# Programming and App Development

*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

- Community college programming and app development (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.
- The community college-level occupation is projected to have 115 annual job openings through 2025, increasing employment by 7% in the region.
- The median hourly earnings for the community college-level occupation is $28.75 per hour, above the regional $24.36 per hour self-sustainable wage standard for a single adult with one child.
- Regional community colleges have issued an annual average of 113 awards in computer programming programs over the last three academic years. One other postsecondary education provider in the region issued one award total over the previous three academic years.
- The COE recommends expanding computer programming programs. See the recommendation section for further detail.

## Introduction

This report aims to quantify regional supply and employment demand related to android, iOS, and C# programming jobs, referred to as programming and app development in this report. The skills and educational requirements needed to program with these programming languages/platforms are the same. The California Community College computer programming (TOP 0707.10) program provides the training most closely associated with programming and app development. 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). This report contains sections that detail regional demand for android programming workers, iOS programming workers, and C# programming workers found in employer job advertisements.

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 workers in this occupation 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 a community college programming and app development program in the region.

## Job Counts and Projections

In 2020, there were 7,112 total computer programming jobs in the region. Employment for the community college-level computer programming occupation is projected to increase by 7% through 2025; 115 job openings are projected annually. The bachelor's degree-level occupations are expected to have 520 annual job openings, increasing employment by 13% over the next five years. Exhibit 1 displays the job counts, five-year projected job growth, job openings, and the share of incumbent workers age 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 | 4,956 | 5,697 | 15% | 2,355 | 471 | 15% |
| Computer Programmers | 759 | 760 | 0% | 244 | 49 | 23% |
| **Bachelor's Degree-level Total** | **5,714** | **6,457** | **13%** | **2,600** | **520** | **16%** |

| 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+ |
|---|---|---|---|---|---|---|
| Web Developers and Digital Interface Designers | 1,398 | 1,496 | 7% | 574 | 115 | 11% |
| **Community College-level Total** | **1,398** | **1,496** | **7%** | **574** | **115** | **11%** |
| **Total** | **7,112** | **7,953** | **12%** | **3,174** | **635** | **15%** |

Source: Emsi 2021.3

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 1,517 job ads posted for the computer programming occupational group. On average, regional employers fill online job advertisements for computer programming workers in 34 days, nine days shorter than the statewide time to fill. Job advertisements indicate that regional employers face significantly fewer challenges filling open positions than other employers in California.

*Exhibit 2: Job ads and time to fill*

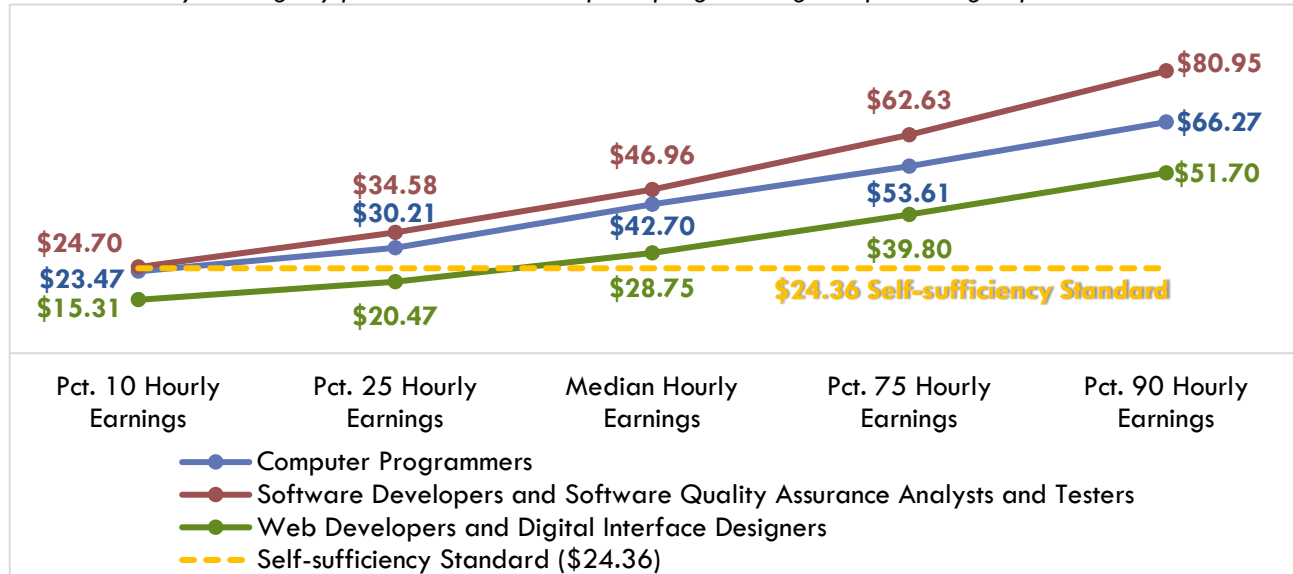| Occupation | Job Ads | Regional Average Time to Fill (Days) | Statewide Average Time to Fill (Days) |
|---|---|---|---|
| Software Developers and Software Quality Assurance Analysts and Testers | 1,145 | 34 | 43 |
| Computer Programmers | 105 | 32 | 39 |
| **Bachelor's Degree-level Total** | **1,250** | **34** | **43** |
| Web Developers and Digital Interface Designers | 267 | 33 | 43 |
| **Community College-level Total** | **267** | **33** | **43** |
| **Total** | **1,517** | **34** | **43** |

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 the top 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*



| | Pct. 10 Hourly Earnings | Pct. 25 Hourly Earnings | Median Hourly Earnings | Pct. 75 Hourly Earnings | Pct. 90 Hourly Earnings |
|---|---|---|---|---|---|
| Software Developers and Software Quality Assurance Analysts and Testers | $24.70 | $34.58 | $46.96 | $62.63 | $80.95 |
| Computer Programmers | $23.47 | $30.21 | $42.70 | $53.61 | $66.27 |
| Web Developers and Digital Interface Designers | $15.31 | $20.47 | $28.75 | $39.80 | $51.70 |
| Self-sufficiency Standard ($24.36) | | | | | |

Legend:
- Computer Programmers
- Software Developers and Software Quality Assurance Analysts and Testers
- Web Developers and Digital Interface Designers
- Self-sufficiency Standard ($24.36)

Source: Emsi 2021.3

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, 2021).

## 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 $65,000 and $85,000 annually, above the region's $51,452 annual ($24.36 hourly) self-sufficiency standard. Consider the salary information with caution since only 24% (363 out of 1,517) 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 | | | | | |
|---|---|---|---|---|---|---|
| | *Number of job ads* | Less than $35,000 | $35,000 to $49,999 | $50,000 to $74,999 | More than $75,000 | Average Annual Salary |
| **Bachelor's Degree-level** | | | | | | |
| Software Developers and Software Quality Assurance Analysts and Testers | 238 | 9% | 10% | 21% | 60% | $85,000 |
| Computer Programmers | 42 | 45% | 21% | 17% | 17% | $67,000 |
| **Community College-level** | | | | | | |
| Web Developers and Digital Interface Designers | 83 | 7% | 29% | 23% | 41% | $65,000 |

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. Displaying employer names provides some insight into where students may find employment after completing a program. Esri 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=1,145)* | • Esri<br>• Anthem Blue Cross<br>• QTC Management Inc. | • CACI<br>• Inland Empire Health Plans |
| Computer Programmers *(n=105)* | • San Bernardino County<br>• University of California Riverside<br>• Esri | • Loma Linda University Health<br>• Anthem Blue Cross |
| **Community College-level** | | |
| Web Developers and Digital Interface Designers *(n=267)* | • Esri<br>• Anthem Blue Cross<br>• Monster Energy | • California State University San Bernardino<br>• California Baptist University |

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.

*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=1,105)* | • Software Engineering<br>• Unit Testing<br>• Web Application Development | • Communication Skills<br>• Teamwork/ Collaboration<br>• Problem Solving<br>• Troubleshooting | • JavaScript<br>• SQL<br>• C#<br>• Python<br>• C++<br>• ArcGIS |
| Computer Programmers *(n=98)* | • Software Development<br>• Relational Databases<br>• Project Planning and Development Skills | • Communication Skills<br>• Writing<br>• Teamwork/ Collaboration<br>• Problem Solving | • SQL<br>• JavaScript<br>• Microsoft Office<br>• C#<br>• .NET |
| **Community College-level** | | | |
| Web Developers and Digital Interface Designers *(n=265)* | • Software Development<br>• User Interface (UI) Design<br>• Graphic Design | • Communication Skills<br>• Teamwork/ Collaboration<br>• Problem Solving<br>• Creativity | • JavaScript<br>• Adobe Photoshop<br>• Adobe InDesign<br>• HTML 5<br>• Adobe Illustrator |

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* | Real-Time Minimum Advertised Education Requirement | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | | | Number of Job Ads | 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% | 933 | 5% | 4% | 91% |
| Computer Programmers | Bachelor's degree | 20% | 70 | 30% | 4% | 66% |
| **Community College-level** | | | | | | |
| Web Developers and Digital Interface Designers | Associate degree | 25% | 199 | 5% | 4% | 91% |

Source: Emsi 2021.3, 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 | *818* | 28% | 52% | 20% |
| Computer Programmers | None | *63* | 27% | 54% | 19% |
| **Community College-level** | | | | | |
| Web Developers and Digital Interface Designers | None | *199* | 31% | 50% | 19% |

Source: Emsi 2021.3, Burning Glass – Labor Insights

## Android Programming Job Advertisements

A keyword filter was applied to the job advertisement search for the computer programming occupational group to limit the search to advertisements specific to android programming. Over the last twelve months, there were 105 regional advertisements related to android programming. The job titles most frequently included in android job advertisements were senior application developer, solutions engineer, and android developer.

The employers posting the most job advertisements for android programmers were Esri, Rapid Response Monitoring, and Anthem Blue Cross. Most employers sought candidates with android programming skills to convert their current applications to operate on the android platform. Approximately 99% of android programming job advertisements sought candidates with a bachelor's degree or higher. There were insufficient android advertisements to obtain reliable salary information. The software and programming skills most frequently included in android advertisements were JavaScript, C++, ArcGIS, HTML 5, Python, Linux, and .NET.

## iOS Programming Job Advertisements

A keyword filter, including iOS and swift, was applied to the job advertisement search for the computer programming occupational group to limit the search to advertisements specific to iOS programming. Over the last twelve months, there were 99 regional advertisements related to iOS programming. IOS programming

job advertisements most frequently included the following job titles; solutions engineer, software engineer – full stack developer, application specialist, and senior C++ software engineer.

The employers posting the most job advertisements for iOS programmers were Esri, Anthem Blue Cross, IDIQ, and Brightside Health, Inc. Most employers sought candidates with iOS programming skills to convert their current applications to operate on the iOS platform. Approximately 94% of iOS programming job advertisements sought candidates with a bachelor's degree or higher. Job advertisements indicate that, on average, employers are willing to pay iOS programmers $102,000 annually. Job advertisements for iOS programmers exceed the advertised wages for standard computer programming occupations. The software and programming skills most frequently included in iOS advertisements were JavaScript, Python, C++, SQL, Swift, and ArcGIS.

## C# Programming Job Advertisements

A keyword filter was applied to the job advertisement search for the computer programming occupational group to limit the search to advertisements specific to C# programming. Over the last twelve months, there were 340 regional advertisements related to C# programming. The job titles most frequently included in C# programming job advertisements were software engineer, senior software engineer, and senior application developer.

The employers posting the most job advertisements for C# programmers were Esri, QTC Management Inc, Rapid Response Monitoring, and CACI. Approximately 96% of C# programming job advertisements sought candidates with a bachelor's degree or higher. Job advertisements indicate that, on average, employers are willing to pay C# programmers $98,000 annually. Job advertisements for C# programmers exceed the advertised wages for standard computer programming occupations. The software and programming skills most frequently included in C# advertisements were C#, JavaScript, SQL, .NET, and Python.

## Programs Completions and Student Outcomes

Exhibit 9 displays student completions for computer programming (0707.10) programs over the last three academic years. Regional community colleges have issued 113 awards annually in computer programming programs in the previous three academic years. Program completion and student outcome methodologies can be found in the appendix.

*Exhibit 9: 2017-20, Annual average community college awards for computer programming programs in the region*

| TOP 0707.10 – Computer Programming | Associate Degree | Certificate requiring 30 to < 60-semester units | Certificate requiring 18< 30-semester units | Certificate requiring 16< 30-semester units | Certificate requiring 12< 18-semester units | Certificate requiring 8< 16-semester units | Certificate requiring 6< 18-semester units | Total CC Annual Average Awards, Academic Years 2017-20 |
|---|---|---|---|---|---|---|---|---|
| Chaffey | - | - | - | - | - | 1 | - | 1 |
| Copper Mountain | 4 | 3 | - | - | - | - | - | 7 |
| Moreno Valley | 3 | - | 2 | 1 | - | - | - | 6 |
| Mt. San Jacinto | - | 5 | - | 2 | - | - | - | 8 |
| Norco | 7 | 5 | 2 | 1 | - | - | 12 | 28 |
| Riverside | 12 | - | 10 | 3 | 10 | 10 | 8 | 53 |
| San Bernardino | 9 | - | - | - | - | - | 1 | 9 |
| Victor Valley | - | - | 0 | 0 | - | - | - | 1 |
| **Total** | **35** | **13** | **14** | **8** | **10** | **11** | **21** | **113** |

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. The outcome methodology is available in the appendix section of this report.

*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% |

| Strong Workforce Program Metrics: 0707.10 – Computer Programming Academic Year 2018-19, unless noted otherwise | Inland Empire/Desert Region | California |
|---|---|---|
| Median annual earnings (all exiters) | $31,460 | $41,448 |
| 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 (CIP 11.0201) programs. Completion data is compiled from the Integrated Postsecondary Education Data System (IPEDS) for the most recent three years available. On average, one other postsecondary education institution in the region issued one bachelor's degree in the 2017-18 academic year.

*Exhibit 11: Other educational provider 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
*California State University San Bernardino issued one bachelor degree in a computer programming/programmer, general program in the 2017-18 academic year.

## Recommendation

Community college programming and app development (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 is expected to have 115 annual job openings and increase employment by 7% over the next five years in the region. The median hourly earnings for the community college-level computer programming occupation is $28.75 per hour, above the $24.36 per hour self-sustainable wage standard.

Regional community college computer programming (TOP 0707.10) programs have issued 113 awards annually over the last three academic years. One other postsecondary education provider in the region has

issued one award in a program 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 programming and app development (computer programming) programs to meet the regional need for more workers. Any college considering programming and app development 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 programming and app development employment opportunities in the region.

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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 2017 and 2020 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, 2021a). 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, 2021a).

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 (10th to 90th percentile) | Median Hourly Wage (50th 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) | 4,956 | 741 | 15% | 471 | $24.70 to $80.95 | $46.96 | $103,900 | Bachelor's degree & None | None |
| Computer Programmers (15-1251) | 759 | 2 | 0% | 49 | $23.47 to $66.27 | $42.70 | $93,500 | Bachelor's degree & None | None |
| **Bachelor's Degree-level Total** | **5,714** | **743** | **13%** | **520** | - | - | - | - | - |
| Web Developers and Digital Interface Designers (15-1257) | 1,398 | 98 | 7% | 115 | $15.31 to $51.70 | $28.75 | | Associate degree & None | None |
| **Community College-level Total** | **1,398** | **98** | **7%** | **115** | - | - | - | - | - |
| **Total** | **7,112** | **841** | **12%** | **635** | - | - | - | - | - |

Source: Emsi 2021.3