C·O·E CENTERS OF EXCELLENCE FOR LABOR MARKET RESEARCH

Labor Market Analysis: 0702.00/Computer Information Systems

Cloud Computing Foundation (Certificate requiring 8 to fewer than 16 semester units)

Los Angeles Center of Excellence, December 2022

Summary

Program Endorsement:	Endorsed: All Criteria Met ☐	Endorsed: Some Criteria Met ☒	Not Endorsed ☐

Program Endorsement Criteria		
Supply Gap:	Yes ☑	No ☐
Living Wage: (Entry-Level, 25th)	Yes ☑	No ☐
Education:	Yes ☐	No ☑
Emerging Occupation(s)		
Yes ☐		No ☑

The Los Angeles Center of Excellence for Labor Market Research (LA COE) prepared this report to provide regional labor market supply and demand data related to four occupations:

- ***Computer Systems Analysts* (15-1211)** Analyze science, engineering, business, and other data processing problems to develop and implement solutions to complex applications problems, system administration issues, or network concerns. Perform systems management and integration functions, improve existing computer systems, and review computer system capabilities, workflow, and schedule limitations. May analyze or recommend commercially available software.[1]
- ***Database Administrators* (15-1242)** Administer, test, and implement computer databases, applying knowledge of database management systems. Coordinate changes to computer databases. Identify, investigate, and resolve database performance issues, database capacity, and database scalability. May plan, coordinate, and implement security measures to safeguard computer databases.[2]
- ***Network and Computer Systems Administrators* (15-1244)** Install, configure, and maintain an organization's local area network (LAN), wide area network (WAN), data communications network, operating systems, and physical and virtual servers. Perform system monitoring and verify the integrity and availability of hardware, network, and server resources and systems. Review system and application logs and verify completion of scheduled jobs, including system backups. Analyze network and server resource consumption and control user access. Install and upgrade software and maintain software licenses. May assist in network modeling, analysis, planning, and coordination between network and data communications hardware and software.[3]
- ***Software Developers* (15-1252)** Research, design, and develop computer and network software or specialized utility programs. Analyze user needs and develop software

[1] Computer Systems Analysts (bls.gov)
[2] Database Administrators (bls.gov)
[3] Network and Computer Systems Administrators (bls.gov)

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.[4]

Although the four occupations in this report typically require a bachelor's degree and are not traditionally considered middle-skill[5], community college programs have historically trained students for entry-level jobs in this field or provided the foundational knowledge necessary for other programs that further students' education level. This report is intended to help determine whether there is demand in the local labor market that is not being met by the supply from community college programs that align with the relevant occupations.

Based on the available data, there appears to be a supply gap for these cloud computing-related occupations in the region. While entry-level wages exceed the self-sufficiency standard wage in both Los Angeles and Orange counties, the occupations in this report typically require a bachelor's degree. **Therefore, due to some of the criteria being met, the LA COE endorses this proposed program.** Detailed reasons include:

Demand:

- ***Supply Gap Criteria –*** Over the next five years, **8,157 jobs are projected to be available annually** in the region due to new job growth and replacements, **which is more than the three-year average of 2,269 awards conferred** by educational institutions in the region.
- ***Living Wage Criteria –*** Within Los Angeles County, all four of these cloud computing-related occupations have entry-level wages **above** the self-sufficiency standard hourly wage ($18.10/hour).[6]
- ***Educational Criteria –***The Bureau of Labor Statistics (BLS) lists a **bachelor's degree** as the typical entry-level education for these cloud computing-related occupations.
    - National-level educational attainment data indicates **between 14% and 45% of workers in the field have completed some college or an associate degree.**

[4] Software Developers (bls.gov)

[5] The COE classifies middle-skill jobs as the following:

- All occupations that require an educational requirement of some college, associate degree or apprenticeship;
- All occupations that require a bachelor's degree, but also have more than one-third of their existing labor force with an educational attainment of some college or associate degree; or
- All occupations that require a high school diploma or equivalent or no formal education, but also require short- to long-term on-the-job training where multiple community colleges have existing programs.

[6] Self-Sufficiency Standard wage data was pulled from The Self-Sufficiency Standard Tool for California. For more information, visit: http://selfsufficiencystandard.org/california.

Supply:

- There are **28 community colleges** in the greater LA/OC region that issue awards related to cloud computing, conferring an average of **1,405 awards annually** between 2018 and 2021.
- Between 2017 and 2020, there was an average of **864 awards conferred annually** in related training programs by non-community college institutions throughout the greater LA/OC region.

Occupational Demand

Exhibit 1 shows the five-year occupational demand projections for these occupations related to cloud computing. In the greater Los Angeles/Orange County region, the number of jobs related to these occupations is projected to increase by 8% through 2026. There will be more than 8,100 job openings per year through 2026 due to job growth and replacements.

Exhibit 1: Occupational demand in Los Angeles and Orange Counties[7]

Geography	2021 Jobs	2026 Jobs	2021-2026 Change	2021-2026 % Change	Annual Openings
Los Angeles	62,934	68,234	5,301	8%	5,696
Orange	27,527	29,756	2,229	8%	2,461
Total	**90,460**	**97,990**	**7,529**	**8%**	**8,157**

Wages

The labor market endorsement in this report considers the entry-level hourly wages for these occupations related to cloud computing in Los Angeles County as they relate to the county's self-sufficiency standard wage. Orange County wages are included below in order to provide a complete analysis of the greater LA/OC region. Detailed wage information, by county, is included in Appendix A.

Los Angeles County—All four occupations in this report have entry-level wages above the self-sufficiency standard wage for one adult ($18.10 in Los Angeles County). Typical entry-level hourly wages are in a range between $34.62 and $44.81. Experienced workers can expect to earn wages between $62.41 and $76.58.

Exhibit 2: Hourly Earnings for Occupations in LA County

Occupation	Entry-Level Hourly Earnings (25th Percentile)	Median Hourly Earnings	Experienced Hourly Earnings (75th Percentile)
Computer Systems Analysts (15-1211)	$37.19	$49.66	$65.98
Database Administrators (15-1242)	$34.62	$47.37	$62.41
Network and Computer Systems Administrators (15-1244)	$34.69	$45.22	$57.46
Software Developers (15-1252)	$44.81	$60.61	$76.58

[7] Five-year change represents new job additions to the workforce. Annual openings include new jobs and replacement jobs that result from retirements and separations.

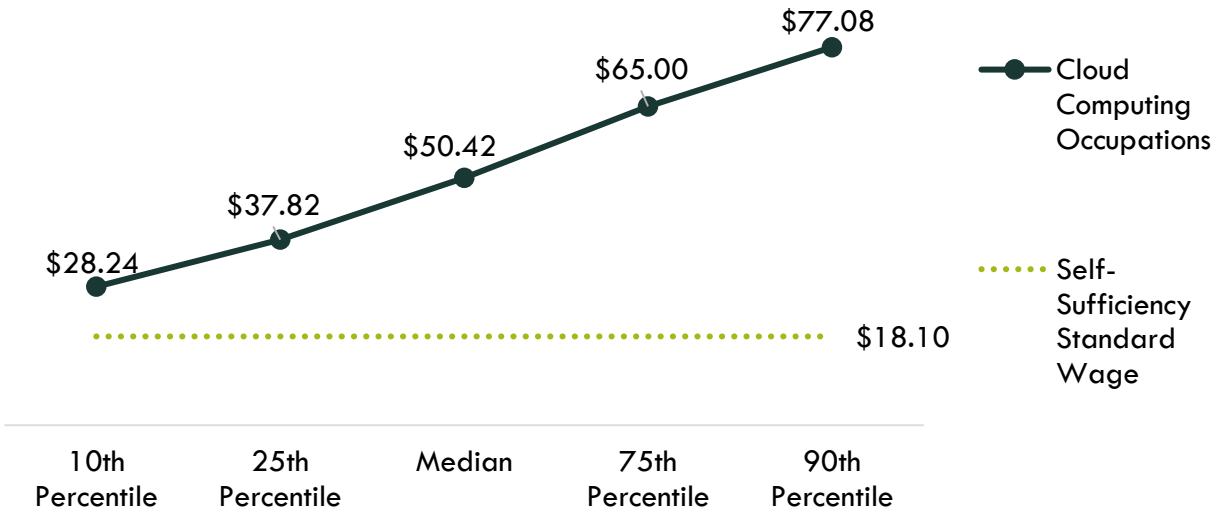
Orange County—All four occupations related to cloud computing have entry-level wages above the self-sufficiency standard wage for one adult ($20.63 in Orange County). Typical entry-level hourly wages are in a range between $34.14 and $45.10. Experienced workers can expect to earn wages between $56.52 and $74.27, which are higher than the self-sufficiency standard.

Exhibit 3: Hourly Earnings for Occupations in Orange County

Occupation	Entry-Level Hourly Earnings (25th Percentile)	Median Hourly Earnings	Experienced Hourly Earnings (75th Percentile)
Computer Systems Analysts (15-1211)	$37.17	$48.45	$63.44
Database Administrators (15-1242)	$34.14	$46.13	$60.52
Network and Computer Systems Administrators (15-1244)	$34.66	$44.79	$56.52
Software Developers (15-1252)	$45.10	$59.52	$74.27

On average, the entry-level earnings for the occupations in this report are $37.82; this is above the living wage for one single adult in Los Angeles County ($18.10). Exhibit 4 shows the average wage for the occupations in this report, from entry-level to experienced workers.

Exhibit 4: Average Hourly Earnings for Cloud Computing Occupations in LA/OC

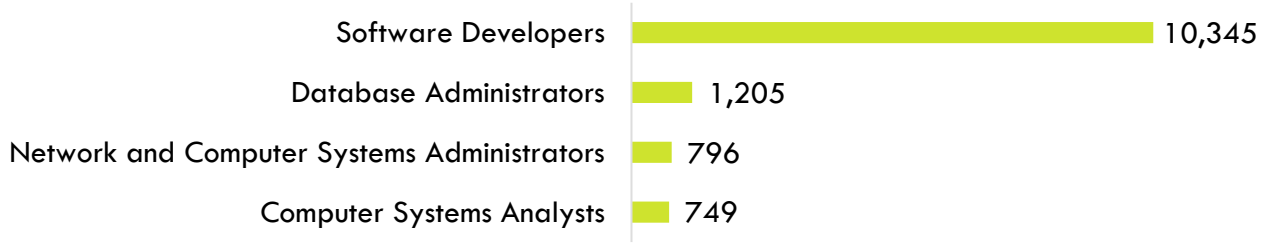


Job Postings

Over the past 12 months, there were 13,095 online job postings for the occupations of interest that also listed cloud computing skills and/or qualifications. Exhibit 5 displays the number of job postings by occupation. The majority of job postings (79%) were for *software developers*, followed by *database administrators* (9%). The highest number of job postings were for software engineers, DevOps engineers, data engineers, systems administrators, and principal software

engineers. The top skills were Amazon Web Services, computer science, Python, software engineering, and Java. The top three employers, by number of job postings, in the region were Jobot, Motion Recruitment, and Boeing.

Exhibit 5: Job postings by occupation (last 12 months)



Educational Attainment

The Bureau of Labor Statistics (BLS) lists a bachelor's degree as the typical entry-level education for all four of the occupations in this report. While the national-level educational attainment data indicates between 14% and 45% of workers in the field have completed some college or an associate degree, only one occupation in this report counts more than one-third of current workers in the field who have earned an associate degree or less education (*network and computer systems administrators)*. The other three occupations (*computer systems analysts, database administrators and architects,* and *software developers and software quality assurance analysts and testers)* have between 14% and 26% of workers in the field who have earned an associate degree or less education. Also of note, between 55% and 86% of workers in these occupations have earned a bachelor's degree or more education. Of the 63% of cloud computing-related job postings listing a minimum education requirement in the greater Los Angeles/Orange County region, 3% (218) requested high school or vocational training, 2% (188) requested an associate degree, and 95% (7,836) requested a bachelor's degree.

Educational Supply

Community College Supply—Exhibit 6 shows the annual and three-year average number of awards conferred by community colleges in programs that have historically trained for the occupations of interest. The colleges with the most completions in the region are Mt San Antonio, Long Beach, and Orange Coast. The TOP codes with the most annual average completions were Computer Programming (0707.10), Computer Networking (0708.10), and Information Technology, General (0701.00).

Exhibit 6: Regional community college awards (certificates and degrees), 2018-2021

TOP	Program	College	2018-19 Awards	2019-20 Awards	2020-21 Awards	3-Year Average
0701.00	Information Technology, General	East LA	23	10	4	12
		Glendale	-	-	3	1
		LA Harbor	-	-	1	0
		LA Mission	1	3	1	2
		LA Southwest	-	-	2	1
		Long Beach	34	64	106	68

TOP	Program	College	2018-19 Awards	2019-20 Awards	2020-21 Awards	3-Year Average
		Mt San Antonio	74	90	49	71
		Santa Monica	39	-	1	13
		West LA	4	5	-	3
		LA Subtotal	**175**	**172**	**167**	**171**
		Santa Ana	-	-	3	1
		OC Subtotal	**-**	**-**	**3**	**1**
		Supply Subtotal/Average	**175**	**172**	**170**	**172**
0702.00	Computer Information Systems	Citrus	5	8	4	6
		Compton	1	-	-	0
		East LA	19	15	23	19
		El Camino	14	21	11	15
		Glendale	-	5	6	4
		LA City	1	1	4	2
		LA Mission	5	1	1	2
		LA Trade-Tech	8	20	15	14
		Long Beach	-	-	3	1
		Mt San Antonio	-	79	6	28
		Rio Hondo	21	10	6	12
		West LA	8	10	9	9
		LA Subtotal	**82**	**170**	**88**	**113**
		Cypress	5	4	-	3
		Fullerton	15	11	31	19
		Irvine	-	2	-	1
		Orange Coast	4	2	-	2
		Saddleback	-	-	1	0
		Santa Ana	4	2	16	7
		Santiago Canyon	3	4	1	3
		OC Subtotal	**31**	**25**	**49**	**35**
		Supply Subtotal/Average	**113**	**195**	**137**	**148**
0707.00	Computer Software Development	LA City	1	-	-	0
		LA Pierce	-	-	4	1
		Santa Monica	-	-	1	0
		LA Subtotal	**1**	**-**	**5**	**2**
		Cypress	1	1	-	1
		Golden West	4	2	6	4
		Orange Coast	7	2	2	4

TOP	Program	College	2018-19 Awards	2019-20 Awards	2020-21 Awards	3-Year Average
		Saddleback	13	3	10	9
		OC Subtotal	**25**	**8**	**18**	**17**
		Supply Subtotal/Average	**26**	**8**	**23**	**19**
0707.10	Computer Programming	Cerritos	-	2	3	2
		Citrus	-	1	3	1
		East LA	8	4	1	4
		Glendale	2	3	-	2
		LA City	-	6	8	5
		LA Harbor	-	-	2	1
		LA Mission	6	4	7	6
		LA Pierce	18	4	5	9
		LA Southwest	-	1	2	1
		LA Valley	7	6	13	9
		Long Beach	4	5	3	4
		Mt San Antonio	119	114	83	105
		Pasadena	11	21	23	18
		Santa Monica	44	46	65	52
		West LA	1	-	-	0
		LA Subtotal	**220**	**217**	**218**	**218**
		Cypress	22	20	6	16
		Fullerton	16	28	24	23
		Irvine	8	4	-	4
		Orange Coast	31	157	206	131
		Santa Ana	13	1	-	5
		Santiago Canyon	9	3	2	5
		OC Subtotal	**99**	**213**	**238**	**183**
		Supply Subtotal/Average	**319**	**430**	**456**	**402**
0707.20	Database Design and Administration	Citrus	1	1	-	1
		Long Beach	3	1	13	6
		Mt San Antonio	11	12	8	10
		Pasadena	-	4	24	9
		Santa Monica	1	5	2	3
		LA Subtotal	**16**	**23**	**47**	**29**
		Santa Ana	1	8	2	4
		OC Subtotal	**1**	**8**	**2**	**4**
		Supply Subtotal/Average	**17**	**31**	**49**	**32**

TOP	Program	College	2018-19 Awards	2019-20 Awards	2020-21 Awards	3-Year Average
0707.30	Computer Systems Analysis	Cerritos	2	3	-	2
		East LA	-	1	-	0
		LA City	-	-	1	0
		LA Harbor	-	-	1	0
		LA Mission	-	1	1	1
		LA Pierce	-	-	6	2
		LA Subtotal	**2**	**5**	**9**	**5**
		Cypress	2	-	-	1
		OC Subtotal	**2**	**-**	**-**	**1**
		Supply Subtotal/Average	**4**	**5**	**9**	**6**
0708.00	Computer Infrastructure and Support	Cerritos	-	4	4	3
		Glendale	-	3	4	2
		LA City	-	3	5	3
		LA Harbor	1	1	1	1
		LA Mission	2	12	17	10
		LA Valley	5	2	4	4
		Long Beach	3	8	8	6
		Mt San Antonio	24	24	24	24
		Pasadena	1	1	24	9
		Rio Hondo	-	10	11	7
		West LA	4	15	16	12
		LA Subtotal	**40**	**83**	**118**	**80**
		Coastline	49	46	73	56
		Cypress	2	3	1	2
		Orange Coast	-	7	5	4
		Saddleback	-	-	3	1
		Santa Ana	-	-	27	9
		OC Subtotal	**51**	**56**	**109**	**72**
		Supply Subtotal/Average	**91**	**139**	**227**	**152**
0708.10	Computer Networking	Cerritos	11	9	8	9
		Glendale	3	3	-	2
		LA City	23	-	4	9
		LA Pierce	39	20	12	24
		Long Beach	55	47	48	50
		Mt San Antonio	8	11	4	8
		Rio Hondo	5	7	2	5

TOP	Program	College	2018-19 Awards	2019-20 Awards	2020-21 Awards	3-Year Average
		West LA	77	48	58	61
		LA Subtotal	**221**	**145**	**136**	**167**
		Coastline	38	59	92	63
		Cypress	70	95	61	75
		Fullerton	-	-	1	0
		Irvine	11	21	10	14
		Saddleback	10	21	19	17
		Santa Ana	14	12	23	16
		OC Subtotal	**143**	**208**	**206**	**186**
		Supply Subtotal/Average	**364**	**353**	**342**	**353**
0708.20	Computer Support	Citrus	-	1	1	1
		Glendale	10	7	2	6
		LA Pierce	9	8	6	8
		LA Valley	-	-	1	0
		Long Beach	8	14	40	21
		Pasadena	7	30	34	24
		LA Subtotal	**34**	**60**	**84**	**59**
		Cypress	3	5	3	4
		Santa Ana	9	-	-	3
		OC Subtotal	**12**	**5**	**3**	**7**
		Supply Subtotal/Average	**46**	**65**	**87**	**66**
0709.00	World Wide Web Administration	Glendale	6	7	10	8
		LA Pierce	9	-	2	4
		Long Beach	22	24	34	27
		Santa Monica	-	-	16	5
		West LA	13	9	6	9
		LA Subtotal	**50**	**40**	**68**	**53**
		Fullerton	-	-	1	0
		Saddleback	-	2	2	1
		OC Subtotal	**-**	**2**	**3**	**2**
		Supply Subtotal/Average	**50**	**42**	**71**	**54**
		Supply Total/Average	**1,205**	**1,440**	**1,571**	**1,405**

Non-Community College Supply—For a comprehensive regional supply analysis, it is important to consider the supply from other institutions in the region that provide training programs for the cloud computing-related occupations of interest. Exhibit 7 shows the annual and three-year average number of awards conferred by these institutions in relevant programs. Due to different data collection periods, the most recent three-year period of available data is from 2017 to 2020. Between 2017 and 2020, non-community college institutions in the region conferred an average of 864 awards.

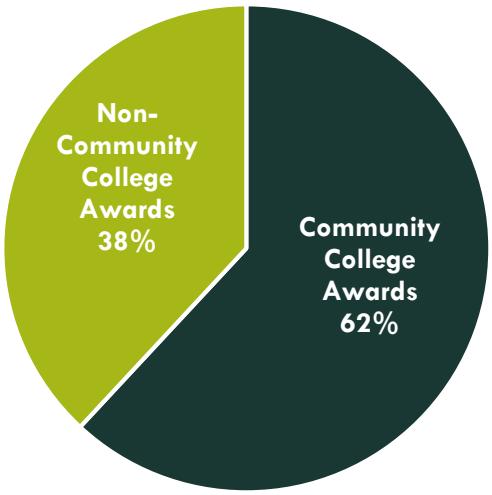
Exhibit 7: Regional non-community college awards, 2017-2020

CIP	Program	Institution	2017-18 Awards	2018-19 Awards	2019-20 Awards	3-Year Average
11.0101	Computer and Information Sciences, General	Azusa Pacific University	26	30	21	26
		Brand College	2	-	-	1
		Brandman University	20	20	30	23
		Chapman University	12	13	18	14
		Los Angeles Pacific College	-	-	6	2
		Loyola Marymount University	42	32	27	34
		Pacific States University	-	2	-	1
		The Master's Univ. and Seminary	6	7	11	8
		University of California-Irvine	-	1	-	0
		University of La Verne	18	39	23	27
		University of the People	100	80	203	128
		Vanguard Univ. of Southern CA	1	-	-	0
11.0103	Information Technology	Abraham Lincoln University	1	1	-	1
		Brand College	37	50	13	33
		California Intercontinental Univ.	-	-	2	1
		CSU-Dominguez Hills	1	5	4	3
		CSU-Los Angeles	127	122	166	138
		CSU-Northridge	54	54	29	46
		Platt College-Anaheim	1	11	15	9
		Platt College-Los Angeles	-	6	12	6
		Trident University International	87	71	-	53
		University of La Verne	-	3	2	2
11.0199	Computer and Information Sciences, Other	Antioch University-Los Angeles	47	4	-	17
		Brand College	-	2	-	1
		CSU-Dominguez Hills	59	55	65	60
11.0201	Computer Programming/ Programmer, General	ABCO Technology	23	29	46	33
		Platt College-Anaheim	4	4	4	4

CIP	Program	Institution	2017-18 Awards	2018-19 Awards	2019-20 Awards	3-Year Average
11.0301	Data Processing and Data Processing Technology/ Technician	Brand College	2	-	-	1
11.0501	Computer Systems Analysis/Analyst	Brand College	2	-	-	1
11.0802	Data Modeling/ Warehousing and Database Administration	ABCO Technology	6	7	15	9
11.0901	Computer Systems Networking and Telecommunications	Brand College	-	2	2	1
11.1001	Network and System Administration/ Administrator	ABCO Technology	13	5	25	14
		Brand College	6	23	9	13
		California Intercontinental Univ.	1	3	1	2
11.1002	System, Networking, and LAN/WAN Management/ Manager	ABCO Technology	7	9	19	12
		Brand College	-	-	1	0
11.1003	Computer and Information Systems Security/Auditing/ Information Assurance	Learnet Academy	17	-	5	7
11.1004	Web/Multimedia Management and Webmaster	ABCO Technology	17	24	37	26
		Los Angeles Pacific College	-	-	1	0
		Pepperdine University	2	-	-	1
11.1005	Information Technology Project Management	California Intercontinental Univ.	-	1	-	0
11.1006	Computer Support Specialist	Southern CA Institute of Tech.	26	25	26	26
15.1202	Computer/ Computer Systems Technology/ Technician	Learnet Academy.	1	-	4	2
		Supply Total/Average	**849**	**828**	**915**	**864**

Exhibit 8 shows the proportion of community college awards conferred in LA/OC compared to the number of non-community college awards for the programs in this report. More than half of the awards conferred in these programs are awarded by community colleges in the LA/OC region.

Exhibit 8: Community College Awards Compared to Non-Community College Awards in LA/OC Region, 3-Year Average



Appendix A: Occupational demand and wage data by county

Exhibit 9. Los Angeles County

Occupation (SOC)	2021 Jobs	2026 Jobs	5-Yr Change	5-Yr % Change	Annual Openings	Entry-Level Hourly Earnings (25th Percentile)	Median Hourly Earnings	Experienced Hourly Earnings (75th Percentile)
Computer Systems Analysts (15-1211)	14,546	14,876	330	2%	1,107	$37.19	$49.66	$65.98
Database Administrators (15-1242)	2,175	2,241	65	3%	172	$34.62	$47.37	$62.41
Network and Computer Systems Administrators (15-1244)	6,950	7,015	65	1%	465	$34.69	$45.22	$57.46
Software Developers (15-1252)	39,263	44,103	4,841	12%	3,952	$44.81	$60.61	$76.58
Total	**62,934**	**68,234**	**5,301**	**8%**	**5,696**	**-**	**-**	**-**

Exhibit 10. Orange County

Occupation (SOC)	2021 Jobs	2026 Jobs	5-Yr Change	5-Yr % Change	Annual Openings	Entry-Level Hourly Earnings (25th Percentile)	Median Hourly Earnings	Experienced Hourly Earnings (75th Percentile)
Computer Systems Analysts (15-1211)	6,076	6,238	162	3%	458	$37.17	$48.45	$63.44
Database Administrators (15-1242)	839	867	28	3%	67	$34.14	$46.13	$60.52
Network and Computer Systems Administrators (15-1244)	2,794	2,852	58	2%	192	$34.66	$44.79	$56.52
Software Developers (15-1252)	17,818	19,799	1,981	11%	1,744	$45.10	$59.52	$74.27
Total	**27,527**	**29,756**	**2,229**	**8%**	**2,461**	**-**	**-**	**-**

Exhibit 11. Los Angeles and Orange Counties

Occupation (SOC)	2021 Jobs	2026 Jobs	5-Yr Change	5-Yr % Change	Annual Openings	Typical Entry-Level Education
Computer Systems Analysts (15-1211)	20,621	21,113	492	2%	1,565	Bachelor's degree
Database Administrators (15-1242)	3,015	3,108	93	3%	239	Bachelor's degree
Network and Computer Systems Administrators (15-1244)	9,744	9,866	123	1%	658	Bachelor's degree
Software Developers (15-1252)	57,081	63,903	6,822	12%	5,696	Bachelor's degree
Total	**90,460**	**97,990**	**7,529**	**8%**	**8,157**	**-**

Appendix B: Sources

- O*NET Online
- Labor Insight (Burning Glass Technologies)
- Lightcast (formerly Emsi)
- Bureau of Labor Statistics (BLS)
- California Employment Development Department, Labor Market Information Division, OES
- California Community Colleges Chancellor's Office Management Information Systems (MIS)
- Self-Sufficiency Standard at the Center for Women's Welfare, University of Washington
- Chancellor's Office Curriculum Inventory (COCI 2.0)

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