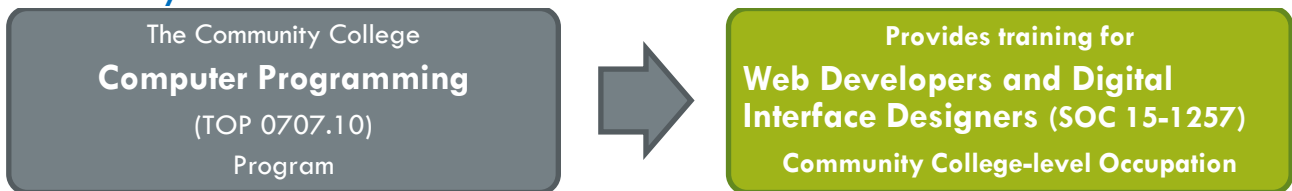


Computer Programming – Python Programming Language

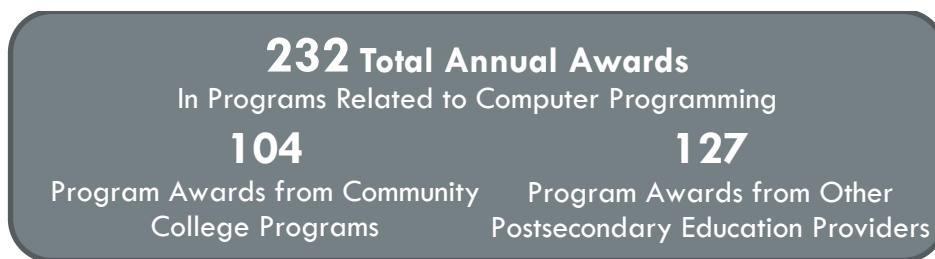
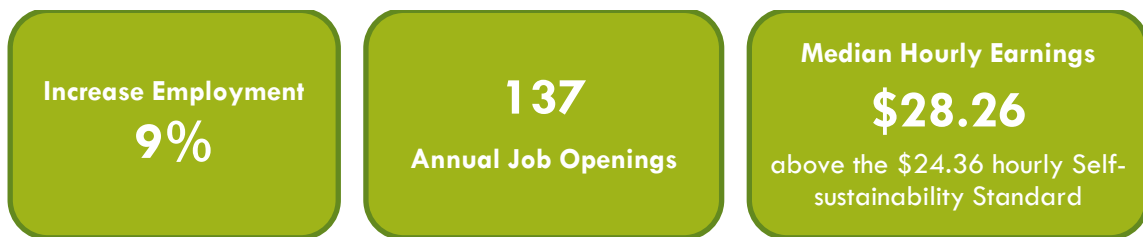
Inland Empire/Desert Region (Riverside and San Bernardino counties)

This workforce demand report uses state and federal job projection data developed before the economic impact of COVID-19. The COE is monitoring the situation and will provide more information as it becomes available. Please consult with local employers to understand their current employment needs.

Summary



Over the next five years (2020-2025), community college-level computer programming employment is projected to




The Inland Empire/Desert Centers of Excellence
Recommends
Computer Programming Program Expansion
to meet the need for more workers in the region

Introduction

This report provides labor market research and postsecondary programs outcomes related to the California Community College computer programming (TOP 0707.10). Computer programming programs prepare students for employment through instruction related to entry-level programming, including methods,

procedures, symbols, and rules used in planning and writing instructions in computer language for the solution of the problem. These programs include programming for the World Wide Web (Taxonomy of Programs, 2012).

The knowledge, skills, and abilities trained by computer programming programs lead to three distinct occupations, collectively referred to as the computer programming occupational group in this report. The computer programming occupational group is separated into community college-level and bachelor's degree-level occupations to illuminate job opportunities for individuals with varying education levels.

The **community college-level occupation** in this report requires an associate degree. Approximately 25% of incumbent web developers and digital interface designers have a community college-level education, some college or an associate degree, as their highest level of educational attainment. The community college-level occupation included in the computer programming occupational group is:

- Web Developers and Digital Interface Designers (SOC 15-1257)

This report's **bachelor's degree-level occupations** typically require workers to obtain a four-year degree before entering employment. Between 12% and 20% of workers in these occupations have a community college-level education, some college or an associate degree, as their highest level of educational attainment. The bachelor's degree-level occupations included in the computer programming occupational group are:

- Computer Programmers (SOC 15-1251)
- Software Developers and Software Quality Assurance Analysts and Testers (15-1256)

This report's educational supply and employment demand portions focus solely on the community college-level jobs students will likely obtain after completing regional community college computer programming training.

Python programming language training is closely associated with the computer programming program. A real-time search for Python programming language job advertisements is included in this report to gauge employer demand associated with this skill-set. [Python Programming Job Advertisements](#) section for details.

Job Counts and Projections

In 2020, there were 7,232 total computer programming jobs in the region. Employment for the community college-level computer programming occupation, web developers and digital interface designers, is projected to increase by 9% through 2025; 137 job openings are projected annually. The bachelor's degree-level occupational group is expected to have 621 annual job openings, increasing employment by 16% over the next five years. Exhibit 1 displays the job counts, five-year projected job growth, job openings, and the share of incumbent workers aged 55 years and greater in the region.

Exhibit 1: Five-year projections for the computer programming occupational group, 2020-2025

Occupation	2020 Jobs	2025 Jobs	5-Yr % Change (New Jobs)	5-Yr Openings (New + Replacement Jobs)	Annual Openings (New + Replacement Jobs)	% of workers age 55+
Software Developers and Software Quality Assurance Analysts and Testers	4,992	5,895	18%	2,839	568	15%
Computer Programmers	774	776	0%	264	53	22%
Bachelor's Degree-level Total	5,766	6,670	16%	3,103	621	16%
Web Developers and Digital Interface Designers	1,465	1,602	9%	687	137	11%
Community College-level Total	1,465	1,602	9%	687	137	11%
Total	7,232	8,273	14%	3,790	758	15%

Source: Emsi 2022.1

Exhibit 2 shows the number of job ads posted during the last 12 months and the regional and statewide average time filling each occupation. Over the previous 12 months, there were 1,824 job ads posted for the computer programming occupational group in the Inland Empire/Desert Region. On average, regional employers fill online job advertisements for computer programming workers in 35 days, three days shorter than the statewide average time to fill. Job advertisements indicate that regional employers face similar challenges filling open positions as other employers in California. See the [Python programming](#) section for specific job and skill demand in the region.

Exhibit 2: Job ads and time to fill

Occupation	Job Ads	Regional Average Time to Fill (Days)	Statewide Average Time to Fill (Days)
Software Developers and Software Quality Assurance Analysts and Testers	1,387	37	39
Computer Programmers	124	32	34
Bachelor's Degree-level Total	1,511	37	39
Web Developers and Digital Interface Designers	313	30	34
Community College-level Total	313	30	34
Total	1,824	35	38

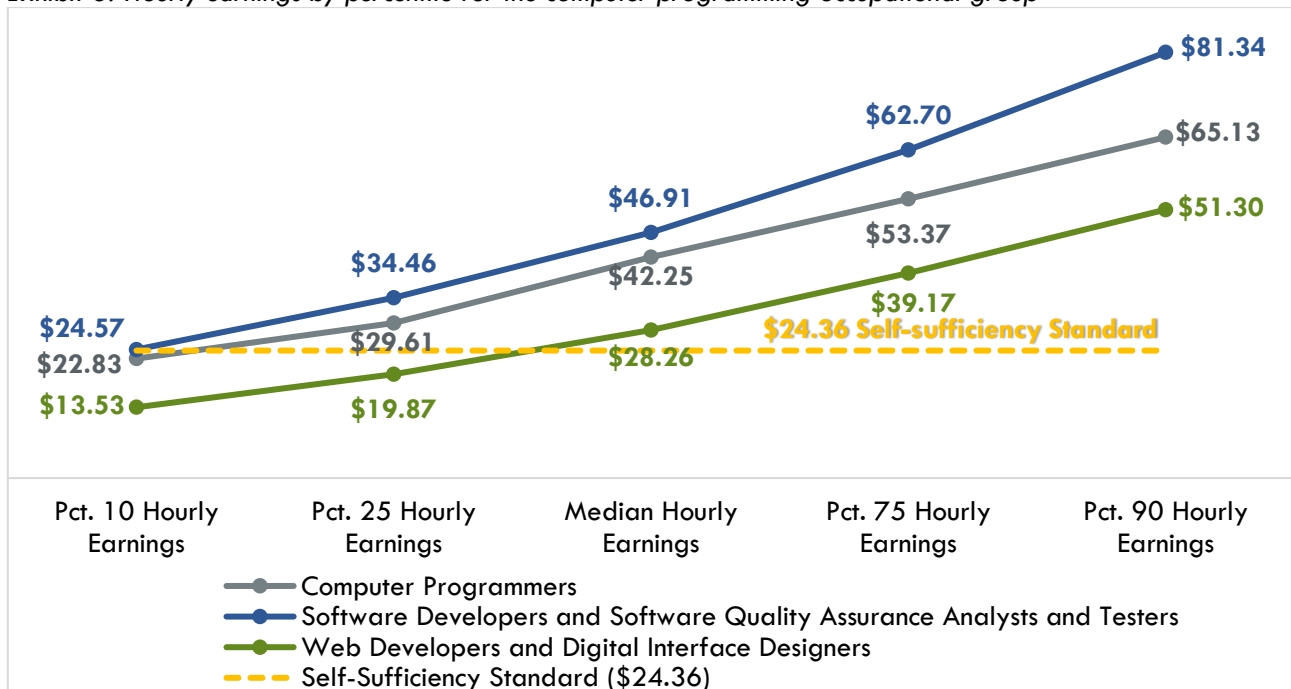
Source: Burning Glass – Labor Insights

Earnings and Benefits

Community colleges should ensure their training programs lead to employment opportunities that provide self-sustainable income. The University of Washington estimates that a self-sufficient hourly rate for a single adult with one school-age child is \$24.36 per hour or \$51,452 annually in Riverside County; \$23.73 per hour or \$50,119 annually in San Bernardino County (Pearce, 2021). For this study, the higher hourly earnings requirement in Riverside County is adopted as the self-sufficiency standard for the two-county region.

Exhibit 3 displays the hourly earnings for the computer programming occupational group. The hourly earnings for computer programmers and software developers and software quality assurance analysts and testers surpass the regional self-sufficiency standard at the 25th percentile, indicating that at least 75% of workers earn a self-sustainable wage. The 50th percentile hourly earnings for web developers and digital interface designers exceed the regional self-sufficiency standard.

Exhibit 3: Hourly earnings by percentile for the computer programming occupational group



Source: Emsi 2022.1

According to the occupational guides developed by the California Labor Market Information Division, benefits for the computer programming occupational group typically include medical, dental, and life insurance, vacation, sick leave, and holidays (Detailed Occupational Guides, 2022).

Advertised Salary from Online Job Ads

Exhibit 4 displays online job ad salary data for the computer programming occupational group over the last 12 months. Online job ad salary information reveals that employers are willing to pay the computer

programming occupational group between \$71,000 and \$90,000 annually, above the region's \$51,452 annual (\$24.36 hourly) self-sufficiency standard. Consider the salary information with caution since only 25% (456 out of 1,824) of online job ads for these occupations provided salary information. The salary figures are prorated to reflect full-time, annual wage status.

Exhibit 4: Advertised salary information

Occupation	Real-Time Salary Information					Average Annual Salary
	Number of job ads	Less than \$35,000	\$35,000 to \$49,999	\$50,000 to \$74,999	More than \$75,000	
Bachelor's Degree-level						
Software Developers and Software Quality Assurance Analysts and Testers	302	5%	8%	22%	65%	\$90,000
Computer Programmers	46	13%	18%	28%	41%	\$71,000
Community College-level						
Web Developers and Digital Interface Designers	108	5%	20%	21%	54%	\$72,000

Source: Burning Glass – Labor Insights

Employers, Skills, Education, and Work Experience

Exhibit 5 displays the employers that posted the most job ads during the last 12 months in the region. Showing employer names provides some insight into where students may find employment after completing a program. Esri, a supplier of geographic information system software, posted the most job advertisements for the computer programming occupational group in the region.

Exhibit 5: Employers posting the most job ads for the computer programming occupational group

Occupation	Top Employers	
Bachelor's Degree-level		
Software Developers and Software Quality Assurance Analysts and Testers (n=1,387)	<ul style="list-style-type: none"> Esri Anthem Blue Cross QTC Management Incorporated University of California, Riverside CACI 	<ul style="list-style-type: none"> DT Professional Services Danaher Corporation California State University, San Bernardino Raytheon General Dynamics
Computer Programmers (n=124)	<ul style="list-style-type: none"> University of California, Riverside Anthem Blue Cross 	<ul style="list-style-type: none"> Ubisoft Loma Linda University Medical Center

Occupation	Top Employers
Community College-level	
Web Developers and Digital Interface Designers (n=313)	<ul style="list-style-type: none"> • Esri • Danaher Corporation • Anthem Blue Cross

Source: Burning Glass – Labor Insights

Exhibit 6 lists a sample of specialized, employability, and software and programming skills employers seek when looking for workers to fill positions in the computer programming occupational group. Specialized skills are occupation-specific skills that employers request for industry or job competency. Employability skills are foundational skills that transcend industries and occupations; this category is often referred to as “soft skills.” The skills requested in job ads may be utilized to guide curriculum development. JavaScript, a programming language, was the most sought-after software and programming skill, appearing in 31% of regional job advertisements.

Exhibit 6: Sample of in-demand skills from employer job ads

Occupation	Specialized skills	Employability skills	Software and Programming Skills
Bachelor's Degree-level			
Software Developers and Software Quality Assurance Analysts and Testers (n=1,336)	<ul style="list-style-type: none"> • Software Engineering • Unit Testing • Web Application Development • Agile Development 	<ul style="list-style-type: none"> • Communication Skills • Teamwork/ Collaboration • Problem Solving • Troubleshooting • Writing 	<ul style="list-style-type: none"> • SQL • JavaScript • Microsoft C# • Python • C++
Computer Programmers (n=117)	<ul style="list-style-type: none"> • Technical Support • Software Development • Project Planning and Development Skills • Customer Service 	<ul style="list-style-type: none"> • Communication Skills • Teamwork/ Collaboration • Problem Solving • Detail-Oriented 	<ul style="list-style-type: none"> • SQL • JavaScript • Microsoft C# • Hypertext Preprocessor (PHP)
Community College-level			
Web Developers and Digital Interface Designers (n=265)	<ul style="list-style-type: none"> • User Interface (UI) Designer • Front-end Development • Agile Development • Software Engineering 	<ul style="list-style-type: none"> • Communication Skills • Teamwork/ Collaboration • Problem Solving • Creativity • Research 	<ul style="list-style-type: none"> • JavaScript • Adobe Creative Suite • HTML5 • SQL

Source: Burning Glass – Labor Insights

Exhibit 7 displays the typical entry-level education, educational attainment, and minimum advertised education requirements for the computer programming occupational group. According to the Bureau of Labor Statistics, between 12%-25% of incumbent workers in this field hold a community college-level of educational attainment; "some college, no degree" and an "associate degree." The majority of employers sought candidates with a bachelor's degree or higher.

Exhibit 7: Typical entry-level education, educational attainment, and minimum advertised education requirements

Occupation	Typical Entry-Level Education Requirement	CC-Level Educational Attainment*	Number of Job Ads	Real-Time Minimum Advertised Education Requirement		
				High school or vocational training	Associate degree	Bachelor's degree or higher
Bachelor's Degree-level						
Software Developers and Software Quality Assurance Analysts and Testers	Bachelor's degree	12%	1,133	6%	3%	91%
Computer Programmers	Bachelor's degree	20%	84	22%	8%	70%
Community College-level						
Web Developers and Digital Interface Designers	Associate degree	25%	234	5%	5%	90%

Source: Emsi 2022.1, Burning Glass – Labor Insights

*Percentage of incumbent workers with a Community College Award or Some Postsecondary Coursework

Exhibit 8 displays the work experience typically required to enter each occupation and the real-time work experience requirements from employer job ads. Approximately half of the employers posting advertisements for the computer programming occupational group sought candidates with three to five years of previous work experience.

Exhibit 8: Work experience required and real-time work experience requirements

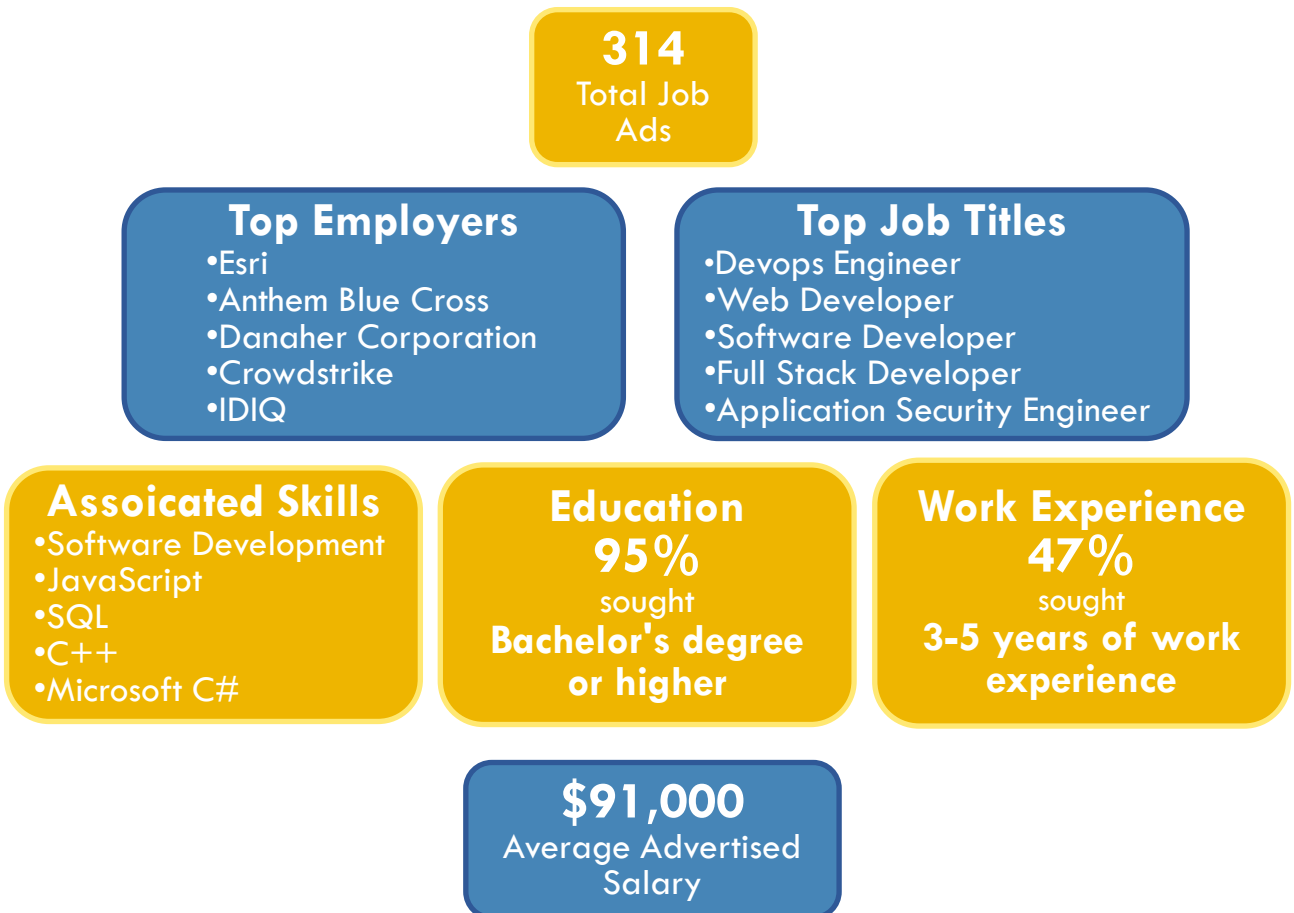
Occupation	Work Experience Typically Required	Real-Time Work Experience			
		Number of job ads	0 – 2 years	3 – 5 years	6+ years
Bachelor's Degree-level					
Software Developers and Software Quality Assurance Analysts and Testers	None	1,011	25%	51%	24%
Computer Programmers	None	80	35%	39%	26%

Occupation	Work Experience Typically Required	Real-Time Work Experience			
		Number of job ads	0 – 2 years	3 – 5 years	6+ years
Community College-level					
Web Developers and Digital Interface Designers	None	252	28%	56%	16%

Source: Emsi 2022.1, Burning Glass – Labor Insights

Python Programming Language Job Advertisements

The job advertisement search for the computer programming occupational group was limited to advertisements specific to the Python programming language through the application of a Python programming skills filter. Job advertisement information may provide helpful insight into the regional demand for Python programming skills. Over the last twelve months in the Inland Empire/Desert Region:



Programs Completions and Student Outcomes

Exhibit 9 displays student completions for computer programming (0707.10) programs over the last three academic years, 2018-21. Regional community colleges have issued 104 awards annually in computer programming programs over the previous three academic years. Program completion and student outcome methodologies can be found in the appendix.

Exhibit 9: 2018-21, Annual average community college awards for computer programming programs in the region

TOP 0707.10 – Computer Programming	Academic Year 2018-19	Academic Year 2019-20	Academic Year 2020-21	Total CC Annual Average Awards, Academic Years 2018-21
Chaffey				3
Certificate (8 to < 16 units)	0	4	5	3
Copper Mountain				4
Associate Degree	3	3	1	2
Certificate (30 to < 60 units)	4	1	1	2
Moreno Valley				6
Associate Degree	4	4	2	3
Certificate (18 to < 30 units)	3	0	0	1
Certificate (16 to < 30 units)	0	4	2	2
Mt. San Jacinto				10
Certificate (30 to < 60 units)	11	0	0	4
Certificate (16 to < 30 units)	0	7	11	6
Norco College				26
Associate Degree	7	7	5	6
Certificate (30 to < 60 units)	5	5	6	5
Certificate (18 to < 30 units)	2	0	0	1
Certificate (16 to < 30 units)	0	3	5	3
Certificate (6 to < 18 units)	14	12	7	11
Riverside				45
Associate Degree	12	8	5	8
Certificate (18 to < 30 units)	11	0	0	4
Certificate (16 to < 30 units)	0	10	6	5
Certificate (12 to < 18 units)	31	0	0	10
Certificate (8 to < 16 units)	0	30	17	16
Certificate (6 to < 18 units)	5	0	0	2
San Bernardino				9
Associate Degree	15	6	3	8
Certificate (30 to < 60 units)	0	0	2	1

TOP 0707.10 – Computer Programming	Academic Year 2018-19	Academic Year 2019-20	Academic Year 2020-21	Total CC Annual Average Awards, Academic Years 2018-21
Certificate (6 to < 18 units)	2	0	0	1
Victor Valley				1
Certificate (18 to < 30 units)	1	0	0	0
Certificate (16 to < 30 units)	0	1	0	0
Total	130	105	78	104

Source: MIS Data Mart

California program outcome data may provide a useful insight into the likelihood of success for the proposed program. Community college student outcome information based on the selected TOP code and region is provided in Exhibit 10. Among the students exiting computer programming programs in the region, 61% of students reported working in their field of study, the median annual earnings were \$31,460, and 56% attained a living wage.

Exhibit 10: 0707.10 – Computer programming strong workforce program outcomes

Strong Workforce Program Metrics: 0707.10 – Computer Programming Academic Year 2018-19, unless noted otherwise	Inland Empire/Desert Region	California
Unduplicated count of enrolled students (2019-20)	2,715	38,422
Completed 9+ career education units in one year (2019-20)	25%	21%
Perkins Economically disadvantaged students (2019-20)	80%	68%
Students who attained a noncredit workforce milestone in a year (2019-20)	49%	61%
Students who earned a degree, certificate, or attained apprenticeship (2019-20)	54	720
Transferred to a four-year institution (transfers)	283	4,107
Job closely related to the field of study (2017-18)	61%	65%
Median annual earnings (all exiters)	\$31,460	\$41,452
Median change in earnings (all exiters)	22%	21%
Attained a living wage (completers and skills-builders)	56%	55%

Sources: LaunchBoard Community College Pipeline and Strong Workforce Program Metrics

Exhibit 11 displays awards that other postsecondary education providers reported in computer programming/programmer, general (CIP 11.0201) programs. Completion data is compiled from the Integrated Postsecondary Education Data System (IPEDS) for the most recent three years available. California State University San Bernardino issued one bachelor's degree in the 2017-18 academic year in computer programming/programmer, general programs.

Exhibit 11: Other educational providers computer programming/programmer, general programs, three-year annual average credentials in the region

11.0201 – Computer Programming/Programmer, General	Bachelor's Degree	Other Educational Providers Annual Average Credentials, Academic Years 2016-19
California State University-San Bernardino	0	0
Total	0	0

Source: IPEDS

Exhibit 12 displays awards that other postsecondary education providers reported in computer systems analysis/analyst (CIP 11.0501) programs. On average, California Technical Academy issued 127 awards annually over the last three academic years in computer systems analysis/analyst programs.

Exhibit 12: Other educational provider computer systems analysis/analyst, three-year annual average credentials in the region

11.0501 – Computer Systems Analysis/Analyst	Award 1<2 Academic Years	Award <1 Academic Year	Other Educational Providers Annual Average Credentials, Academic Years 2016-19
California Technical Academy	96	31	127
Total	96	31	127

Source: IPEDS

Recommendation

Community college computer programming (TOP 0707.10) programs provide the knowledge, skills, and abilities that prepare students for employment in two bachelor's degree-level occupations and one community college-level occupation. This report's educational supply and employment demand portions focus solely on the community college-level jobs students will likely obtain after completing a community college computer programming program in the Inland Empire/Desert Region.

The community college-level computer programming occupation, web developers and digital interface designers, is expected to have 137 annual job openings and increase employment by 9% over the next five years. The median hourly earnings for web developers and digital interface designers is \$28.26 per hour, above the \$24.36 per hour self-sustainable wage standard.

Regional community college computer programming (TOP 0707.10) programs have issued 104 awards annually over the last three academic years. Other postsecondary education providers in the region have issued 127 awards in programs related to computer programming over the previous three academic years. Among the students exiting computer programming programs in the region, 61% of students reported working in their field of study, the median annual earnings were \$31,460, and 56% attained a living wage.

The Centers of Excellence recommends expanding community college computer programming programs to meet the regional need for more workers. Any college considering computer programming programs should partner with local four-year universities to ensure their programs are transferable. Students holding a bachelor's degree, in addition to an associate degree and certificates, will have increased access to in-demand and high-wage computer programming employment opportunities in the region.

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April 2022

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Appendix: Occupation definitions, sample job titles, five-year projections, and earnings for computer programming occupations

Occupation Definitions (SOC code), Education and Training Requirement, Community College Education Attainment

Bachelor's Degree-level

Computer Programmers (15-1251)

Create, modify, and test the code and scripts that allow computer applications to run. Work from specifications drawn up by software and web developers or other individuals. May develop and write computer programs to store, locate, and retrieve specific documents, data, and information.

Sample job titles: Analyst Programmer, Application Programmer Analyst, Computer Programmer, Computer Programmer Analyst, Internet Programmer, Java Developer, Programmer, Programmer Analyst, Web Applications Programmer, Web Programmer

Entry-Level Educational Requirement: Bachelor's degree

Training Requirement: None

Work Experience: None

Incumbent workers with a Community College Award or Some Postsecondary Coursework: 20%

Software Developers and Software Quality Assurance Analysts and Testers (15-1256)

Research, design, and develop computer and network software or specialized utility programs. Analyze user needs and develop software solutions, applying principles and techniques of computer science, engineering, and mathematical analysis. Update software or enhance existing software capabilities. May work with computer hardware engineers to integrate hardware and software systems and develop specifications and performance requirements. May maintain databases within an application area, working individually or coordinating database development as part of a team. Develop and execute software tests to identify software problems and their causes. Test system modifications to prepare for implementation. Document software and application defects using a bug tracking system and report defects to software or web developers. Create and maintain databases of known defects. May participate in software design reviews to provide input on functional requirements, operational characteristics, product designs, and schedules.

Sample job titles: Application Developer, Application Integration Engineer, Developer, Infrastructure Engineer, Network Engineer, Software Architect, Software Developer, Software Development Engineer, Software Engineer, Systems Engineer, Application Integration Engineer, Computer Consultant, Information Technology

Analyst (IT Analyst), Product Assurance Engineer, Quality Assurance Analyst (QA Analyst), Software Quality Assurance Engineer (SQA Engineer), Software Quality Engineer, Software Test Engineer, Systems Engineer, Test Engineer

Entry-Level Educational Requirement: Bachelor's degree

Training Requirement: None

Work Experience: None

Incumbent workers with a Community College Award or Some Postsecondary Coursework: 12%

Community College-level

Web Developers and Digital Interface Designers (15-1257)

Design digital user interfaces or websites. Develop and test layouts, interfaces, functionality, and navigation menus to ensure compatibility and usability across browsers or devices. May use web framework applications as well as client-side code and processes. May evaluate web design following web and accessibility standards, and may analyze web use metrics and optimize websites for marketability and search engine ranking. May design and test interfaces that facilitate the human-computer interaction and maximize the usability of digital devices, websites, and software with a focus on aesthetics and design. May create graphics used in websites and manage website content and links.

Sample job titles: Technology Applications Engineer, Web Architect, Web Design Specialist, Web Designer, Web Developer, Webmaster

Entry-Level Educational Requirement: Associate degree

Training Requirement: None

Work Experience: None

Incumbent workers with a Community College Award or Some Postsecondary Coursework: 25%

Appendix: Methodology

Exhibit 9 displays the average annual California Community College (CCC) awards conferred during the three academic years between 2018 and 2021 from the California Community Colleges Chancellor's Office Management Information Systems (MIS) Data Mart. Awards are the combined total of associate degrees and certificates issued during the timeframe, divided by three in this case to calculate an annual average. This is done to minimize the effect of atypical variations that might be present in a single year.

Community college student outcome information is from LaunchBoard and based on the selected TOP code and region. These metrics are based on records submitted to the California Community Colleges Chancellor's Office Management Information Systems (MIS) by community colleges, which come from self-reported student information from CCC Apply and the National Student Clearinghouse. Employment and earnings metrics are sourced from California's Employment Development Department's Unemployment Insurance database records. When available, outcomes for completers are reported to demonstrate the impact that earning a degree or certificate can have on employment and earnings. For more information on the types of students included for each metric, please see the web link for LaunchBoard's Strong Workforce Program Metrics Data Element Dictionary in the References section (LaunchBoard, 2021 a). Finally, employment in a job closely related to the field of study comes from self-reported student responses on the CTE Employment Outcomes Survey (CTEOS), administered by Santa Rosa Junior College (LaunchBoard, 2021 a).

Job postings data is limited to the information provided by employers and the ability of artificial intelligence search engines to identify this information. Additionally, preliminary calculations by Georgetown Center on Education and the Workforce found that "just 30 to 40 percent of openings for candidates with some college or an associate degree, and only 40 to 60 percent of openings for high school diploma holders appear online" (Carnevale et al., 2014). Online job postings often do not reveal employers' hiring intentions; it is unknown if employers plan to hire one or multiple workers from a single online job posting or collecting resumes for future hiring needs. A closed job posting may not be the result of a hired worker.

Table 1. 2020 to 2025 job growth, wages, entry-level education, training, and work experience required for the computer programming occupational group in the Inland Empire/Desert Region (Riverside and San Bernardino Counties combined)

Occupation (SOC)	2020 Jobs	5-Year Change (New Jobs)	5-Year % Change (New Jobs)	Annual Openings (New + Replacement Jobs)	Entry-Experienced Hourly Wage (10 th to 90 th percentile)	Median Hourly Wage (50 th percentile)	Average Annual Earnings	Entry-Level Education & On-The-Job-Training	Work Experience Required
Software Developers and Software Quality Assurance Analysts and Testers (15-1256)	4,992	902	18%	568	\$24.57 to \$81.34	\$46.91	\$104,300	Bachelor's degree & None	None
Computer Programmers (15-1251)	774	2	0%	53	\$22.83 to \$65.13	\$42.25	\$92,000	Bachelor's degree & None	None
Bachelor's Degree-level Total	5,766	904	16%	621	-	-	-	-	-
Web Developers and Digital Interface Designers (15-1257)	1,465	137	9%	137	\$13.53 to \$51.30	\$28.26	\$66,200	Associate degree & None	None
Community College-level Total	1,465	137	9%	137	-	-	-	-	-
Total	7,232	1,041	14%	758	-	-	-	-	-

Source: Emsi 2022.1