,819	19.7
			Occupation change not reported.....	153	0.3
<b>FIELD OF SCIENCE OR ENGINEERING IN 1976</b>			Same job in 1976 and 1978.....	26,258	47.7
Total.....	57,837	100.0	Not reported.....	2,298	4.2
Computer specialists.....	41,815	72.3	Not employed or employment status not reported in February 1976.....	3,933	7.2
Engineers.....	3,359	5.8	Employed in January 1974.....	51,720	94.0
Mathematical specialists.....	1,125	1.9	Job change between 1974 and 1978.....	31,505	57.3
Mathematicians.....	1,083	1.9	Occupation change.....	17,741	32.3
Statisticians.....	42	0.1	No occupation change.....	13,764	25.0
Life scientists.....	33	0.1	Occupation change not reported.....	-	-
Agricultural scientists.....	-	-	Same job in 1974 and 1978.....	17,930	32.6
Biologists.....	16	(%)	Not reported.....	2,285	4.2
Medical scientists.....	18	(%)	Not employed or employment status not reported in February 1974.....	3,274	6.0
Physical scientists.....	403	0.7	Employed in 1972.....	53,196	96.7
Chemists.....	53	0.1	Job change between 1972 and 1978.....	37,699	68.6
Physicists and astronomers.....	315	0.5	Occupation change.....	19,579	35.6
Other physical scientists.....	35	0.1	No occupation change.....	18,120	32.9
Environmental scientists.....	61	0.1	Occupation change not reported.....	-	-
Earth scientists.....	28	(%)	Same job in 1972 and 1978.....	12,751	23.2
Atmospheric scientists.....	33	0.1	Not reported.....	2,746	5.0
Oceanographers.....	-	-	Not employed or employment status not reported in 1972.....	1,798	3.3

**Table 4. Employment Status and Selected Job-Related Characteristics of Computer Specialists: 1978**

(Detail may not add to total because of rounding. For meaning of symbols, see text)

Employment status and selected job-related characteristics	Computer specialists		Employment status and selected job-related characteristics	Computer specialists	
	Number	Percent		Number	Percent
<b>EMPLOYMENT STATUS IN FEBRUARY 1978</b>			<b>INDUSTRY IN 1978--Continued</b>		
Total.....	57,637	100.0	Transportation, communications, and other public utilities.....	2,774	5.0
In labor force.....	55,473	95.9	Wholesale and retail trade.....	850	1.5
Employed.....	54,994	95.1	Finance, insurance, and real estate.....	4,190	7.6
Full time.....	54,164	93.6	Educational institutions, total.....	4,302	7.8
Part time.....	759	1.3	College or university.....	3,859	7.0
Seeking full-time work.....	35	(Z)	Other.....	443	0.8
Not seeking full-time work.....	725	1.3	Health services.....	824	1.5
Not reported.....	-	-	Services except education and health, total.....	8,406	15.3
Full or part time not reported.....	71	0.1	Engineering and architectural services.....	1,400	2.5
Unemployed.....	479	0.8	Research institutions.....	2,185	4.0
Not in labor force.....	2,364	4.1	Other.....	4,822	8.8
Retired.....	523	0.9	Public administration.....	4,718	8.6
Student.....	83	0.1	Federal.....	2,288	4.2
Family responsibilities.....	1,535	2.7	Other.....	2,157	3.9
Could not find work.....	-	-	Military.....	273	0.5
Other.....	223	0.4	Other industries.....	3,666	6.7
			Not reported.....	378	0.7
<b>FULL-TIME EMPLOYMENT IN SCIENCE OR ENGINEERING IN 1978</b>			<b>TYPE OF EMPLOYER IN 1978</b>		
Total employed full time in February 1978.....	54,164	100.0	Total employed in February 1978....	54,994	100.0
In science or engineering.....	53,386	98.6	Business or industry.....	41,569	75.6
Not in science or engineering.....	778	1.4	Educational institutions, total.....	4,375	8.0
Preferred nonscience or nonengineering..	235	0.4	Junior or 2-year college, technical institute.....	114	0.2
Promoted out of science or engineering..	62	0.1	Medical school.....	152	0.3
Pay better in nonscience or nonengineering.....	260	0.5	4-year college or university, except medical school.....	4,016	7.3
Locational preference.....	20	(Z)	Elementary or secondary school system..	92	0.2
Science or engineering position not available.....	17	(Z)	Hospital or clinic.....	501	0.9
Other reason.....	104	0.2	Nonprofit organization.....	1,361	2.5
Reason not reported.....	80	0.1	U.S. military service/commissioned groups.....	273	0.5
			Government, total.....	6,417	11.7
<b>UNEMPLOYMENT IN CALENDAR YEAR 1977</b>			Federal.....	3,942	7.2
Total.....	57,837	100.0	State.....	959	1.7
Unemployed in calendar year 1977.....	1,995	3.4	Local or other.....	1,516	2.8
1 to 4 weeks.....	793	1.4	International agency.....	106	0.2
5 to 10 weeks.....	466	0.8	Other.....	19	(Z)
11 to 14 weeks.....	108	0.2	Not reported.....	375	0.7
15 to 26 weeks.....	174	0.3			
27 weeks or more.....	418	0.7	<b>PRIMARY WORK ACTIVITY IN 1978</b>		
Median weeks of unemployment.....	7	(X)	Total employed in February 1978....	54,994	100.0
Weeks of unemployment not reported.....	35	(Z)	Research and development.....	8,519	15.5
Not unemployed in calendar year 1977.....	55,214	95.5	Basic research.....	283	0.5
Not reported.....	628	1.1	Applied research.....	1,431	2.6
			Development.....	5,657	10.3
<b>INDUSTRY IN 1978</b>			Design.....	1,147	2.1
Total employed in 1978.....	54,994	100.0	Management or administration, total.....	11,939	21.7
Agriculture, forestry, and fisheries.....	114	0.2	Research and development.....	4,469	8.1
Mining and petroleum extraction.....	245	0.4	Other.....	7,470	13.6
Construction.....	168	0.3	Teaching and training.....	2,322	4.2
Manufacturing, total.....	24,359	44.3	Production and inspection.....	2,247	4.1
Primary metal industries.....	502	0.9	Quality control.....	329	0.6
Fabricated metal industries.....	366	0.7	Operations.....	1,069	1.9
Machinery, except electrical.....	661	1.2	Distribution-sales.....	849	1.5
Electrical machinery equipment and supplies.....	764	1.4	Consulting.....	4,013	7.3
Electronic machinery and computing equipment.....	13,308	24.2	Clinical diagnosis.....	39	(Z)
Aircraft and aircraft parts.....	1,500	2.7	Consulting.....	3,975	7.2
Motor vehicles and motor vehicle equipment.....	1,002	1.8	Report writing, statistical work, and computer applications.....	24,110	43.8
Ordnance.....	853	1.6	Report writing.....	1,075	2.0
Chemicals and allied products.....	1,672	3.0	Statistical work.....	475	0.9
Petroleum refining and related industries.....	1,209	2.2	Computer applications.....	22,559	41.0
Other manufacturing.....	2,521	4.6	Other activities.....	1,440	2.6
			Not reported.....	405	0.7

See footnotes at end of table.



**Table 4. Employment Status and Selected Job-Related Characteristics of Computer Specialists: 1978—Continued**

(Detail may not add to total because of rounding. For meaning of symbols, see text)

Employment status and selected job-related characteristics	Computer specialists		Employment status and selected job-related characteristics	Computer specialists	
	Number	Percent		Number	Percent
<b>NATIONAL INTEREST TOPICS<sup>1</sup></b>			<b>FEDERAL SUPPORT IN 1978<sup>2</sup>--Continued</b>		
Total.....	57,837	100.0	Department of Defense.....	8,086	14.7
Health.....	2,633	4.6	Department of Energy.....	1,577	2.9
Education, total.....	3,621	6.3	Department of Health, Education and Welfare.....	1,814	3.3
Teaching.....	2,624	4.5	Department of Housing and Urban Development.....	244	0.4
Other.....	997	1.7	Department of the Interior.....	55	0.1
Environmental protection, pollution control, Space.....	1,421	2.5	Department of Justice.....	441	0.8
National defense.....	7,197	12.4	Department of Labor.....	342	0.6
Crime prevention and control.....	639	1.1	Department of Transportation.....	1,046	1.9
Food production and technology.....	356	0.6	Agency for International Development.....	62	0.1
Energy and fuel.....	3,020	5.2	Environmental Protection Agency.....	413	0.8
Other mineral resources.....	232	0.4	NASA.....	1,867	3.4
Community development and services.....	650	1.1	National Science Foundation.....	849	1.5
Housing.....	121	0.2	Nuclear Regulatory Commission.....	178	0.3
Other.....	1,857	3.2	Other department or agency.....	1,175	2.1
Not applicable.....	28,695	49.6	Agency not known.....	380	0.7
Not reported.....	6,652	11.5	Agency not reported.....	113	0.2
<b>FEDERAL SUPPORT IN 1978<sup>2</sup></b>			No Federal support.....	36,260	65.9
Total employed in February 1978.....	54,994	100.0	Federal support not known.....	2,813	5.1
With Federal support.....	15,252	27.7	Not reported.....	670	1.2
Department of Agriculture.....	314	0.6			
Department of Commerce.....	304	0.6			

<sup>1</sup>Area of national concern in which persons devoted the largest proportion of professional time.

<sup>2</sup>Sum of individual agencies support may exceed total with Federal support because of multiple response.

**Table 5. Basic Annual Salary Rate of Full-Time Employed Computer Specialists: 1978**

(Detail may not add to total because of rounding. For meaning of symbols, see text)

Salary	Computer specialists		Salary	Computer specialists	
	Number	Percent		Number	Percent
Total employed full time in February 1978.....	54,164	100.0	With salary <sup>1</sup> reported--Continued		
With salary <sup>1</sup> reported.....	52,350	96.7	\$25,000 to \$29,999.....	15,494	28.6
Less than \$8,000.....	44	(Z)	\$30,000 to \$39,999.....	13,154	24.3
\$8,000 to \$9,999.....	55	0.1	\$40,000 to \$49,999.....	1,130	2.1
\$10,000 to \$14,999.....	840	1.6	\$50,000 and over.....	542	1.0
\$15,000 to \$19,999.....	5,681	10.5	Median salary.....(dollars)..	\$25,867	(X)
\$20,000 to \$24,999.....	15,410	28.4	Salary not reported.....	1,814	3.3

<sup>1</sup>Refers to salary for job held during the week of February 12-18, 1978.

## Appendix A. Definitions and Explanations

The 1978 National Survey of Natural and Social Scientists and Engineers was the fourth survey based on the 1970 population of scientists and engineers. It was conducted by the Bureau of the Census for the National Science Foundation. The first survey, the 1972 Professional, Technical, and Scientific Manpower Survey,<sup>1</sup> was conducted among a nationwide sample of approximately 150,000 persons who were recorded in the 1970 Census of Population as being in the experienced civilian labor force in 1 of 63 engineering, scientific, or related occupations. The survey also included a small sample of persons who had completed 4 or more years of college, but were not in any of the specified occupations. Based on responses in the 1972 survey and on criteria established by the National Science Foundation, approximately 50,000 persons from the 1972 survey sample (excluding the small sample of college graduates) were chosen as the sample for the series of longitudinal surveys known as the National Sample of Scientists and Engineers. The 1978 National Survey of Natural and Social Scientists and Engineers was the third survey in this longitudinal series; it was preceded by surveys in 1976 and 1974.<sup>2</sup>

Questionnaires for the 1978 survey were mailed in February 1978. After all data collection activities, 81 percent of the sample (approximately 40,800 persons) completed their questionnaires. The 19 percent who did not complete their questionnaires included persons who refused to participate, the deceased, and persons who returned questionnaires with insufficient information to permit processing. For an analysis of response, see appendix E.

The estimates derived for this survey were prepared by using a ratio estimation procedure and an adjustment for nonresponse in 1978. For each sample case for which a completed questionnaire was obtained, the information from the 1978 survey was matched with the 1972 survey data and the 1970 census data for the same person. Weights applied to samples cases in the 1972 survey were then used to weight the resultant matched data file. The weighting procedure for the 1972 survey involved first the preparation of a preliminary estimate by weighting the results for each sample person by the reciprocal of the probability of selection. As a second

step, these weights were adjusted by applying a factor for certain age-sex-race cells within each occupation category. Within each of the cells, the factor was computed as the ratio of the 1970 census count to the preliminary estimate. The final 1972 weight was this factor multiplied by the inverse of the probability of selection for each person. To the extent that the data being tabulated and the estimated count of persons in the cells are positively correlated, the ratio estimate procedure will improve the reliability of the estimate. A discussion of the reliability of the estimates, including a description of the standard errors of totals and percentages, is presented in appendix B.

A nonresponse adjustment was done in 1978 to reduce the bias in the survey estimates due to the high nonresponse rate in 1978. This adjustment was done separately for in-scope<sup>3</sup> and out-of-scope<sup>4</sup> persons, and included an adjustment for the mortality in the longitudinal sample from 1972 to 1978. The first step in the nonresponse adjustment was to adjust the nonrespondents for mortality from 1972 to 1978 by means of mortality tables for age-race-sex groups. The second step was to determine the estimated proportion of nonrespondents that were in-scope and out-of-scope. To estimate these proportions, an intensive follow-up was conducted to obtain interviews for a subsample of the 1978 nonrespondents. This follow-up showed that approximately 80 percent of the nonrespondents were in-scope and the remaining 20 percent were out-of-scope. The final step was to determine a nonresponse adjustment factor for different age-race-sex cells. Within each of the cells, the factor was computed as the ratio of the weighted count, using the 1972 weights, of the estimated total (i.e., respondent and nonrespondent) in-scope or out-of-scope persons, divided by the weighted count of the respondent in-scope or out-of-scope persons.

The final weight for the 1978 survey was the product of the 1972 weight and the appropriate 1978 nonresponse adjustment factor.

The definitions for many of the characteristics shown in this report are self-explanatory or can best be understood by referring to the appropriate 1978 questionnaire items or reference lists (appendixes C and D). An explanation of the other subjects is provided below.

**Age in 1978.** The reference period for age in 1978 was April 1978. The age classification is based on the age of the person at his or her last birthday. The median age is that age that

<sup>1</sup>For a description of the 1972 survey and related matters, see U.S. Bureau of the Census, *Characteristics of Persons in Engineering and Scientific Occupations: 1972*, Technical Paper No. 33, U.S. Government Printing Office, Washington, D.C., 1974.

<sup>2</sup>Results from the 1974 survey were published in U.S. Bureau of the Census, *Current Population Reports, Series P-23, No. 53, Selected Characteristics of Persons in Fields of Science or Engineering: 1974*, U.S. Government Printing Office, Washington, D.C., 1975; results from the 1976 survey were published in U.S. Bureau of the Census, *Current Population Reports, Series P-23, No. 76, Selected Characteristics of Persons in Fields of Science or Engineering: 1976*, U.S. Government Printing Office, Washington, D.C., 1978.

<sup>3</sup>"In-scope" means "in a field of science or engineering."

<sup>4</sup>"Out-of-scope" refers to the category "not in a field of science or engineering."

divides the distribution into two equal parts, one-half being older than the median age and one-half younger. Median ages were divided from an estimation process that distributed the subject populations into 5-year age groups.

**Race.** The data on race are based on responses in the 1970 Census of Population. The "other races" category includes all races not included in the specific categories listed.

**Divisions of the United States.** The divisions of the United States comprise the following States:

*New England:* Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont

*Middle Atlantic:* New York, New Jersey, Pennsylvania

*East North Central:* Illinois, Indiana, Michigan, Ohio, Wisconsin.

*West North Central:* Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota.

*South Atlantic:* Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia.

*East South Central:* Alabama, Kentucky, Mississippi, Tennessee.

*West South Central:* Arkansas, Louisiana, Oklahoma, Texas.

*Mountain:* Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming.

*Pacific:* Alaska, California, Hawaii, Oregon, Washington.

Outlying areas of the United States include Puerto Rico, Guam, Virgin Islands, American Samoa, and Canal Zone.

**Fields of science and engineering.** Science or engineering (S/E) fields are categories established by the survey sponsor, the National Science Foundation, to identify persons who could be classified as engineers or scientists under most definitions. In general, to be classified into one of the fields, a person had to have at least two of the following three characteristics: (1) employment in the field, (2) attainment of a specified educational level in an academic discipline related to the field, or (3) self-identification, based upon total education and experience, as being in the field. More detailed information on the criteria for membership in a scientific and technical field is given in U.S. Bureau of the Census, *Current Population Reports, Series P-23, No. 76, Selected Characteristics of Persons in Fields of Science or Engineering: 1976*, U.S. Government Printing Office, Washington, D.C., 1978.

**Highest degree held.** Highest degree held in 1978 refers to the highest academic degree awarded to the respondent in 1978

or earlier. Data on highest degree held were derived as follows: The level and the year of award of the highest degree received by the respondent between January 1972 and 1978 surveys (this degree will be referred to as degree "A") were compared with the level and year of award, determined from the 1976, 1974, and 1972 surveys, of the previously-designated highest degree held by the respondent (this is referred to as degree "B"). If degree A was at the same level or at a higher level than degree B, and if its date of award was later than that of degree B, degree A was designated as the highest degree held in 1978; otherwise, degree B was designated as the highest degree held in 1978.

The "other degree" category includes persons whose highest academic degree was one of the following: RN, LL.B, MD, and academic degrees other than those shown in the tables.

**Major field of study for highest degree held.** The data on major field of study refer to the major subject associated with the highest degree held in 1978 determined by the method described above. For persons who received their highest degree held in 1978 after January 1972, the data are derived from question 3 of the 1978 questionnaire (see appendix C), or question 1, part b of the 1976 questionnaire or from question 2, part b5 of the 1974 questionnaire. For persons who received their highest degree in 1971 or earlier, the data on major subject are based on the 1972 survey.

**Employment status.** Employed persons are those who reported that they were employed, either full time or part time, on vacation, or otherwise temporarily absent from a job for health or personal reasons during the reference week (February 12-18, 1978). The unemployed are persons who marked the "unemployed and seeking work" category (box 3) of item 5a of the 1978 questionnaire (see appendix C), or who indicated in item 7 that they were on layoff from a job. All other persons were classified as "not in the labor force."

**Unemployment in 1977.** The data on unemployment in 1977 relate to the occurrence of unemployment during the entire calendar year rather than just during a reference week. Medians are based on the intervals shown in the tables.

**Primary work activity in 1978.** The data on primary work activity in 1978 were derived, in general, from answers to question 11b of the 1978 questionnaire. In certain instances of nonresponse to question 11b, however, the data were derived from an imputation procedure that used responses to question 11a.

**Type of employer.** The data on type of employer in 1978 are based entirely on responses to question 12 of the 1978 questionnaire.

**Basic annual salary rate.** The statistics on salary refer to the basic annual salary associated with the job held in February 1978. The figures relate to salary before deductions for income tax, Social Security, retirement, etc., but do not include bonuses, overtime pay, or earnings from secondary

jobs. For employees of educational institutions whose salary was for 9 or 10 months, the salary rate was adjusted to a 12-month basis. Median salaries were derived by an estimation process that distributed the subject population into \$1,000 intervals.

**Job and occupational mobility in 1976 and 1978.** The data on mobility between 1976 and 1978 were derived from answers on both the 1976 and 1978 questionnaires. Persons were classified as with a "job change between 1976 and 1978" if they were employed in both 1976 and 1978 and reported in the 1978 survey that their current job began in 1976 or later. Persons were classified as "same job in 1976 and 1978" if the beginning date of their most recent job was in 1975 or earlier, and as "not reported" if they did not report the beginning date of the most recent job. For persons with a job change, the detailed occupation of the 1978 job was compared with that of the 1976 job, and persons were

classified as with the same or a different occupation or as "occupation change not reported."

**Job and occupational mobility in 1974 and 1978 and in 1972 and 1978.** The data on mobility between 1974 and 1978 and between 1972 and 1978 were derived from answers on the 1974 and 1978 questionnaires and 1972 and 1978 questionnaires, respectively. The procedure was analogous to that described for the data on job and occupational mobility in 1976 and 1978.

**Years of professional experience.** Median years of professional experience are based on 1-year intervals.

**Symbols.** A dash (—) represents zero, and "X" means "not applicable." The symbol "Z" means less than 0.05 percent. The symbol "\*" means based on fewer than 20 sample cases. For the characteristic "Unemployment in Calendar Year 1977," the symbol "27+" means that the median fell in the category "27 weeks or more."

## Appendix B. Reliability of the Estimates and Standard Errors of Totals and Percentages

There are two types of possible errors associated with estimates based on data from a sample survey: sampling and nonsampling. The following is a description of the sampling and nonsampling errors associated with the 1978 Survey of Scientists and Engineers.

### SAMPLING ERRORS

The particular sample used for this survey is one of a large number of possible samples of the same size that could have been selected using the same sample design. Even if the same schedules and instructions were used, estimates from each of the different samples would differ from each other. The deviation of a sample estimate from the average of all possible samples is defined as the sampling error. The standard error of a survey estimate attempts to provide a measure of this variation among the estimates from the possible samples, and thus, is a measure of the precision with which an estimate from the sample approximates the average result of all possible samples.

As calculated for this survey, the standard error also partially measures the variation in the estimates due to response errors (nonsampling errors), but it does not measure, as such, any systematic biases in the data. Therefore, the accuracy of the estimates depends on both the sampling and nonsampling errors, measured by the standard error, and biases and some additional nonsampling errors not measured by the standard error.

The figures presented in the tables B-1 and B-2 are approximations to the standard errors of the various estimates for this survey. A number of approximations and generalizations have been used so that the standard errors would be applicable to a wide variety of characteristics and still be prepared at a moderate cost. Thus, the standard errors in the following tables provide an indication of the order of magnitude, rather than precise measurements of the standard errors.

**Standard errors on totals.** Table B-1 presents the standard errors applicable to estimated totals for characteristics of computer specialists. Linear interpolation can be used to determine standard errors for estimated totals not specifically shown in table B-1. In addition, standard errors for estimated numbers not shown in these tables may also be computed directly from the following standard error formula:

$$\text{standard error of } x = \sqrt{ax^2 + bx}$$

The "a" and "b" parameters for the computer science group are—

Field	"a" parameter	"b" parameter
Computer specialists, Total	.000113	41.9

For example, there are an estimated 523 computer specialists, total, who were retired in 1978. The above table shows that  $a = .000113$  and  $b = 41.9$  for computer specialists, total. Thus, the estimated standard error of 523 is

$$\sqrt{(.000113)(523)^2 + (41.9)(523)} = 148.137$$

**Table B-1. Standard Errors of Totals**

(68 chances out of 100)

Size of estimate	Computer specialists
100.....	60
200.....	90
500.....	140
700.....	170
1,000.....	200
2,500.....	320
5,000.....	460
10,000.....	660
25,000.....	1,090
50,000.....	1,670
75,000.....	1,940

**Standard errors on percentages.** The reliability of an estimated percentage, computed by using sample data for both the numerator and the denominator, depends upon both the size of the percentage and the size of the total upon which the percentage is based. Estimated percentages are relatively more reliable than the corresponding estimates of the numerators of the percentage, particularly if the percentages are 50 percent or more.

Table B-2 presents the standard errors of estimated percentages for computer specialists, total. Two-way linear interpolation can be used to determine standard errors for estimated percentages not specifically shown in table B-2. In addition, the standard errors for percentages not shown

in these tables can also be computed directly from the following formula:<sup>1</sup> standard error of the percentage  $p$  on a base of  $y = \sqrt{\frac{p(100-p)}{y}}$

For example, an estimated 1.3 percent of the 57,837 computer specialists, worked part-time in 1978. The above table shows that  $b = 41.9$  for computer specialists. Thus, the standard error for the 1.3 percent on a base of 57,837 is

$$\sqrt{\frac{(1.3)(100-1.3)(41.9)}{57,837}} = .30 \text{ percent}$$

**Standard error intervals.** The sample estimate and its estimated standard error enable one to construct interval estimates that include the average result of all possible samples with a known probability. For example, if all possible samples were selected, each of these surveyed under identical conditions and an estimate and its estimated standard error were calculated from each sample, then—

1. Approximately 68 percent of the intervals from one standard error below the estimate to one standard error above the estimate would include the average result of all possible samples;
2. Approximately 90 percent of the intervals from 1.6 standard errors below the estimate to 1.6 standard errors above the estimate would include the average result of all possible samples;
3. Approximately 95 percent of the intervals from two standard errors below the estimate to two standard errors above the estimate would include the average result of all possible samples.

The average result of all possible samples either is or is not contained in any particular computed interval. However, for a particular sample one can say with specified confidence that the average result of all possible samples is included within the constructed interval.

For example, of the 57,837 computer specialists, in 1978, 30.1 percent have the master's degree as the highest degree held in 1978. The standard error of this percent as computed from table B-2 is 1.2 percentage points. Based on these data, we may conclude that the percentage of computer specialists with the Master's Degree as the highest degree held in 1978 lies between 27.7 percent and 32.5 percent with 95 percent confidence, i.e., within 2 standard errors.

**Standard errors of differences between estimates.** The figures in these tables are not directly applicable to standard

<sup>1</sup>The tables for the standard errors of percentages for most scientific and engineering fields (SEF's) were combined. The tables of standard errors given for such collapsed groups are always conservative, i.e., the table for the SEF with the largest standard errors was chosen to represent all the SEF's in the group. Because of this, the standard errors calculated directly from the formula may differ slightly from those found in the tables.

errors of differences between two sample estimates. The standard error of the estimated difference between two figures may be approximated by the square root of the sum of the squares of the standard error of each estimate. This approximation will yield an exact result when the two characteristics are uncorrelated. If the two characteristics are positively (negatively) correlated, the approximation will overestimate (underestimate) the standard error of the difference. For a difference between two sample estimates, one of which represents a subclass of the other, the table can be used with the difference considered as the sample estimate.

For example, of the 57,837 computer specialists, in 1978, 62.0 percent have the bachelor's as the highest degree in 1978. The standard error of this percent as computed from table B-2 is 1.3 percentage points. The standard error of the difference between the percentage of those with bachelor's degrees and the percentage of those with master's degrees (i.e.  $62.0 - 30.1 = 31.9$  percent) is then approximately

$$\sqrt{(1.3)^2 + (1.2)^2} = 1.77 \text{ percentage points}$$

Based on these data, we may conclude with 95 percent confidence that the average estimate of the difference of the percentages derived from all possible samples lies within the interval 28.4 percentage points to 35.4 percentage points.

**Standard errors of medians.** The figures in these tables are not directly applicable to standard errors of estimated medians. The sampling variability of an estimated median depends upon the size of the base as well as on the distribution from which the median is determined. An approximate method for measuring the reliability of a median is to determine an interval about the estimated median, such that there is a stated degree of confidence that the median based on all possible samples lies within the interval. The following procedure may be used to estimate confidence limits of a median based on a sample data:

1. Determine the standard error of a 50 percent characteristic from the approximate standard error table (table B-2) using the appropriate base;
2. Add this standard error to 50 percent to obtain an upper boundary percentage and subtract this standard error from 50 percent to obtain a lower boundary percentage;
3. Using the cumulative distribution from which the median is derived, read off the numbers corresponding to the boundary percentages. The interval between these two numbers (i.e., the confidence limits) will be the 68-percent confidence interval. A 95-percent confidence interval may be determined by finding the values corresponding to 50 percent plus or minus twice the standard error in step (1).

For example, the data for 1978 indicate that the estimate of the median age for computer specialists is 38.5 years. The distribution of computer specialists by age is shown in the table below:

Age (Years)	Percentage	Cumulative Distribution
Under 30	0.7	0.7
30 to 34	26.5	27.1
35 to 39	32.8	59.9
40 to 44	16.4	76.3
45 to 49	13.0	89.3
50 to 54	6.2	95.4
55 to 59	3.1	98.5
60 to 64	1.1	99.6
65 to 69	0.2	99.8
70 and over	0.2	100.0

From standard error table B-2, the standard error of a 50 percent characteristic with a base of 57,837 is 1.3 percentage points. From the table of cumulative age distribution, the percentage point that corresponds to 35 years is 27.1 percent and to 40 years is 59.9 percent. The lower confidence limit corresponding to 48.7 percent (50 percent minus 1.3 percent) is found by linear interpolation between 35 years and 40 years to be 38.3 years, i.e.,

$$35 + [(40 - 35) \left( \frac{48.7 - 27.1}{59.9 - 27.1} \right)] = 38.3$$

Similarly, the upper confidence limit corresponding to 51.3 percent (50 percent plus 1.3 percent) is found to be 38.7 years:

$$35 + [(40 - 35) \left( \frac{51.3 - 27.1}{59.9 - 27.1} \right)] = 38.7$$

Consequently the 68-percent confidence interval, as shown by the data, is from 38.3 years to 38.7 years. Likewise, we could conclude that the 95-percent confidence interval is from 38.1 years (the distribution point corresponding to 47.4 percent) to 38.9 years (corresponding to 52.6 percent).

### NONSAMPLING ERRORS

In general, nonsampling errors can be attributed to many sources: inability to obtain information about all cases; definitional difficulties, differences in the interpretation of questions, inability or unwillingness to provide correct information on the part of the respondents, mistakes in recording or coding the data, and other errors of collection, response, processing, coverage, and estimation for missing data. As the above list indicates nonsampling errors are not unique to sample surveys, since they can, and do, occur in complete censuses as well.

The primary source of nonsampling error in the 1978 National Sample survey is probably the high nonresponse rate. An adjustment in the estimation procedure for the 23 percent noninterview rate in the 1972 survey and the additional 19 percent nonresponse rate in 1978 was made, but there still remains some unknown bias in the estimate due to differences in the characteristics of those who were interviewed in 1978 and those who were not.

It should also be pointed out that estimates for this survey do not represent those who have entered the labor force in scientific and engineering fields since 1970. In particular, this survey does not include the large numbers of graduates produced since 1970. This causes significant biases for such items as the relative distributions of sex, age, and race and the unemployment figures if the results are assumed to be indicative of the current scientific and engineering fields including new entrants since 1970.

**Table B-2. Standard Errors of Percentages for Computer Specialists**

(68 chances out of 100)

Base of percentage	1 or 99	2 or 98	5 or 95	10 or 90	15 or 85	25 or 75	50
100	6.4	9.1	14.1	19.4	23.1	28.0	32.4
200	4.6	6.4	10.0	13.7	16.3	19.8	22.9
500	2.9	4.1	6.3	8.7	10.3	12.5	14.5
700	2.4	3.4	5.3	7.3	8.7	10.6	12.2
1,000	2.0	2.9	4.5	6.1	7.3	8.9	10.2
2,500	1.3	1.8	2.8	3.9	4.6	5.6	6.5
5,000	.9	1.3	2.0	2.7	3.3	4.0	4.6
10,000	.6	.9	1.4	1.9	2.3	2.8	3.2
25,000	.4	.6	.9	1.2	1.5	1.8	2.0
50,000	.3	.4	.6	.9	1.0	1.3	1.4
75,000	.2	.3	.5	.7	.8	1.0	1.2
100,000	.2	.3	.4	.6	.7	.9	1.0



# Appendix C. Questionnaire and Reference Lists

O.M.B. No. 99-577003; Approval Expires December 31, 1978

PMS-26D U.S. DEPARTMENT OF COMMERCE BUREAU OF THE CENSUS	<b>1978 NATIONAL SURVEY OF                  NATURAL AND SOCIAL SCIENTISTS AND ENGINEERS</b>	NOTICE - Your report to the Census Bureau is confidential. It may be seen only by sworn Census employees and may be used only for statistical purposes.  <i>Please read</i> instructions carefully before answering questions.  Answer as accurately as you can by printing your reply clearly or by entering an "X" in the box next to the appropriate reply.  When the instructions for a question direct you to enter a code and description from a list, please refer to the reference list attached to this questionnaire.
		PLEASE COMPLETE AND RETURN TO Bureau of the Census, 1201 East Tenth Street, Jeffersonville, Indiana 47132
A. Do you currently live in the State (or foreign country) printed in the above mailing label?		
1 <input type="checkbox"/> Yes, same State (or foreign country)		
2 <input type="checkbox"/> No, different State (or foreign country) - Please enter your current State (or foreign country) of residence		
FROM THE DIRECTOR BUREAU OF THE CENSUS		
<p>This is the final questionnaire for the series of surveys known as the National Sample of Scientists and Engineers. The National Science Foundation, the project sponsor, and the Bureau of the Census wish to thank you for your invaluable contribution to this program. Each of the biennial surveys has given policymakers and planners an increasingly clearer view of the dynamics of the educational system and the job market for one of the Nation's central resources—highly trained persons. The goal of this final survey is to complete the picture for the decade of the 1970's.</p> <p>Thus, we are asking you to provide one final report on your employment and related topics. The questionnaire is much shorter than previous ones. Please note that the sample includes many kinds of highly trained persons in addition to scientists and engineers. For the survey to be successful and yield truly representative information, it is important that each person fill out and return the questionnaire.</p> <p>Please complete the questions which follow on pages 2 through 4 and return your questionnaire in the enclosed preaddressed envelope. For some questions you are instructed to enter a code and description from Reference List A, B, or C. These lists are attached to the questionnaire.</p> <p>This information is being collected under the authority of the National Science Foundation Act of 1950, as amended. The information you provide is confidential and may be seen only by sworn employees of the Bureau of the Census. The information cannot be used for anything but statistical purposes and cannot be given to any other Government agency, private concern, or individual. The data will be released only in the form of statistical summaries from which it will be impossible to identify information about any particular person. Your response is entirely voluntary, and your failure to provide some or all of the requested information will in no way adversely affect you.</p> <p>Thank you for your cooperation.</p> <p>Sincerely,</p> <p><i>Manuel D. Plotkin</i></p> <p>MANUEL D. PLOTKIN</p> <p>Enclosure</p>		

<b>PART I - EDUCATION AND TRAINING</b>																									
1. Since January 1972 have you attended any college, university, or other post high school institution?	1 <input type="checkbox"/> Yes - Continue with question 2a 2 <input type="checkbox"/> No - Skip to question 4																								
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PART III - JOB ACTIVITIES - Continued															
<p><b>13. What was the basic salary associated with this position?</b> (If not working during February 12-18, report ending salary of most recent prior job.) If you were on a postdoctoral appointment, include stipend plus allowances. (Basic salary refers to salary before deductions for income tax, social security, retirement, etc. but does not include bonuses, overtime, summer teaching, or other payment for secondary jobs.)</p>	<p style="text-align: center;">Job held during week of February 12-18, 1978, or most recent prior job</p> <p>a. \$ _____ .00</p> <p>b. <input type="checkbox"/> Per year <input type="checkbox"/> Per month <input type="checkbox"/> Per week</p> <p>c. If academically employed, mark whether salary is for - <input type="checkbox"/> 9-10 months <input type="checkbox"/> 11-12 months</p>														
<p><b>14. Between what dates did you hold this position?</b> <i>Enter month and year.</i> Consider a change in positions to have occurred if there were significant changes in your duties, level of responsibility, or occupation, even if you continued to work for the same employer.</p>	<p>a. Beginning month and year: _____</p>	<p>b. Ending month and year: _____</p>	<p>OR <input type="checkbox"/> Present</p>												
<p><b>15a. Was ANY of your work supported or sponsored by U.S. Government funds?</b></p>	<p><input type="checkbox"/> Yes - Continue with 15b <input type="checkbox"/> No <input type="checkbox"/> Don't know } Skip to 16a</p>														
<p><b>b. Which of the following agencies or departments were supporting the work?</b> <i>Mark as many as apply.</i></p>	<table style="width:100%; border: none;"> <tr> <td style="width: 33%; border: none;"> <p>01 <input type="checkbox"/> AID (Agency for International Development)</p> <p>02 <input type="checkbox"/> Department of Agriculture</p> <p>03 <input type="checkbox"/> Department of Commerce</p> <p>04 <input type="checkbox"/> Department of Defense</p> <p>05 <input type="checkbox"/> Department of Energy</p> <p>06 <input type="checkbox"/> Department of Health, Education, and Welfare</p> <p>07 <input type="checkbox"/> Alcohol and Drug Abuse Mental Health Administration</p> <p>08 <input type="checkbox"/> NIH (National Institutes of Health)</p> <p>09 <input type="checkbox"/> Office of Education</p> <p>10 <input type="checkbox"/> Other HEW - Specify _____</p> </td> <td style="width: 33%; border: none;"> <p>11 <input type="checkbox"/> Department of the Interior</p> <p>12 <input type="checkbox"/> Department of Justice</p> <p>13 <input type="checkbox"/> Department of Labor</p> <p>14 <input type="checkbox"/> Department of Transportation</p> <p>15 <input type="checkbox"/> EPA (Environmental Protection Agency)</p> <p>16 <input type="checkbox"/> NASA (National Aeronautics and Space Administration)</p> <p>17 <input type="checkbox"/> NSF (National Science Foundation)</p> <p>18 <input type="checkbox"/> Nuclear Regulatory Commission</p> <p>19 <input type="checkbox"/> Other agency or department - Specify _____</p> </td> <td style="width: 33%; border: none;"> <p>20 <input type="checkbox"/> Department of Housing and Urban Development</p> <p>21 <input type="checkbox"/> Don't know source agency or department</p> </td> </tr> </table>			<p>01 <input type="checkbox"/> AID (Agency for International Development)</p> <p>02 <input type="checkbox"/> Department of Agriculture</p> <p>03 <input type="checkbox"/> Department of Commerce</p> <p>04 <input type="checkbox"/> Department of Defense</p> <p>05 <input type="checkbox"/> Department of Energy</p> <p>06 <input type="checkbox"/> Department of Health, Education, and Welfare</p> <p>07 <input type="checkbox"/> Alcohol and Drug Abuse Mental Health Administration</p> <p>08 <input type="checkbox"/> NIH (National Institutes of Health)</p> <p>09 <input type="checkbox"/> Office of Education</p> <p>10 <input type="checkbox"/> Other HEW - Specify _____</p>	<p>11 <input type="checkbox"/> Department of the Interior</p> <p>12 <input type="checkbox"/> Department of Justice</p> <p>13 <input type="checkbox"/> Department of Labor</p> <p>14 <input type="checkbox"/> Department of Transportation</p> <p>15 <input type="checkbox"/> EPA (Environmental Protection Agency)</p> <p>16 <input type="checkbox"/> NASA (National Aeronautics and Space Administration)</p> <p>17 <input type="checkbox"/> NSF (National Science Foundation)</p> <p>18 <input type="checkbox"/> Nuclear Regulatory Commission</p> <p>19 <input type="checkbox"/> Other agency or department - Specify _____</p>	<p>20 <input type="checkbox"/> Department of Housing and Urban Development</p> <p>21 <input type="checkbox"/> Don't know source agency or department</p>									
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PART IV - OTHER INFORMATION															
<p><b>16a. At anytime during calendar year 1977 were you without a job AND actively seeking employment?</b></p>	<p><input type="checkbox"/> Yes - Continue with 16b <input type="checkbox"/> No - Skip to Question 17</p>														
<p><b>b. For how many weeks were you seeking employment?</b></p>	<table style="width:100%; border: none;"> <tr> <td style="width: 25%; border: none;"><input type="checkbox"/> 1 to 4 weeks</td> <td style="width: 25%; border: none;"><input type="checkbox"/> 5 to 10 weeks</td> <td style="width: 25%; border: none;"><input type="checkbox"/> 11 to 14 weeks</td> <td style="width: 25%; border: none;"><input type="checkbox"/> 15 to 26 weeks</td> </tr> <tr> <td style="border: none;"><input type="checkbox"/> 1 to 4 weeks</td> <td style="border: none;"><input type="checkbox"/> 5 to 10 weeks</td> <td style="border: none;"><input type="checkbox"/> 11 to 14 weeks</td> <td style="border: none;"><input type="checkbox"/> 15 to 26 weeks</td> </tr> <tr> <td style="border: none;"><input type="checkbox"/> 1 to 4 weeks</td> <td style="border: none;"><input type="checkbox"/> 5 to 10 weeks</td> <td style="border: none;"><input type="checkbox"/> 11 to 14 weeks</td> <td style="border: none;"><input type="checkbox"/> 15 to 26 weeks</td> </tr> </table>			<input type="checkbox"/> 1 to 4 weeks	<input type="checkbox"/> 5 to 10 weeks	<input type="checkbox"/> 11 to 14 weeks	<input type="checkbox"/> 15 to 26 weeks	<input type="checkbox"/> 1 to 4 weeks	<input type="checkbox"/> 5 to 10 weeks	<input type="checkbox"/> 11 to 14 weeks	<input type="checkbox"/> 15 to 26 weeks	<input type="checkbox"/> 1 to 4 weeks	<input type="checkbox"/> 5 to 10 weeks	<input type="checkbox"/> 11 to 14 weeks	<input type="checkbox"/> 15 to 26 weeks
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<input type="checkbox"/> 1 to 4 weeks	<input type="checkbox"/> 5 to 10 weeks	<input type="checkbox"/> 11 to 14 weeks	<input type="checkbox"/> 15 to 26 weeks												
<p><b>17. How many years of professional experience, including teaching, have you had?</b> <i>Enter number of years</i></p>	<p>_____ Years</p>														
<p><b>18. Based on your total education and experience, what do you regard yourself as professionally?</b> <i>Enter code and description from Reference List C.</i></p>	<table style="width:100%; border: none;"> <tr> <td style="width: 10%; border: none;">Code</td> <td style="border: none;">Description from Reference List C</td> </tr> <tr> <td style="border: none;"> </td> <td style="border: none;"> </td> </tr> </table>			Code	Description from Reference List C										
Code	Description from Reference List C														
<p><b>19. Listed at the right are selected topics of critical national interest. If you devote a significant proportion of your professional time to any of these problem areas, please mark the box for the one on which you spend the MOST time.</b> <i>Mark only one box.</i></p>	<table style="width:100%; border: none;"> <tr> <td style="width: 33%; border: none;"> <p>01 <input type="checkbox"/> Health</p> <p>02 <input type="checkbox"/> Environment protection, pollution control</p> <p>03 <input type="checkbox"/> Education</p> <p>04 <input type="checkbox"/> Teaching</p> <p>05 <input type="checkbox"/> Other</p> <p>06 <input type="checkbox"/> Space</p> <p>07 <input type="checkbox"/> National defense</p> <p>08 <input type="checkbox"/> Crime prevention and control</p> </td> <td style="width: 33%; border: none;"> <p>09 <input type="checkbox"/> Food production and technology</p> <p>10 <input type="checkbox"/> Energy and fuel</p> <p>11 <input type="checkbox"/> Other mineral resources</p> <p>12 <input type="checkbox"/> Community development and services</p> <p>13 <input type="checkbox"/> Housing (planning, design, construction)</p> <p>14 <input type="checkbox"/> Other - Specify _____</p> </td> <td style="width: 33%; border: none;"> <p>15 <input type="checkbox"/> Does not apply</p> </td> </tr> </table>			<p>01 <input type="checkbox"/> Health</p> <p>02 <input type="checkbox"/> Environment protection, pollution control</p> <p>03 <input type="checkbox"/> Education</p> <p>04 <input type="checkbox"/> Teaching</p> <p>05 <input type="checkbox"/> Other</p> <p>06 <input type="checkbox"/> Space</p> <p>07 <input type="checkbox"/> National defense</p> <p>08 <input type="checkbox"/> Crime prevention and control</p>	<p>09 <input type="checkbox"/> Food production and technology</p> <p>10 <input type="checkbox"/> Energy and fuel</p> <p>11 <input type="checkbox"/> Other mineral resources</p> <p>12 <input type="checkbox"/> Community development and services</p> <p>13 <input type="checkbox"/> Housing (planning, design, construction)</p> <p>14 <input type="checkbox"/> Other - Specify _____</p>	<p>15 <input type="checkbox"/> Does not apply</p>									
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<p><b>20a. Are you physically handicapped?</b></p>	<p><input type="checkbox"/> Yes - Continue with 20b <input type="checkbox"/> No - Skip to Question 21</p>														
<p><b>b. What is the nature of your handicap(s)?</b> <i>Mark as many as apply.</i></p>	<table style="width:100%; border: none;"> <tr> <td style="width: 33%; border: none;"><input type="checkbox"/> Visual</td> <td style="width: 33%; border: none;"><input type="checkbox"/> Orthopedic</td> <td style="width: 33%; border: none;"></td> </tr> <tr> <td style="border: none;"><input type="checkbox"/> Auditory</td> <td style="border: none;"><input type="checkbox"/> Other - Specify _____</td> <td style="border: none;"></td> </tr> </table>			<input type="checkbox"/> Visual	<input type="checkbox"/> Orthopedic		<input type="checkbox"/> Auditory	<input type="checkbox"/> Other - Specify _____							
<input type="checkbox"/> Visual	<input type="checkbox"/> Orthopedic														
<input type="checkbox"/> Auditory	<input type="checkbox"/> Other - Specify _____														
<p><b>21. Is your ethnic heritage Hispanic?</b> (Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture)</p>	<p><input type="checkbox"/> Yes <input type="checkbox"/> No</p>														
<p><b>22. In the event that it is necessary to contact you to clarify some of the information you provided, may we contact you by telephone?</b></p>	<p><input type="checkbox"/> Yes - Enter number(s) on which you can be reached →</p> <p><input type="checkbox"/> No</p>		<table style="width:100%; border: none;"> <tr> <td style="width: 50%; border: none;">Area code</td> <td style="border: none;">Telephone number</td> </tr> <tr> <td style="border: none;"> </td> <td style="border: none;"> </td> </tr> </table>	Area code	Telephone number										
Area code	Telephone number														
<p><b>23. Please print your name here</b></p>	<p>Date prepared _____</p>														

## REFERENCE LIST A - MAJOR FIELDS OF STUDY

This list is to be used in answering question 3 about the field in which you have obtained study or training. It is divided into two sections. Section I is a list of fields of academic study generally leading to bachelor's or higher degrees. Section II is a list of fields of study and training below those generally leading to a bachelor's degree.

Please scan the entire list, choose the appropriate answer for the question and then enter the code and description in the appropriate section of question 3. If none of the categories listed below adequately describes what you were studying or being trained in, use the "Other" category (code 600 or 625) and enter a brief description of what you were studying in the space provided on the questionnaire.

### Section I - FIELDS OF ACADEMIC STUDY LEADING TO BACHELOR'S OR HIGHER DEGREES

Code	Description	Code	Description
<b>Biological and Agricultural Sciences and Related Fields</b>		<b>Mathematical Sciences</b>	
501	Agriculture, business	557	Mathematics
502	Agriculture, general	558	Statistics and actuarial sciences
503	Agonomy, field crops	559	Computer sciences and systems analysis
504	Anatomy and histology	560	Operations research management science
505	Animal physiology		
506	Animal science		
507	Bacteriology, virology, mycology, parasitology		
508	Biochemistry		
509	Biology, general		
510	Biophysics		
511	Botany, general		
512	Dairy science (dairy husbandry)		
513	Entomology		
514	Farm management		
515	Fish and game or wildlife management		
516	Food science (food technology and processing, dairy manufacturing and technology, food industry)		
517	Forestry		
518	Genetics		
519	Horticulture		
520	Immunology		
521	Microbiology		
522	Plant pathology		
523	Plant physiology		
524	Soil science (soil management, soil conservation)		
525	Zoology, general		
526	Biological and agricultural sciences, other fields		
	<b>Education</b>		
527	Biological sciences education		
528	Mathematics education		
529	Physical sciences education		
530	Trade and industrial training		
531	Education, other fields		
	<b>Engineering</b>		
532	Aerospace, aeronautical, astronautical, and related fields		
533	Agricultural		
534	Architectural		
535	Chemical, petroleum refining		
536	Civil, construction, transportation		
537	Electrical, electronics		
538	Engineering sciences, mechanics, physics		
539	Engineering technology		
540	Environmental, sanitary engineering		
541	General or unified		
542	Industrial		
543	Mechanical		
544	Metallurgical, materials, ceramics		
545	Mining, mineral, geological		
546	Naval architecture and marine engineering		
547	Nuclear		
548	Operations research systems engineering		
549	Petroleum		
550	Engineering, other fields		
	<b>Health Fields</b>		
551	Medicine or premedicine, and clinical medical sciences		
552	Nursing (3 year or longer program)		
553	Pathology		
554	Pharmacology		
555	Pharmacy		
556	Health professions, other fields (4 year or longer program)		
	<b>Physical Sciences</b>		
560	Astronomy		
561	Chemistry		
562	Geography		
563	Meteorology		
564	Physics		
565	Physical sciences, general		
566	Geology and geophysics		
567	Oceanography		
568	Physical sciences, other fields		
	<b>Psychology</b>		
569	Clinical		
570	Educational		
571	General psychology		
572	Psychology, other fields		
	<b>Social Sciences</b>		
573	Anthropology		
574	Area studies, regional studies		
575	Economics, agricultural		
576	Economics, except agricultural		
577	Foreign service programs		
578	Geography		
579	History		
580	Industrial relations		
581	International relations		
582	Political science or government		
583	Public administration		
584	Social sciences, general		
585	Social work, social administration, social welfare		
586	Sociology		
587	Social sciences, other fields		
	<b>Arts, Humanities, and Other Specialties</b>		
588	Arts, general		
589	Business and commerce, including accounting, hotel and restaurant administration, and secretarial studies		
590	English and journalism		
591	Fine and applied arts, all fields		
592	Foreign language and literature, all fields		
593	Geography		
594	Home economics, all fields		
595	Law or prelaw		
596	Library science		
597	Military science, including merchant marine deck officer		
598	Philosophy, all fields		
599	Religion and theology, all fields		
600	Other (Describe briefly under the applicable item on the questionnaire.)		

PLEASE DETACH BEFORE RETURNING YOUR COMPLETED QUESTIONNAIRE

### Section II - FIELDS OF ACADEMIC STUDY AND OCCUPATIONAL TRAINING RELATED TO PROGRAMS BELOW THE BACCALAUREATE

Code	Description	Code	Description
	<b>Data Processing-related fields of study or training</b>		<b>Other fields of study or training</b>
601	Computer programming	616	Business and commerce-related fields of study or training
602	Computer operating	617	Craft (skilled) occupations-related fields of study or training (such as carpentry, bricklaying, tool and die making, etc.)
603	All other data processing fields of study or training	618	Educational-related fields of study or training
	<b>Engineering-related fields of study or training</b>	619	Home economics
604	Drafting and design, all fields	620	Nursing and other health service-related fields of study or training
605	Aeronautical technology	621	Operative occupations-related fields of study or training (such as machine operation, driving, inspecting, etc.)
606	Architectural or building technology	622	Police technology or law enforcement
607	Chemical technology	623	Sales and marketing-related fields of study or training
608	Civil technology	624	Service occupations-related fields of study or training (such as cook, beautician, firefighter, etc.)
609	Electrical and electronics technology	625	All other fields of study or training (Describe briefly under the applicable item on the questionnaire.)
610	Industrial technology		
611	Mechanical technology		
612	All other engineering-related fields of study or training		
	<b>Science-related fields of study or training</b>		
613	Agriculture		
614	Forestry		
615	Other science-related fields of study or training		

**REFERENCE LIST B - KINDS OF BUSINESSES**

This list is to be used in answering question 9 about the kind of business or industry for which you work. Please scan the entire list, choose the appropriate answer for the question and enter the code and description from this list. If none of the categories listed below adequately describes the kind of business for which you worked, use the "Other" category (code 731).

Code	Description	Code	Description
<b>Manufacturing</b>		<b>Other Kinds of Business</b>	
701	Aircraft, aircraft engines, aircraft parts	720	Agriculture, forestry, and fisheries
702	Chemicals and allied products	721	Business, personal, and professional services
703	Electrical machinery, equipment and supplies for the generation, storage, transformation, transmission, and utilization of electrical energy	722	Construction
704	Electronic apparatus, radio, television and communication equipment and parts	723	Engineering or architectural services
705	Electronic computers, accounting, calculating and office machinery and equipment	724	Finance, insurance, or real estate
706	Fabricated metal products (except ordnance, machinery and transportation equipment)	725	Mining and petroleum extraction
707	Machinery (except electrical) including engines and turbines, farming and construction machinery, mining, metalworking and other manufacturing and service industry machines	726	Private, nonprofit organizations other than educational institutions and hospitals
708	Motor vehicles and motor vehicle equipment including trucks, buses, automobiles, railroad engines and cars	727	Professional and technical societies
709	Ordnance, including manufacture of arms, ammunition, tanks, and complete guided missiles, space vehicles and equipment	728	Research institutions
710	Petroleum refining and related industries	729	Retail and wholesale trade
711	Primary metal industries, including smelting, refining, rolling, drawing, alloying, and manufacture of castings, forgings and other basic metal products	730	Transportation, communication, or other public utilities
712	Professional and scientific equipment and supplies	731	Other (Describe briefly under the applicable item on the questionnaire.)
713	Other manufacturing including printing and publishing		
<b>Educational Institutions</b>			
714	College or university offering at least a bachelor's degree		Public Administration (include only uniquely governmental activities, such as the U.S. Postal Service; U.S. Air Force, State court, Department of Motor Vehicles, city building inspection, or city public welfare. For example, if you work for the U.S. Postal Service use code 733, Federal public administration; on the other hand, if you work at a Veterans' Administration Hospital, use code 718, Hospital or clinic; if you work at a State university, use code 714, College or university; if you work for a county road building agency, use code 722, Construction; if you work in a Defense Department research laboratory, use code 728, Research institution.)
715	Junior college or technical institute		
716	Medical school	732	Uniformed military service
717	Other educational institutions	733	Federal public administration
<b>Health Services</b>		734	State public administration
718	Hospital or clinic	735	Local public administration (city, county, etc.)
719	Other medical and health services	737	Regional government
		736	Other government

**REFERENCE LIST C - OCCUPATIONS**

This list is to be used in answering questions 10 and 18 about your occupational classification. Please scan the entire list, choose the appropriate entry and enter the code and description from this list. If you cannot find exactly the right entry, please choose the one that comes nearest to it. If none of the entries is at all appropriate, use the "Other" category (code 475) and enter a brief description in the space provided on the questionnaire.

Code	Description	Code	Description
401	Engineers, including college professors and instructors		<b>Health Occupations, including persons who are primarily practitioners. Persons engaged primarily in medical research, teaching, and similar activities use code 432, Medical scientist.</b>
402	Engineer, aeronautical and astronautical	438	Physician or surgeon
403	Engineer, agricultural	439	Technician, dental
404	Engineer, chemical	440	Technician, medical
405	Engineer, civil and architectural	441	Other health occupation (Describe briefly under the applicable item on the questionnaire.)
406	Engineer, electrical and electronic		<b>Technicians and Technologists, except medical</b>
407	Engineer, industrial	442	Designer, electronic parts and machine tools
408	Engineer, metallurgical and materials	443	Designer, industrial
409	Engineer, mining, petroleum, and geological	444	Designer, other
410	Engineer, nuclear	445	Draftsman
411	Engineer, environmental and sanitary	446	Surveyor
412	Engineer, operations research systems	447	Technician, biological and agricultural
413	Engineer, other fields (Describe briefly under the applicable item on the questionnaire.)	448	Technician, electrical and electronic
	<b>Computer Specialist, including college professors and instructors</b>	449	Technician, construction, highways, and architectural
414	Computer programmer	450	Technician, mechanical
415	Computer systems analyst	451	Technician, other engineering
416	Computer scientist	452	Technician, physical science
417	Other computer specialist (Describe briefly under the applicable item on the questionnaire.)	453	Technician, other fields (Describe briefly under the applicable item on the questionnaire.)
	<b>Mathematicians and Statisticians, including college professors and instructors</b>		<b>Teachers</b>
418	Actuary	454	Teacher, elementary school
419	Mathematician	455	Teacher, secondary school
420	Statistician	456	Teacher, college and university, excluding engineering and science (Engineering and science teachers see codes 401-437 above.)
421	Operations research analyst		<b>Administrators, Managers, and Officials, excluding farm</b>
	<b>Physical Scientists, including college professors and instructors</b>	476	Urban and regional planner
422	Chemist	477	College president or dean
423	Earth scientists including geologists, geophysicists, etc.	478	Administrator or manager, scientific and technical research and development
424	Physicist, astronomer	479	Administrator or manager, production and operations
425	Atmospheric scientist, meteorologist	480	Administrator, manager, or official, all other, excluding self-employed
426	Oceanographer	481	Self-employed proprietor
427	Other physical scientist (Describe)		<b>All Other Occupations</b>
	<b>Biological Scientists, including college professors and instructors</b>	462	Accountant
428	Agricultural scientists, including foresters and conservationists	463	Attorney or judge
429	Biological scientist	464	Sales worker
430	Biochemist	465	Clerical worker (such as bookkeeper, secretary, etc.)
431	Biophysicist	466	Clergy
432	Medical scientist, excluding persons who are primarily medical practitioners, see Health Occupations	467	Craft worker (such as baker, carpenter, electrician, mechanic, repair worker)
433	Other biological scientist (Describe)	468	Farmer (owner, manager, tenant, or farm laborer)
	<b>Social Scientists, including college professors and instructors</b>	469	Fire fighter or police
434	Economist	470	Laborer, except farm
435	Psychologist	471	Librarian
436	Sociologist or anthropologist	472	Merchant or shopkeeper, self-employed
437	Other social scientist (Describe briefly under the applicable item on the questionnaire.)	473	Operative (such as assembler, factory worker, miner, welder, truck driver, etc.)
		474	Postal worker
		475	Other occupations, not specified above (Describe briefly under the applicable item on the questionnaire.)

## Appendix D. Source of Data

Characteristic	Table number	Item number on 1978 questionnaire
Age in 1978*	1	(From the 1970 census response)
Sex	1	(From the 1972 survey response, if available; otherwise from the 1970 census response)
Race*	1	(From the 1970 census response)
Residence in 1978	1	A, page 1
Professional identification	1	Part IV, 18
Hispanic heritage	1	Part IV, 21
Occupation in 1978	1	Part III, 10
Highest degree held*	2	2a; otherwise from 1976, 1974, or 1972 survey response
Major field of study for highest degree held*	2	3; otherwise from 1976, 1974 or 1972 survey response
Type of supplementary training: 1977	2	Part I, 4b
Job and occupational mobility: 1976, 1978*	3	1976 survey response and Part III, 10, 14
Job and occupational mobility: 1974, 1978*	3	1974 survey response and Part III, 10, 14
Job and occupational mobility: 1972, 1978*	3	1972 survey response and Part III, 10, 14
Years of professional experience*	3	Part IV, 17
Type of employer	4	Part III, 12
Federal support	4	Part III, 15a, 15b
Unemployment status: 1977	4	Part IV, 16a, 16b
Employment status: February 1978*	4	Part II, 5a, 5b, 7
Full-time employment in science or engineering: February 1978	4	Part II, 6a, 6b
National interest topics	4	Part IV, 19
Industry in 1978	4	Part III, 9
Primary work activity*	4	Part III, 11b
Annual salary rate: 1978	5	Part III, 13

\*For more information, see appropriate subject in appendix A.

## Appendix E. Response Rates

Table E-1 presents response rates of various components of the sample for the 1978 National Survey of Natural and Social Scientists and Engineers. The characteristics presented here are based on the 1970 census or on the 1978, 1976, 1974, or 1972 surveys. Since the percentages in table E-1 are based on a complete count of the sample cases, no reference to the standard error tables is necessary.

Table E-2 presents distributions of respondents and nonrespondents by the set of characteristics shown in table E-1.

Table E-1 is the counterpart of table E-1 of appendix E of the first report in this series *Selected Characteristics of Persons in Physical Science: 1978*. Table E-1 of that report, however, contained data for 362 respondents whose data were not represented in the tables and text of the report. Table E-1 of this report for social scientists and psychologists excludes data for these 362 respondents.



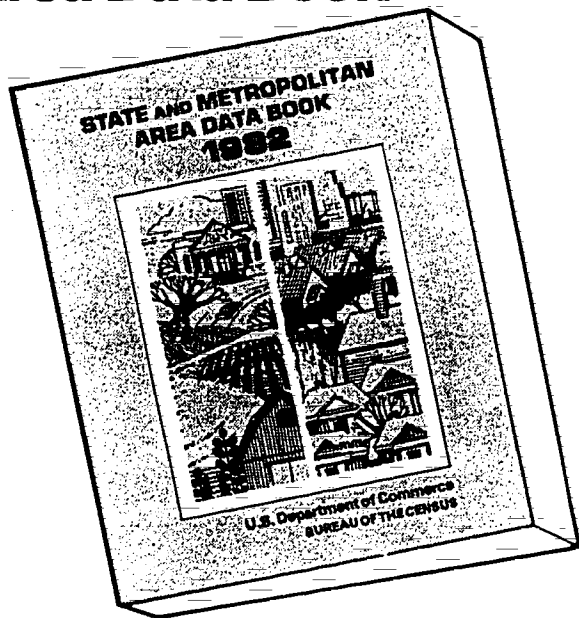
**Table E-1. National Sample, by Field of Science or Engineering in 1976, 1974, and 1972, Age in 1978, and Sex, by Response in the 1978 Survey (Unweighted)**

Sex, age in 1978 and field of science or engineering 1976	Response in 1978			
	Total		Respondents	Nonrespondents
	Number	Percent		
Total.....	50,093	100.0	81.4	18.6
<b>SEX</b>				
Male.....	46,877	100.0	81.6	18.4
Female.....	3,216	100.0	78.5	21.5
<b>AGE IN 1978</b>				
Under 30 years.....	287	100.0	76.0	24.0
30 to 34 years.....	6,264	100.0	75.7	24.3
35 to 39 years.....	9,226	100.0	78.1	21.9
40 to 44 years.....	8,075	100.0	81.3	18.7
45 to 49 years.....	7,644	100.0	83.1	16.9
50 to 54 years.....	6,994	100.0	84.9	15.1
55 to 59 years.....	5,183	100.0	85.8	14.2
60 to 64 years.....	3,193	100.0	85.5	14.5
65 to 69 years.....	1,930	100.0	82.2	17.8
70 years and over.....	1,297	100.0	76.2	23.8
<b>FIELD OF SCIENCE OR ENGINEERING IN 1976</b>				
Respondents in 1976.....	42,644	100.0	91.8	8.2
Total in scope in 1976.....	37,602	100.0	92.0	8.0
Computer specialists.....	2,064	100.0	90.8	9.2
Engineers.....	19,922	100.0	91.4	8.6
Mathematical specialists.....	1,486	100.0	92.6	7.4
Life scientists.....	3,800	100.0	93.9	6.1
Physical scientists.....	4,695	100.0	93.4	6.6
Environmental scientists.....	1,749	100.0	92.3	7.7
Psychologists.....	1,936	100.0	92.1	7.9
Social scientists.....	1,950	100.0	92.4	7.6
Total out-of-scope in 1976.....	5,042	100.0	89.8	10.2
Nonrespondents in 1976.....	7,449	100.0	21.9	78.1
<b>FIELD OF SCIENCE OR ENGINEERING IN 1974</b>				
Respondents in 1974.....	44,158	100.0	88.9	11.1
Total in scope in 1974.....	39,473	100.0	89.2	10.8
Computer specialists.....	2,291	100.0	87.4	12.6
Engineers.....	20,814	100.0	88.6	11.4
Mathematical specialists.....	1,612	100.0	89.3	10.7
Life scientists.....	4,026	100.0	91.0	9.0
Physical scientists.....	4,824	100.0	91.3	8.7
Environmental scientists.....	1,867	100.0	88.6	11.4
Psychologists.....	1,989	100.0	89.0	11.0
Social scientists.....	2,050	100.0	89.2	10.8
Total out-of-scope in 1974.....	4,685	100.0	86.2	13.8
Nonrespondents in 1974.....	5,935	100.0	25.6	74.4
<b>FIELD OF SCIENCE OR ENGINEERING IN 1972</b>				
Respondents in 1972.....	50,093	100.0	81.4	18.6
Total in scope in 1972.....	50,093	100.0	81.4	18.6
Computer specialists.....	3,391	100.0	76.7	23.3
Engineers.....	25,797	100.0	81.1	18.9
Mathematical specialists.....	2,185	100.0	81.9	18.1
Life scientists.....	4,891	100.0	84.1	15.9
Physical scientists.....	6,248	100.0	84.0	16.0
Environmental scientists.....	2,095	100.0	82.2	17.8
Psychologists.....	2,488	100.0	79.9	20.1
Social scientists.....	2,998	100.0	79.4	20.6

**Table E-2. Respondents and Nonrespondents in the 1978 National Survey, by Field of Science or Engineering in 1976, 1974, and 1972, by Age in 1978, and Sex (Unweighted)**

Sex, age in 1978, and field of science or engineering in 1976, 1974, 1972	Responded in 1978		Did not respond in 1978	
	Number	Percent	Number	Percent
Total.....	40,771	100.0	9,322	100.0
<b>SEX</b>				
Male.....	38,245	93.8	8,632	92.6
Female.....	2,526	6.2	690	7.4
<b>AGE IN 1978</b>				
Under 30 years.....	218	0.5	69	0.7
30 to 34 years.....	4,739	11.6	1,525	16.4
35 to 39 years.....	7,208	17.7	2,018	21.6
40 to 44 years.....	6,565	16.1	1,510	16.2
45 to 49 years.....	6,354	15.6	1,290	13.8
50 to 54 years.....	5,939	14.6	1,055	11.3
55 to 59 years.....	4,445	10.9	738	7.9
60 to 64 years.....	2,729	6.7	464	5.0
65 to 69 years.....	1,586	3.9	344	3.7
70 years and over.....	988	2.4	309	3.3
Median age.....	45	(X)	43	(X)
<b>FIELD OF SCIENCE OR ENGINEERING IN 1976</b>				
Responded in 1976.....	39,137	96.0	3,507	37.6
In scope in 1976.....	34,609	84.9	2,993	32.1
Computer specialists.....	1,875	4.6	189	2.0
Engineers.....	18,206	44.7	1,716	18.4
Mathematical specialists.....	1,376	3.4	110	1.2
Mathematicians.....	992	2.4	89	1.0
Statisticians.....	384	0.9	21	0.2
Life scientists.....	3,568	8.8	232	2.5
Agricultural scientists.....	1,446	3.5	94	1.0
Biologists.....	1,720	4.2	112	1.2
Medical scientists.....	402	1.0	26	0.3
Physical scientists.....	4,384	10.8	311	3.3
Chemists.....	2,692	6.6	171	1.8
Physicists and astronomers.....	1,443	3.5	124	1.3
Other physical scientists.....	249	0.6	16	0.2
Environmental scientists.....	1,615	4.0	134	1.4
Earth scientists.....	1,357	3.3	114	1.2
Atmospheric scientists.....	187	0.5	13	0.1
Oceanographers.....	71	0.2	7	0.1
Psychologists.....	1,784	4.4	152	1.6
Social scientists.....	1,801	4.4	149	1.6
Economists.....	750	1.8	70	0.8
Sociologists and anthropologists.....	484	1.2	38	0.4
Other social scientists.....	567	1.4	41	0.4
Out of scope.....	4,528	11.1	514	5.5
Did not respond in 1976.....	1,634	4.0	5,815	62.4

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