

The booming market for programmers

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In the past few years, the market for computer programmers and related workers has become increasingly dynamic. Employers compete openly for recruits, and private colleges vie for computer science students, virtually guaranteeing jobs after graduation. Even the federal government has become involved: its "Passport Canada" program, a joint initiative with industry, helps to locate and recruit software workers from abroad and usher them through the immigration process (Brethour, 1997).

The situation is not unique to Canada. Media reports have suggested that as many as 200,000 programming jobs in the United States are unfilled, and the demand continues to grow. The effects are being felt worldwide.

Among the factors contributing to this situation are the exponential growth of the Internet and the rapid spread of internal computer networks (intranets) within large organizations. Another important factor is the Year 2000 problem – that is, the difficulty facing users of computer programs that will need to be modified to cope with the change of the last two digits of the year from 99 to 00 at the turn of the century.¹

In February 1998, Statistics Canada published results from the Survey on Preparedness of Canadian Business for the Year 2000 (Brunet, 1998), which showed, among other things, that companies were looking for roughly 7,000 programmers, well beyond the resources available within these firms. This figure is undoubtedly far below the actual number of vacant jobs for programmers and systems analysts, for at least three reasons: not all firms

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surveyed had fully investigated their needs; the survey did not cover governments and other public institutions; and programmers needed for work other than the Year 2000 problem were not included.

Not surprisingly, the unemployment rate of programmers was only around 2% to 3% through 1997. This was much lower than the national rate of 9%, and indeed lower than any national unemployment rate since the mid-1960s.

This study documents the growth in employment of computer programmers and related workers, showing who is moving into the profession, and where the jobs are being created.

Sharp growth in employment in past five years

Employment of programmers and systems analysts declined during the recession of the early 1990s (see *Measuring computer programmers*). Since the end of 1992, the number of jobs for this group has risen strongly (Chart). An exception was the brief pause in late 1995, which reflected overall employment. From the fourth quarter of 1992 to the end of 1997, jobs for computer programmers and systems analysts rose 92%, from 139,000 to 267,000. Over the same period, jobs in all other scientific and technical occupations rose only 8%, from 348,000 to 375,000, and total employment rose 9%.

Measuring computer programmers

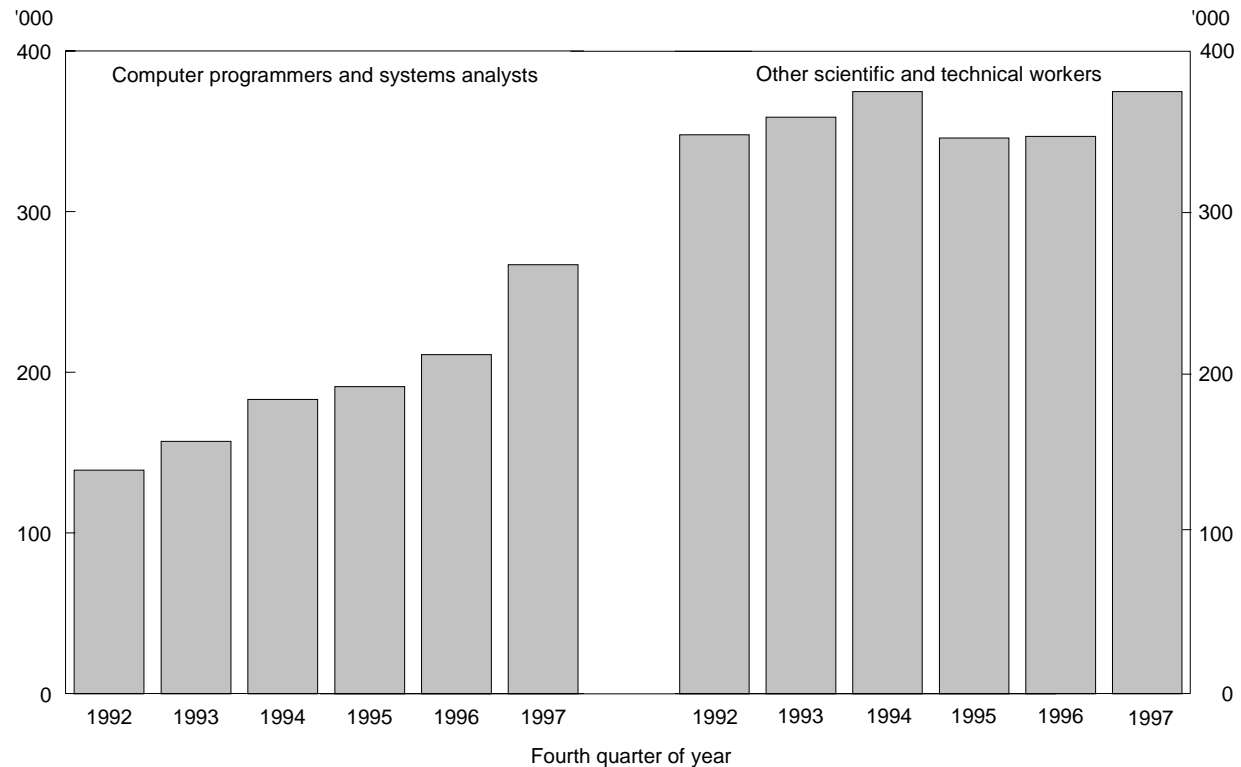
This study uses data from the Labour Force Survey (LFS). Because the household survey uses terminology provided by respondents to create its codes, the data that result can differ from those provided by another source; for example, a survey of employers or a count of association members. As a consequence, no one "true" measure of any occupation exists. Trends and comparisons between groups are more revealing than a group's level at one point in time.

Occupations discussed in this article are defined according to the 1980 Standard Occupational Classification (SOC): computer programmers and systems analysts (code 2183). During 1998, the LFS will begin using the 1991 Standard Occupational Classification, which splits this code into two: computer systems analysts (C062) and programmers (C063). The 1996 Census estimate for these two occupational groups was about 80% of the LFS figure, but the trends in both surveys were the same. Some of this gap is the result of differences in survey operations.

In the 1980 SOC, data processing and information technology managers cannot be isolated, since they are included with other managers. Estimates for this subgroup should be available when data based on the 1991 classification are published. The term "software engineer," included here as "computer programmer," will be coded in the 1991 SOC as "computer engineer" (C047). At the moment, the number of workers defined as such is small, but it may grow in the future.

For comparison purposes, other scientific and technology occupations from the 1980 SOC Major Group 21 (occupations in natural sciences, engineering and mathematics), excluding SOC 2183, cover professionals and technologists in the physical and life sciences, architecture, engineering, community planning, mathematics, statistics and related fields. Although these jobs may not provide a perfect comparison with programmers and systems analysts, they do offer meaningful reference points.

Chart
Job growth for computer programmers has been strong.



Source: Labour Force Survey

An occupation can expand in two ways. Workers can change jobs within a firm or employers can hire new employees. No data are available to measure the first scenario,² but the second can be confirmed easily. In the fourth quarter of 1997, 30% of programmers and systems analysts had been on the job for one year or less, compared with 17% of other scientific and technical workers. This is truly a dynamic field.

Wide variety of people entering the field

Who enters this profession; what are their educational qualifications; and how old are they?

An increase in employment in an occupation is a net product of both

inflows and outflows. Since no statistical series on job transitions is sufficiently current and detailed, the two measures cannot be separated. Instead, the overall employment change in various population subgroups must be examined.

Between late 1992 and 1997, men and women shared new programming opportunities roughly in proportion to their employment at the outset of the period. Of the 128,000 additional jobs, women gained 35,000 (Table 1). By 1997, men accounted for 74% of the profession, lower than that of other scientific and technical occupations (83%), but much higher than the overall workforce (55%).

Some 60% of the gain in employment occurred among workers aged 35 or over. And at the end of 1997,

just 20% of newly hired workers (in the job one year or less) were under 25. Most of the growth in employment, then, has been among persons old enough to have previous work experience.

Employment grew faster for workers with university degrees than for persons with other postsecondary education or training (120% versus 80%). The percentage of university graduates in this field increased from 42% to 48%.

People who had no completed postsecondary education were in the minority at the beginning of the period (26,000 of 139,000), and although their numbers have gone up over the last five years, their percentage growth has been relatively modest at 55%.

Table 1
Patterns of growth between the fourth quarters of 1992
and 1997

	Employment		Change		Distribution	
	1992	1997	'92-'97	'92-'97	1992	1997
	'000	'000	'000	%	%	%
All occupations						
Both sexes	12,847	14,032	1,185	9	100	100
Men	7,032	7,699	667	9	55	55
Women	5,815	6,333	517	9	45	45
Age						
15 to 24	1,995	1,960	-36	-2	16	14
25 to 34	3,668	3,608	-60	-2	29	26
35 to 44	3,522	4,075	553	16	27	29
45 and over	3,662	4,389	727	20	29	31
Education						
No postsecondary certificate	7,135	6,722	-413	-6	56	48
Postsecondary certificate or diploma	3,539	4,649	1,110	31	28	33
University degree	2,173	2,661	488	22	17	19
Computer programmers and systems analysts						
Both sexes	139	267	128	92	100	100
Men	104	197	93	90	75	74
Women	35	70	35	99	25	26
Age						
15 to 24	10	21	10	99	8	8
25 to 34	65	109	43	66	47	41
35 to 44	42	90	48	113	31	34
45 and over	20	47	27	131	15	18
Education						
No postsecondary certificate	26	41	14	55	19	15
Postsecondary certificate or diploma	54	98	44	80	39	37
University degree	58	128	70	120	42	48
Other scientific and technical occupations						
Both sexes	348	375	27	8	100	100
Men	294	310	15	5	85	83
Women	54	65	11	21	15	17
Age						
15 to 24	21	31	10	46	6	8
25 to 34	128	113	-15	-12	37	30
35 to 44	106	125	19	18	31	33
45 and over	92	105	13	14	27	28
Education						
No postsecondary certificate	55	54	-1	-1	16	14
Postsecondary certificate or diploma	114	139	24	21	33	37
University degree	179	182	3	2	51	49

Source: Labour Force Survey

Returning to the profession?

Some observers have speculated that workers who wrote computer programs years ago (and may have gone on to other lines of work) might return to help revise those programs for the Year 2000 challenge. Indeed, the number of programmers aged 45 or over grew by 27,000 between 1992 and 1997; not the largest absolute increase of any age group, but the highest proportionate increase (131% versus 66% to 113% for the younger age groups).

This growth is not in itself remarkable, given the baby boomers' move into middle age. For example, among other scientific and technical occupations, the number of workers aged 45 or over rose 14% overall, compared with 8% for all ages.

Does the striking difference in growth rates of older workers in programming and those in other scientific and technical occupations constitute a return of former programmers? Growth in this age group could occur for three reasons: new workers could be hired, others could transfer from within firms, and the remainder would simply grow older.

Only 12% of programmers hired within the past year were aged 45 or over in 1997. This is lower than the existing percentage of older workers in the profession (18%). Therefore, hiring is not the dominant vehicle for the growth in this group.

Nor is aging the main explanation for the rapid increase; this would have required a strong clustering of programmers in their early forties in 1992, which was not the case. Therefore, the phenomenon is best explained as the result of transfers from other occupational categories within firms.

What is not known is whether these people had worked as programmers in the past or were new to the profession. But stories of workers returning to help deal with the Year 2000 problem are not incompatible with the data.

Aside from all this, computer programming remains a young person's game. Software workers in 1997 were less likely than workers in other scientific and technical occupations to be 45 or over, and more likely to be aged 25 to 34. The proportions under 25 were the same in both groups.

Programmers not working long hours

Is the tight market for programmers reflected in long work weeks for these workers? Surprisingly, programmers averaged slightly less work time per week than other scientific and technical workers (38.8 hours versus 39.7) (Table 2). This gap was not caused by more part-time work. Programmers were slightly less likely to work part time (5% versus 6%). The difference in work weeks arose because full-time hours on average were lower (40.0 compared with 41.1). Furthermore, programmers were no more likely to moonlight (hold a second job) or to work overtime than were other workers.

Probably more surprising, programmers' average weekly hours went down over the five years that employment in this field was growing (from

39.5 to 38.8), whereas other scientific and technical workers' hours remained the same. By all accounts, therefore, the demand for software workers is not translating into more intense input from each worker.

These findings cast into doubt the workaholic image of computer software workers. In fact, programmers seem to have at least as much discretionary time as most other workers, and more than many.

Pay: good but not spectacular

Media reports have often focused on the substantial salaries of software workers, particularly those of new recruits. A full analysis of pay rates would need to take into account many factors, such as training and education, work experience, and personal ability – all beyond the scope of this paper. A cursory look, however, reveals earnings similar to those for workers in other scientific and technical occupations.³

On average, programmers and systems analysts earned more than workers overall in late 1997 (\$843 per week versus \$577), but slightly less than other scientific and technical workers (\$877). Because their weekly hours

were also slightly lower than those of other scientific and technical workers, their hourly equivalent pay was similar (\$22.24 versus \$22.33) (Table 3).

Programmers working for small establishments earned less than those in large companies, as was the case for other scientific and technical workers.

Average earnings of software workers hired within the past year have been on a par with those of new recruits in other scientific and technical professions (\$745 and \$746 per week). Larger firms have offered the best starting salaries (\$808 by those with 500 or more workers), noticeably lower than salaries offered to other scientific and technical workers in similar establishments (\$894).⁴ The proportion of software workers earning more than \$1,000 per week has been about the same as that for other scientific and technical workers (Table 4). This is also true for new recruits.

Self-employment increasing

One of the most notable features of the growth in software workers has been the increase in self-employment. In 1992, 17,000 programmers and

Table 2
Weekly hours of work, fourth quarter 1997

	Employment	Proportion working part time	Average usual hours		
			All	Full-time	Part-time
	'000	%			
Both sexes	14,032	20	36.6	41.5	16.4
Computer programmers and systems analysts	267	5	38.8	40.0	16.5
Other scientific and technical workers	375	6	39.7	41.1	15.7
Men	7,699	11	40.1	43.2	15.7
Computer programmers and systems analysts	197	4	39.4	40.4	15.6
Other scientific and technical workers	310	5	40.3	41.6	15.9
Women	6,333	30	32.3	38.9	16.7
Computer programmers and systems analysts	70	8	37.0	38.6	17.8
Other scientific and technical workers	65	9	36.6	38.7	15.1

Source: Labour Force Survey

systems analysts were working for themselves. By 1997, this had more than tripled, to 58,000. Self-employment thus accounted for slightly under a third of the growth in the profession (41,000 out of 128,000). Because self-employed computer programmers are by definition part of the business services industry sector, it is not surprising that nearly half the growth of software workers in this industry was accounted for by self-employment (41,000 out of 89,000).

In spite of this growth, the bulk of programmers and systems analysts continued to work for others, in firms of varying sizes.⁵ Thirty-one percent worked in establishments of 500 employees or more, a slightly higher concentration than for other scientific and technical workers (24%). Newly hired programmers were somewhat more likely to be employed in small companies. However, the same was true of other scientific and technical workers, so this may simply reflect higher staff turnover in small firms.

Most new jobs are in business services

When managers need programming services they have two options: hire people to do the job, or purchase the service from an outside company or self-employed individual. Such specialized services are found in the business services industry sector.

Almost 70% of the 128,000 additional programming jobs created in Canada between late 1992 and 1997 were in business services. Contracting-out has increasingly been the arrangement of choice (Table 5).

Employers in finance, insurance and real estate; communication; and trade tended to hire their own programming staff, increasing their employment in this field by a factor of two over five years. In absolute numbers, however, the growth was fairly modest: between 7,000 and 16,000 workers.

Table 3
Employees and earnings, by size of workplace,
fourth quarter 1997

	Computer programmers and systems analysts			Other scientific and technical workers		
	Average earnings			Average earnings		
	Weekly		Hourly	Weekly		Hourly
	'000	\$		'000	\$	
Workplace size						
All employees						
Total	209	843	22.24	326	877	22.33
Under 20	29	756	19.61	59	708	18.39
20 to 99	50	782	20.73	95	834	20.99
100 to 499	65	871	22.73	92	926	23.51
500 and over	65	902	24.10	79	997	25.51
Job tenure less than one year						
Total	63	745	19.56	59	746	18.58
Under 20	13	680	17.90	15	557	14.86
20 to 99	20	713	18.76	21	741	18.03
100 to 499	16	782	20.25	13	855	20.35
500 and over	14	808	21.47	11	894	22.81

Source: Labour Force Survey

Table 4
Employees by weekly earnings, fourth quarter 1997

	Computer programmers and systems analysts		Other scientific and technical workers	
	Total	Job tenure less than one year	Total	Job tenure less than one year
	'000			
Weekly earnings	209	63	326	59
Less than \$600	39	21	65	22
\$600 to \$799	54	17	81	15
\$800 to \$999	55	13	76	10
\$1,000 and over	61	13	105	13
	%			
Less than \$600	19	33	20	37
\$600 to \$799	26	26	25	25
\$800 to \$999	26	21	23	16
\$1,000 and over	29	20	32	21

Source: Labour Force Survey

Job creation not equal between regions

Almost one-half of all programmers were employed in Ontario (123,000 out of 267,000), the majority of them in Toronto. Quebec followed with 76,000, most of whom were in Montréal. In Alberta, a little over half of the 25,000 programming jobs were in Calgary, whereas the vast majority of British Columbia's 25,000 programmers lived in Vancouver (Table 6).

Virtually all programmers and systems analysts lived in larger cities; only 29,000 of 267,000 resided in small urban centres or rural areas.⁶ And these workers were much less common in the smaller provinces.

Between late 1992 and 1997, Ontario added the most positions (58,000), representing a growth of 90%. The proportion of programmers employed in the province remained unchanged at 46%. British Columbia had the fastest percentage growth (155%), led by Vancouver (179%). Montréal also saw a 120% growth in programming and systems analysis jobs. The increase in the Atlantic region was lower than in the rest of the country.

In spite of rapid growth in Vancouver, Montréal and Toronto, the highest concentration of programmers and systems analysts was in Ottawa-Hull: 5.3% of the employed.

Conclusion

As in other countries, the Canadian market for computer programmers and systems analysts has been strong in the last few years, especially in urban areas. Many of these new workers are self-employed, while others work for companies specializing in selling computer services to other firms.

In spite of the growing demand for programmers, these workers put in fewer weekly hours than other scientific and technical workers, and their average work week is declining. Employers have not had to drop their

Table 5
Employment of computer programmers and systems analysts in selected industries, fourth quarter 1992 and 1997

	Employment		Change		Proportion
	1992	1997	'92-'97	'92-'97	1997
	'000		'000	%	%
All industries	138.9	267.1	128.2	92.3	1.9
Business services	45.4	134.0	88.6	195.2	12.8
Finance, insurance and real estate	14.2	30.1	15.9	111.6	3.8
Manufacturing	25.9	25.7	-0.2	-0.9	1.2
Government services	20.1	24.3	4.2	20.9	3.2
Communication	9.0	15.6	6.6	72.7	4.8
Trade	7.1	14.4	7.2	101.6	0.6
Community services*	8.2	11.1	2.9	35.9	0.4
Utilities	2.7	4.3	1.7	62.5	2.9
Transportation and storage	3.8	3.0	-0.7	-19.5	0.5

Source: Labour Force Survey

* Comprises education, health and social services, and religion.

Table 6
Regional employment of computer programmers and systems analysts, fourth quarter 1992 and 1997

	Employment		Change		Proportion
	1992	1997	'92-'97	'92-'97	1997
	'000		'000	%	%
Canada	138.9	267.1	128.2	92.3	1.9
Atlantic	4.9	7.6	2.7	56.0	0.8
Quebec	41.6	75.6	34.0	81.8	2.3
Ontario	64.5	122.9	58.4	90.5	2.2
Manitoba	3.7	6.9	3.2	86.9	1.3
Saskatchewan	2.0	4.3	2.3	112.7	0.9
Alberta	12.7	25.4	12.7	100.8	1.7
British Columbia	9.6	24.5	14.9	155.3	1.3
Selected census metropolitan areas (CMAs)					
Vancouver	6.4	18.0	11.6	179.4	1.9
Montréal	24.5	53.9	29.4	120.1	3.4
Edmonton	4.3	9.1	4.8	110.8	1.9
Toronto	34.4	70.2	35.8	104.2	3.1
Calgary	7.4	14.1	6.8	92.3	2.9
Ottawa-Hull	15.6	28.8	13.2	84.4	5.3
Winnipeg	3.4	5.8	2.5	72.4	1.6
Kitchener-Waterloo	2.8	4.0	1.3	44.8	2.0
Québec	7.4	7.7	0.3	3.5	2.4
Hamilton	5.1	5.2	0.1	2.8	1.6
London	3.0	2.8	-0.1	-4.9	1.4
Total CMA	123.7	238.0	114.3	92.4	2.6
Other urban	4.5	9.9	5.4	118.3	0.9
Rural	10.6	19.2	8.6	80.6	0.5

Source: Labour Force Survey

education requirements in order to meet the demand, and most of the new workers are over age 25, rather than recent graduates. Moreover, stories of grand salary offers do not seem to be reflected in the broad picture. Finally, software workers, whether new on the job or with more seniority, receive pay in line with other scientific and technical workers.

Once the Year 2000 problem has been solved, will the demand for programmers lessen, or will it continue to grow as requirements evolve? Society depends on computers for everything from personal banking to national security. Labour market and computer industry observers will want to monitor trends in these occupations. □

Update: First Quarter: 1998

In the first quarter of 1998, employment among programmers and systems analysts averaged 267,000, unchanged from the final quarter of 1997. Brief pauses in growth have been observed over the past five years.

■ Notes

1 In the early days of computers, memory and storage space were in short supply, so years were represented by 2-digit numbers (for example, 69 for 1969). This means that at the end of the century, programs still containing such date fields will appear to be set at 1900. Unless corrected, this problem threatens to create chaos in programs around the world.

2 The Survey of Labour and Income Dynamics is now developing a time series on transitions. At the moment, however, limitations of timeliness and sample size restrict the ability of this data set to reflect recent trends in detailed occupations.

3 Pay is only one aspect of job quality. Other factors, such as pensions, supplementary health and dental plans, and paid vacation leave are also important. Data from the Survey of Work Arrangements show that programmers and systems analysts employed in November 1995 enjoyed benefit levels close to those of other scientific and technical workers.

4 These are averages; some individuals receive rates considerably higher or lower.

5 Trend data on employment by size of employer do not exist back to 1992. The question on number of employees was introduced into the Labour Force Survey at the beginning of 1997, as were data on rates of pay.

6 These are defined as all areas not included in the 25 census metropolitan areas. It should be noted that the Labour Force Survey counts people where they live, not where they work. Some of the 19,000 programmers and systems analysts who live outside the large cities probably commute to these centres to work, or may work from home for clients in these larger places.

■ References

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Note: The survey on which this report is based was sponsored by Task Force Year 2000.