

Summary

Program LMI Endorsement	Endorsed: All LMI Criteria Met <input type="checkbox"/>	Endorsed: Some LMI Criteria Met <input type="checkbox"/>	Not LMI Endorsed <input type="checkbox"/>
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Program LMI Endorsement Criteria

	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Supply Gap:	<i>Comments:</i> The OC COE predicates endorsement only for middle-skill occupations. Since this proposed new program includes above middle-skill occupations only, we are unable to evaluate the labor market information endorsement criteria.	
Living Wage: (Entry-Level, 25 th)	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	<i>Comments:</i> See comment above.	
Education:	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	<i>Comments:</i> See comment above.	

Emerging Occupation(s)		
	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
	<i>Comments:</i> N/A	

The Orange County Center of Excellence for Labor Market Research (OC COE) prepared this report to determine whether there is a supply gap in the Los Angeles/Orange County regional labor market related to four above middle-skill occupations that are most closely related to backend engineering:

- Database Administrators (15-1242)
- Database Architects (15-1243)
- Computer Programmers (15-1251)
- Software Developers (15-1252)

Currently, these four Standard Occupational Classification (SOC) codes are those that are most closely related to backend engineering, which involves designing, building, and maintaining the server-side (“backend”) of web applications. Backend engineers utilize programming languages such as Java, Python, and C# and work with database technologies such as SQL Server and Oracle.

It is important to note that there are currently no middle-skill occupations that are directly related to backend engineering and typical education requirements for backend engineering are high and it is unclear if a community college degree or certificate will be sufficient to obtain backend engineering jobs. The remainder of this report analyzes traditional labor market information for these four backend engineering occupations.

The OC COE predicates endorsement only for middle-skill occupations. **Since this proposed new program includes above middle-skill occupations only, we are unable to evaluate the labor market information endorsement criteria.**

Exhibit 1, on the following page, lists the occupational demand, supply, typical entry-level education, and educational attainment for the occupations included in this report.

Exhibit 1: Labor Market Endorsement Summary

Occupation (SOC)	Demand (Annual Openings)	Supply (CC and Non-CC)	Entry-Level Hourly Earnings (25 th Percentile)	Typical Entry-Level Education	Community College Educational Attainment
Database Administrators (15-1242)	LA: 161	LA: Accounted for Below	OC: \$34.95	Bachelor's degree	19%
	OC: 65	OC: Accounted for Below			
	TTL: 225	TTL: Accounted for Below			
Database Architects (15-1243)	LA: 73	LA: Accounted for Below	OC: \$50.08	Bachelor's degree	19%
	OC: 34	OC: Accounted for Below			
	TTL: 108	TTL: Accounted for Below			
Computer Programmers (15-1251)	LA: 245	LA: Accounted for Below	OC: \$33.54	Bachelor's degree	20%
	OC: 112	OC: Accounted for Below			
	TTL: 357	TTL: Accounted for Below			
Software Developers (15-1252)	LA: 3,480	LA: 3,170	OC: \$50.42	Bachelor's degree	12%
	OC: 1,649	OC: 1,805			
	TTL: 5,128	TTL: 4,325			
Total	5,818	4,975	N/A	N/A	N/A

Demand:

- The number of jobs related to these backend engineering occupations are projected to increase 10% through 2026, equating to 5,818 annual job openings.
- Hourly entry-level wages for these backend engineering occupations range from \$33.54 to \$50.42 in Orange County; all annual job openings have entry-level wages above the living wage.
- There were 45,708 online job postings related to these backend engineering occupations over the past 12 months. The highest number of postings were for software engineers, data engineers, principal software engineers, and DevOps engineers.

- The typical entry-level education for these backend engineering occupations is a bachelor's degree.
- Between 12% and 20% of workers in the field have completed some college or an associate degree as their highest level of educational attainment.

Supply:

- There was an average of 1,470 awards conferred by 28 community colleges in Los Angeles and Orange Counties from 2019 to 2022.
 - Though these community college programs are most closely related to the backend engineering occupations in this report, it is important to note that they train for a variety of occupations, including middle-skill occupations. However, these backend engineering-related occupations have high education requirements and employers typically require more than a community college education for these occupations. For these reasons, community college supply is overstated
- Non-community college institutions conferred an average of 3,505 awards from 2019 to 2021.
- Orange County community college students that exited software applications programs in the 2019-20 academic year had a median annual wage of \$42,038 after exiting the program and 48% of students attained the living wage.
- Throughout Orange County, 72% of software applications students that exited their program in 2018-19 reported that they are working in a job closely related to their field of study.

Demand

Occupational Projections:

Exhibit 2 shows the annual percent change in jobs for these backend engineering occupations from 2017 through 2027. Though there was a 7% decline across all occupations from 2019 to 2020 due to the COVID-19 pandemic, employment in these backend engineering occupations decreased only 1% in Orange County during the same period. Each year from 2019 to 2021. These backend engineering occupations are projected to grow at a slightly higher rate compared to all occupations through 2027.

Exhibit 2: Annual Percent Change in Jobs for Backend Engineering Occupations, 2017-2027

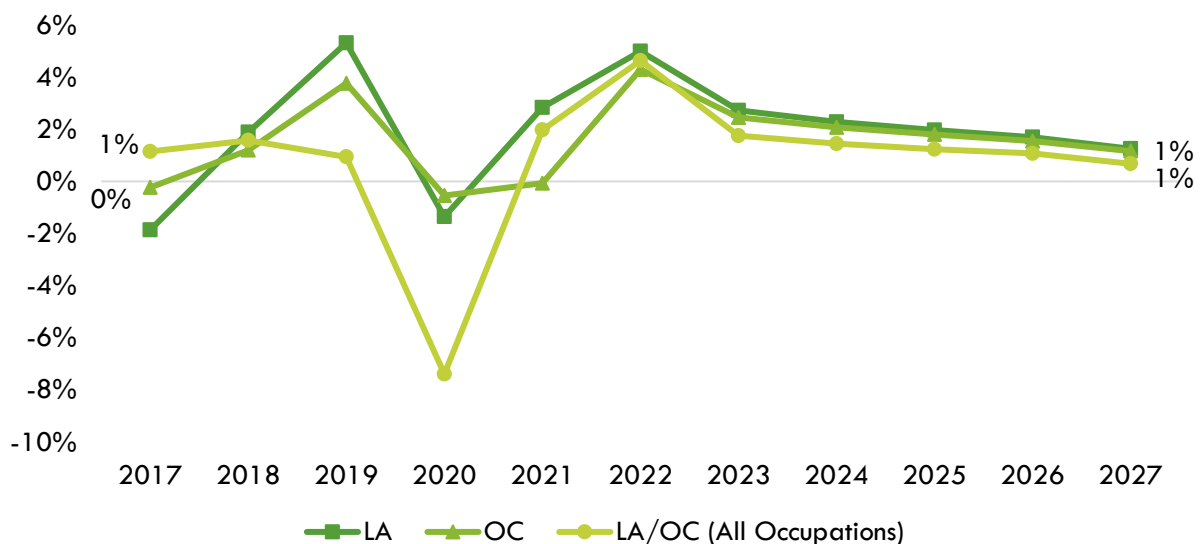


Exhibit 3 shows the five-year occupational demand projections for these backend engineering occupations. In Los Angeles/Orange County, the number of jobs related to these occupations is projected to increase by 10% through 2027. There is projected to be 5,818 jobs available annually.

Exhibit 3: Occupational Demand in Los Angeles and Orange Counties¹

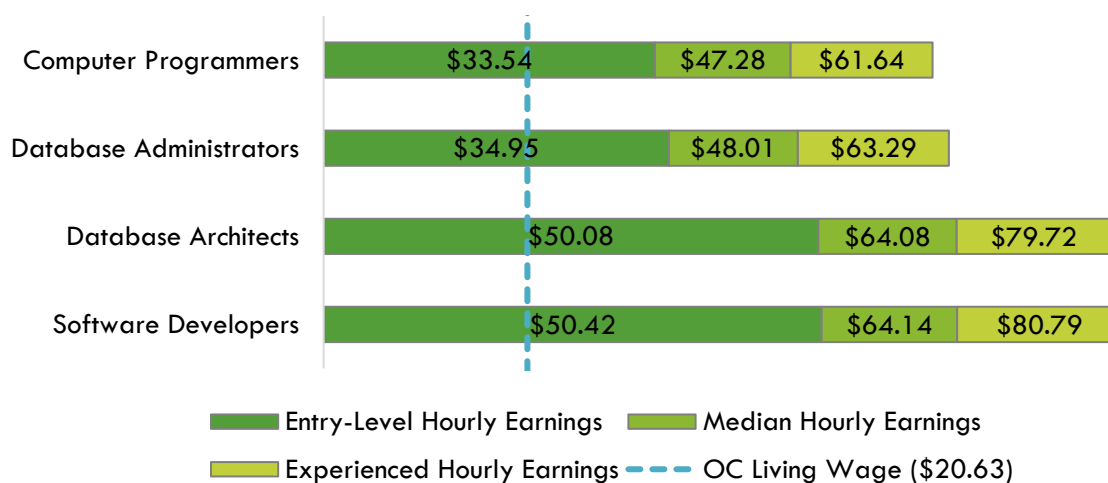
Geography	2022 Jobs	2027 Jobs	2022-2027 Change	2022-2027 % Change	Annual Openings
Los Angeles	43,680	48,192	4,512	10%	3,958
Orange	21,017	22,987	1,970	9%	1,860
Total	64,697	71,179	6,482	10%	5,818

Wages:

The labor market analysis in this report considers the entry-level hourly wages for these backend engineering occupations in Orange County as they relate to the county’s living wage. Los Angeles County wages are included below in order to provide a complete analysis of the LA/OC region.

All annual openings for these backend engineering occupations have entry-level wages above the living wage for one adult (\$20.63 in Orange County). Typical entry-level hourly wages range between \$33.54 and \$50.42. Orange County’s average wages are below the average statewide wage of \$83.86 for these occupations. Exhibit 4 shows the wage range for each of these backend engineering occupations in Orange County and how they compare to the regional living wage, sorted from lowest to highest entry-level wage.

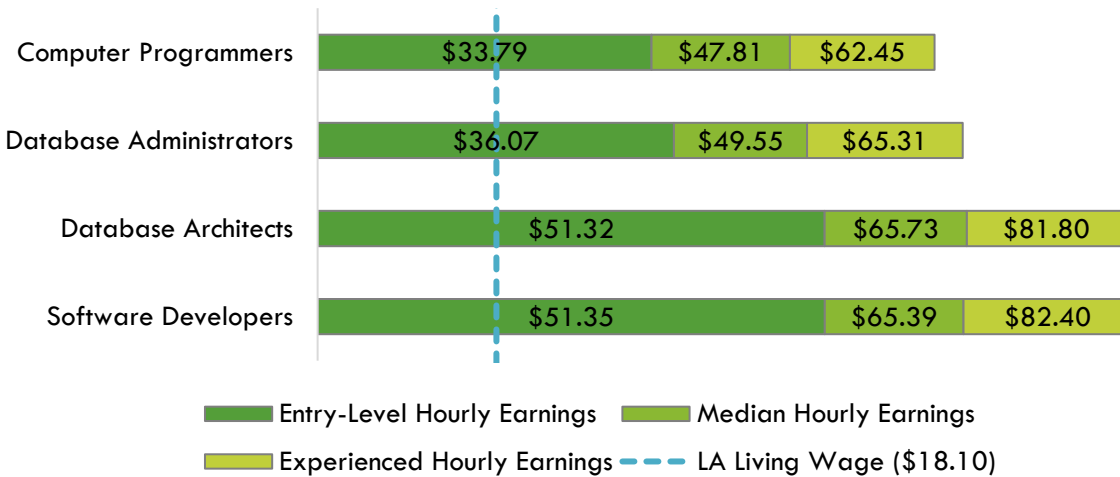
Exhibit 4: Wages by Occupation in Orange County



All annual openings for these backend engineering occupations have entry-level wages above the living wage for one adult (\$18.10 in Los Angeles County). Typical entry-level hourly wages are in a range between \$33.79 and \$51.35. Los Angeles County’s average wages are below the average statewide wage of \$83.86 for these occupations. Exhibit 5 shows the wage range for each of these backend engineering occupations in Los Angeles County how they compare to the regional living wage, sorted from lowest to highest entry-level wage.

¹ Five-year change represents new job additions to the workforce. Annual openings include new jobs and replacement jobs that result from retirements and separations.

Exhibit 5: Wages by Occupation in Los Angeles County



Job Postings:

Important Online Job Postings Data Note: Online job postings data is sourced from Lightcast, a labor market analytics firm that scrapes, collects, and organizes data from online job boards such as LinkedIn, Indeed, Glassdoor, Monster, GovernmentJobs.com, and thousands more. Lightcast uses natural language processing (NLP) to determine the related company, industry, occupation, and other information for each job posting. However, NLP has limitations that include understanding contextual words or phrases; determining differences in words that can be used as nouns, verbs, and/or adjectives; and misspellings or grammatical errors.² For these reasons, job postings could be assigned to the wrong employer, industry, or occupation within Lightcast's database.

Additionally, there are several limitations when analyzing job postings. A single job posting may not represent a single job opening, as employers may be creating a pool of candidates for future openings or hiring for multiple positions with a single posting. Additionally, not all jobs are posted online, and jobs may be filled through other methods such as internal promotion, word-of-mouth advertising, physical job boards, or a variety of other channels.

There were 45,708 online job postings related to these backend engineering occupations listed in the past 12 months. Exhibit 6 shows the number of job postings by occupation. The vast majority (80%) of postings were for software developers.

Exhibit 6: Number of Job Postings by Occupation (n=45,708)

Occupation	Job Postings	Percentage of Job Postings
Software Developers	36,665	80%
Database Administrators	4,027	9%
Computer Programmers	2,603	6%
Database Architects	2,413	5%
Total Postings	45,708	100%

The top employers in the region, by number of job postings, are shown in Exhibit 7.

² K. R. Chowdhary, Fundamentals of Backend engineering (Basingstoke: Springer Nature, 2020), <https://link.springer.com/book/10.1007/978-81-322-3972-7>.

Exhibit 7: Top Employers by Number of Job Postings (n=45,708)

Employer	Job Postings	Percentage of Job Postings
Motion Recruitment	1,845	4%
Boeing	1,640	4%
CyberCoders	1,104	2%
Northrop Grumman	997	2%
VirtualVocations	772	2%
Amazon	763	2%
Disney	644	1%
UnitedHealth Group	502	1%
Randstad	459	1%
SpaceX	441	1%

The top specialized, soft, and computer skills listed by those most frequently mentioned in job postings (denoted in parentheses) are shown in Exhibit 8.

Exhibit 8: Top Skills by Number of Job Postings (n=45,708)

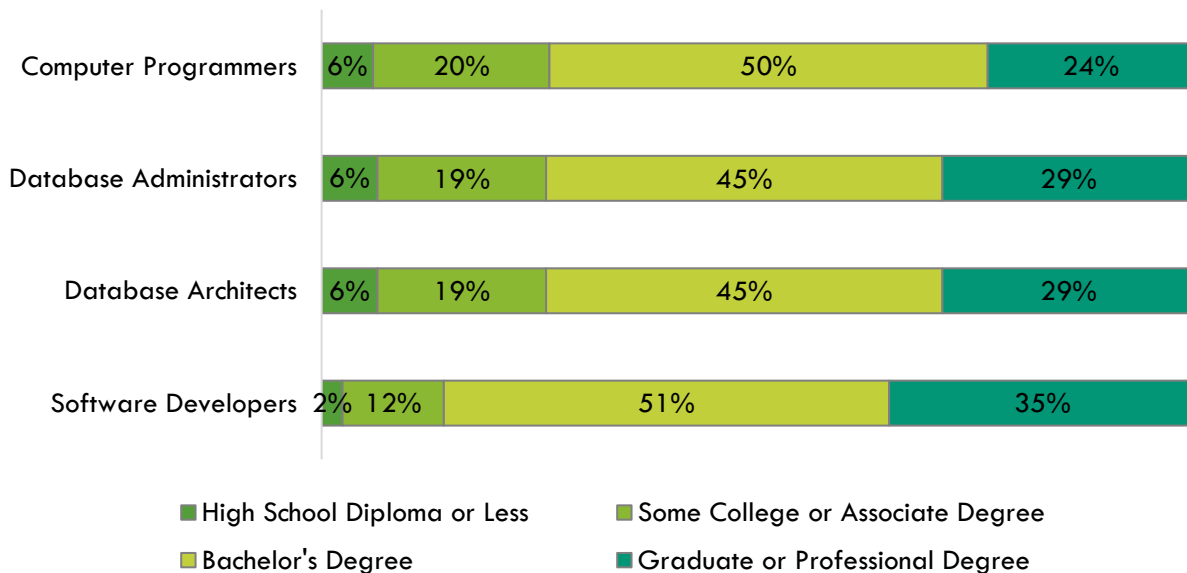
Top Specialized Skills	Top Soft Skills	Top Computer Skills
Computer Science (17,039)	Communications (15,698)	Python (Programming Language) (11,762)
Software Engineering (14,422)	Management (9,440)	SQL (Programming Language) (11,149)
Software Development (12,128)	Problem Solving (7,900)	Java (Programming Language) (9,874)
Python (Programming Language) (11,762)	Leadership (7,741)	Amazon Web Services (9,725)
SQL (Programming Language) (11,149)	Troubleshooting (Problem Solving) (7,593)	JavaScript (Programming Language) (7,770)
Agile Methodology (10,450)	Operations (6,653)	C++ (Programming Language) (7,514)
Java (Programming Language) (9,874)	Writing (5,677)	Application Programming Interface (API) (7,452)
Amazon Web Services (9,725)	Planning (5,484)	C# (Programming Language) (6,406)
JavaScript (Programming Language) (7,770)	Mathematics (5,058)	Microsoft Azure (5,344)
C++ (Programming Language) (7,514)	Research (4,730)	Linux (5,324)

Educational Attainment:

The Bureau of Labor Statistics (BLS) lists a bachelor's degree as the typical entry-level education for these backend engineering occupations. Additionally, the national-level educational attainment data indicates between 12% and 20% of workers in the field have completed some college or an associate degree as their highest level of education. The vast majority of workers in these occupations have completed a bachelor's, master's, or doctoral degree as their highest level of education. Exhibit 9, on the following page, shows the educational attainment for each occupation, sorted by highest community college educational attainment to lowest.

Of the 61% of the cumulative job postings for these backend engineering occupations in Los Angeles/Orange County, 91% (25,536) requested a bachelor's, master's, or doctoral degree and only 9% (436) requested a high school diploma, vocational training, or an associate degree.

Exhibit 9: National-level Educational Attainment for Occupations



Educational Supply

Community College Supply:

Exhibit 10 shows the three-year average number of awards conferred by community colleges in the related TOP codes: Electronic Game Design (0614.20), Information Technology, General (0701.00), Computer Information Systems (0702.00), Computer Software Development (0707.00), Computer Programming (0707.10), Database Design and Administration (0707.20), Computer Infrastructure and Support (0708.00), and Computer Networking (0708.10). The colleges with the most completions are Mt. San Antonio, Orange Coast, and Long Beach. Over the past 12 months, there were no other related program recommendation requests from regional community colleges.

Though these programs are most closely related to the backend engineering occupations in this report, it is important to note that they train for a variety of occupations, including middle-skill occupations such as *computer network support specialists*, *computer network architects*, and *computer user support specialists*. However, the backend engineering-related occupations in this report have high education requirements and employers typically require more than a community college education for these occupations. For these reasons, community college supply is overstated.

Exhibit 10: Regional Community College Awards (Certificates and Degrees),
2019-2022

TOP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2021-2022 Awards	3-Year Award Average
0614.20	Electronic Game Design	Pasadena	1	1	5	3
		LA Subtotal	1	1	5	3
		Golden West	2	0	0	0
		OC Subtotal	2	0	0	0
Supply Subtotal/Average			3	1	5	3
0701.00	Information Technology, General	East LA	10	4	30	15
		Glendale	0	3	17	7
		LA Harbor	0	1	2	1
		LA Mission	3	1	4	3
		LA Southwest	0	2	12	5
		Long Beach	64	106	88	85
		Mt San Antonio	90	49	23	53
		Santa Monica	0	1	0	0
		West LA	5	0	6	4
		LA Subtotal	172	167	182	173
		Santa Ana	0	3	9	4
		OC Subtotal	0	3	9	4
		Supply Subtotal/Average			172	170
0702.00	Computer Information Systems	Citrus	8	4	6	6
		Compton	0	0	12	4
		East LA	15	23	11	16
		El Camino	21	11	28	20
		Glendale	5	6	8	6
		LA City	1	4	3	3
		LA Harbor	0	0	1	0
		LA Mission	1	1	1	1
		LA Southwest	0	0	21	7
		LA Trade	20	15	17	17
		Long Beach	0	3	0	1
		Mt San Antonio	79	6	68	51
		Rio Hondo	10	6	15	11
		West LA	10	9	14	11
		LA Subtotal	170	88	205	154
		Coastline	0	0	2	0
		Cypress	4	0	0	1

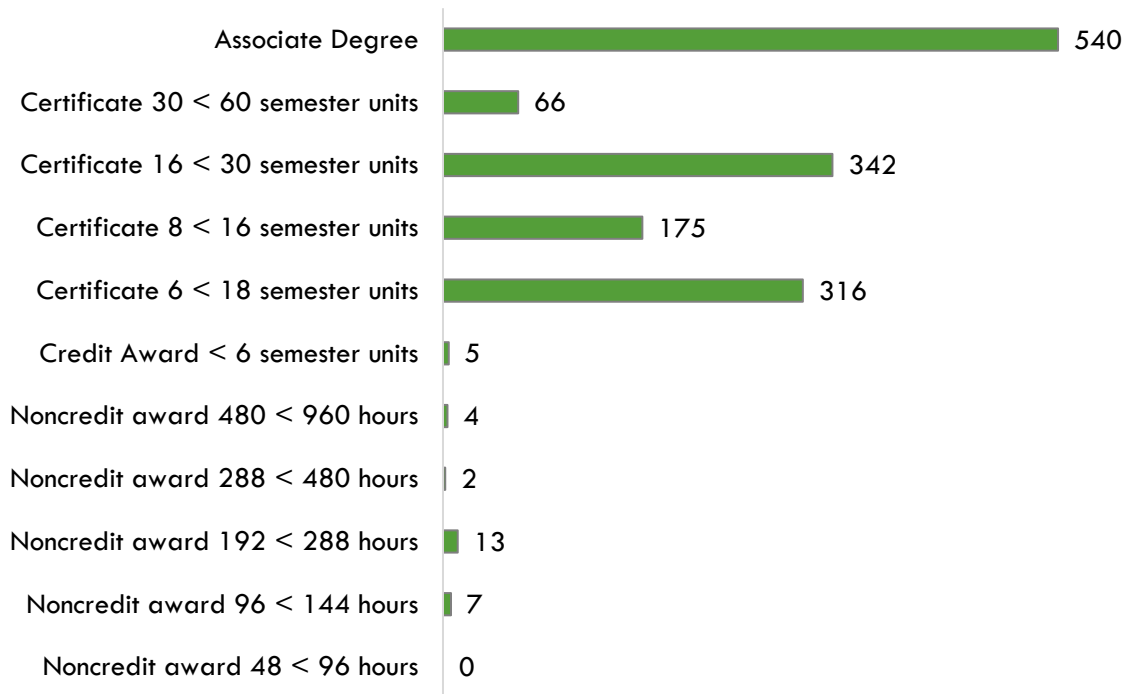
TOP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2021-2022 Awards	3-Year Award Average
		Fullerton	11	31	49	30
		Irvine	2	0	0	1
		Orange Coast	2	0	1	1
		Saddleback	0	1	0	0
		Santa Ana	2	16	18	12
		Santiago Canyon	4	1	1	2
		OC Subtotal	25	49	71	47
		Supply Subtotal/Average	195	137	276	201
0707.00	Computer Software Development	LA City	0	0	1	0
		LA Harbor	0	0	2	1
		LA Mission	0	0	2	1
		LA Pierce	0	4	7	4
		Santa Monica	0	1	1	1
		West LA	0	0	6	2
		LA Subtotal	0	5	19	9
		Cypress	1	0	0	0
		Golden West	2	6	4	4
		Orange Coast	2	2	0	2
		Saddleback	3	10	15	10
		OC Subtotal	8	18	19	16
		Supply Subtotal/Average	8	23	38	25
0707.10	Computer Programming	Cerritos	2	3	7	4
		Citrus	1	3	9	4
		East LA	4	1	0	2
		Glendale	3	0	0	1
		LA City	6	8	10	8
		LA Harbor	0	2	4	2
		LA Mission	4	7	7	7
		LA Pierce	4	5	5	4
		LA Southwest	1	2	2	2
		LA Valley	6	13	8	9
		Long Beach	5	3	7	5
		Mt San Antonio	114	83	125	107
		Pasadena	21	23	23	22
		Santa Monica	46	65	71	61
		LA Subtotal	217	218	278	238
		Coastline	0	0	1	0

TOP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2021-2022 Awards	3-Year Award Average
		Cypress	20	6	5	11
		Fullerton	28	24	28	27
		Irvine	4	0	0	1
		Orange Coast	157	206	160	175
		Santa Ana	1	0	0	0
		Santiago Canyon	3	2	2	2
		OC Subtotal	213	238	196	216
Supply Subtotal/Average			430	456	474	454
0707.20	Database Design and Administration	Citrus	1	0	1	1
		Long Beach	1	13	11	8
		Mt San Antonio	12	8	16	12
		Pasadena	4	24	14	14
		Santa Monica	5	2	4	3
		LA Subtotal	23	47	46	38
		Santa Ana	8	2	2	4
OC Subtotal	8	2	2	4		
Supply Subtotal/Average			31	49	48	42
0707.30	Computer Systems Analysis	Cerritos	3	0	5	2
		East LA	1	0	0	0
		LA City	0	1	6	2
		LA Harbor	0	1	1	1
		LA Mission	1	1	1	1
		LA Pierce	0	6	5	4
		Mt San Antonio	0	0	9	3
		Rio Hondo	0	0	3	1
		LA Subtotal	5	9	30	14
		-	-	-	-	-
		OC Subtotal	-	-	-	-
Supply Subtotal/Average			5	9	30	14
0708.00	Computer Infrastructure and Support	Cerritos	4	4	9	5
		East LA	0	0	3	1
		El Camino	0	0	5	2
		Glendale	3	4	11	6
		LA City	3	5	12	6
		LA Harbor	1	1	2	1
		LA Mission	12	17	32	20
		LA Valley	2	4	3	3

TOP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2021-2022 Awards	3-Year Award Average		
		Long Beach	8	8	2	6		
		Mt San Antonio	24	24	36	28		
		Pasadena	1	24	8	11		
		Rio Hondo	10	11	19	13		
		West LA	15	16	7	13		
		LA Subtotal	83	118	149	115		
		Coastline	46	73	91	70		
		Cypress	3	1	1	1		
		Orange Coast	7	5	7	6		
		Saddleback	0	3	13	5		
		Santa Ana	0	27	14	13		
		OC Subtotal	56	109	126	95		
		Supply Subtotal/Average			139	227	275	210
		0708.10	Computer Networking	Cerritos	9	8	6	8
Glendale	3			0	2	1		
LA City	0			4	8	4		
LA Pierce	20			12	19	16		
Long Beach	47			48	52	49		
Mt San Antonio	11			4	25	13		
Rio Hondo	7			2	5	5		
West LA	48			58	24	43		
LA Subtotal	145			136	141	139		
Coastline	59			92	49	67		
Cypress	95			61	71	76		
Fullerton	0			1	0	0		
Irvine	21			10	18	16		
Saddleback	21			19	15	19		
Santa Ana	12	23	45	27				
OC Subtotal	208	206	198	205				
Supply Subtotal/Average			353	342	339	344		
Supply Subtotal/Average			1,336	1,414	1,676	1,470		

Exhibit 11 shows the annual average community college awards by type from 2019-20 through 2021-22. The plurality of the awards are for associate degrees, followed by certificates between 16 and less than 30 semester units.

Exhibit 11: Annual Average Community College Awards by Type, 2018-2021



Community College Student Outcomes:

Exhibit 12 shows the Strong Workforce Program (SWP) metrics for software applications programs in Rancho Santiago Community College District (RSCCD), the Orange County Region, and California. Of the 2,570 software applications students in the 2020-21 academic year, 36% (921) attended a RSCCD college.

Additionally, RSCCD students that exited software applications programs in the 2019-20 academic year had slightly lower median annual earnings (\$\$37,762) compared to all software applications students in Orange County (\$42,038). A similar percentage of RSCCD real estate students attained the living wage (44%) when compared to all software applications students in Orange County (48%).

Exhibit 12: Software Applications (0702.10) Strong Workforce Program Metrics, 2020-21³

SWP Metric	RSCCD	OC Region	California
SWP Students	921	2,570	15,948
SWP Students Who Earned 9 or More Career Education Units in the District in a Single Year	Insufficient data	25%	36%
SWP Students Who Completed a Noncredit CTE or Workforce Preparation Course	80%	79%	69%
SWP Students Who Earned a Degree or Certificate or Attained Apprenticeship Journey Status	Insufficient data	13	271
SWP Students Who Transferred to a Four-Year Postsecondary Institution (2019-20)	Insufficient data	240	1,432
SWP Students with a Job Closely Related to Their Field of Study (2018-19)	66%	72%	69%

³ All SWP metrics are for 2020-21 unless otherwise noted.

SWP Metric	RSCCD	OC Region	California
Median Annual Earnings for SWP Exiting Students (2019-20)	\$37,672	\$42,038	\$39,616
Median Change in Earnings for SWP Exiting Students (2019-20)	12%	17%	15%
SWP Exiting Students Who Attained the Living Wage (2019-20)	44%	48%	58%

Non-Community College Supply:

For a comprehensive regional supply analysis, it is also important to consider the supply from other institutions in the region that provide training programs for these backend engineering occupations. Exhibit 13 shows the annual and three-year average number of awards conferred by these institutions in the related Classification of Instructional Programs (CIP) Codes: Computer and Information Sciences, General (11.0101), Information Technology (11.0103), Computer Programming/Programmer, General (11.0201), Computer Science (11.0701), and Computer/Computer Systems Technology/Technician (15.1202). Due to different data collection periods, the most recent two-year period of available data is from 2019 to 2021. Currently, only two years of data are currently available due to changes in the CIP Taxonomy. Between 2019 and 2021, four-year colleges in the region conferred an average of 3,505 awards annually in related training programs.

Exhibit 13: Regional Non-Community College Awards, 2017-2020

CIP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2-Year Award Average
11.0101	Computer and Information Sciences, General	Azusa Pacific University	21	25	23
		Chapman University	18	23	20
		Los Angeles Pacific College	6	2	4
		Loyola Marymount University	27	45	36
		Mount Saint Mary's University	0	0	0
		Pacific States University	0	0	0
		Pitzer College	0	1	0
		The Master's University and Seminary	11	5	8
		University of California-Irvine	0	1	0
		University of La Verne	23	36	30
		University of Massachusetts Global	30	36	33
		University of the People	203	292	248
		Westcliff University	0	0	0
Supply Subtotal/Average			339	466	402
11.0103	Information Technology	Bethesda University	0	0	0
		Brand College	13	17	15

CIP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2-Year Award Average
		California Intercontinental University	2	0	1
		California State University-Dominguez Hills	4	10	7
		California State University-Los Angeles	166	116	141
		California State University-Northridge	29	51	40
		Platt College-Anaheim	15	17	16
		Platt College-Los Angeles	12	6	9
		University of La Verne	2	3	2
		Westcliff University	0	0	0
Supply Subtotal/Average			243	220	231
11.0201	Computer Programming/ Programmer, General	ABCO Technology	46	34	40
		Platt College-Anaheim	4	0	2
Supply Subtotal/Average			243	220	231
11.0701	Computer Science	Biola University	18	19	18
		California Institute of Technology	72	83	78
		California State Polytechnic University-Pomona	238	270	254
		California State University-Dominguez Hills	57	66	62
		California State University-Fullerton	264	308	286
		California State University-Long Beach	220	221	220
		California State University-Los Angeles	119	152	136
		California State University-Northridge	160	214	187
		Chapman University	30	45	38
		Claremont McKenna College	35	17	26
		Harvey Mudd College	47	48	48
		Occidental College	18	18	18
		Pitzer College	10	5	8
Pomona College	34	33	34		

CIP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2-Year Award Average
		Scripps College	11	5	8
		Southern California Institute of Technology	10	7	8
		The Master's University and Seminary	0	0	0
		University of California-Irvine	805	822	814
		University of California-Los Angeles	287	342	314
		University of Southern California	247	293	270
Supply Subtotal/Average			2,682	2,968	2,827
15.1202	Computer/Computer Systems Technology/Technician	Learnet Academy Inc	4	2	3
		University of La Verne	0	0	0
Supply Subtotal/Average			4	2	3
Supply Total/Average			3,318	3,690	3,505

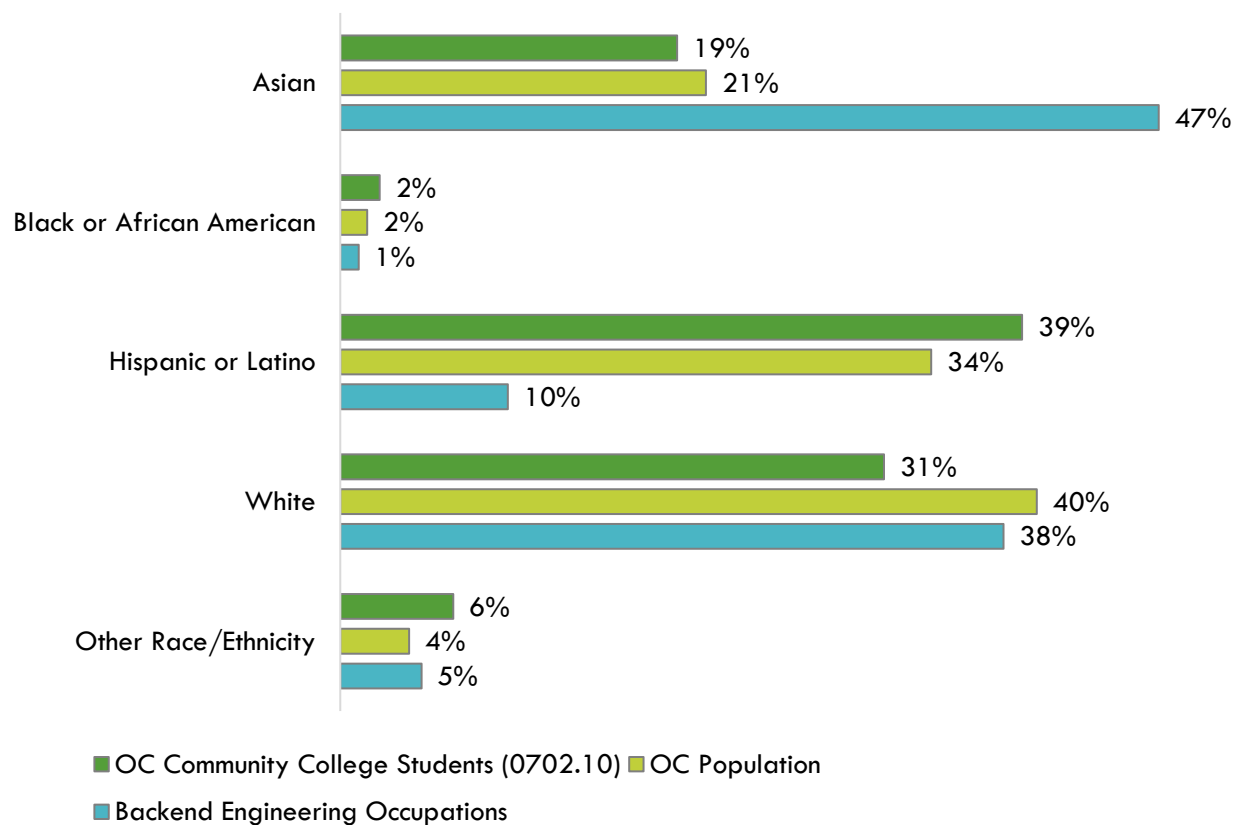
Regional Demographics

This section analyzes demographic data for Orange County community college students enrolled in software applications programs compared to the OC population, as well occupational data, for the purpose of identifying potential diversity and equity issues that can be addressed by community college programs.

Ethnicity:

Exhibit 14 shows the ethnicity of the overall Orange County population, as well as the four backend engineering occupations included in this report. Notably, 47% of workers employed in these backend engineering occupations are Asian, which is significantly higher than the population (21%) and community college software applications students (19%). Conversely, only 10% of workers in these occupations are Hispanic or Latino, which is significantly lower than the population (34%) and community college software application students (39%).

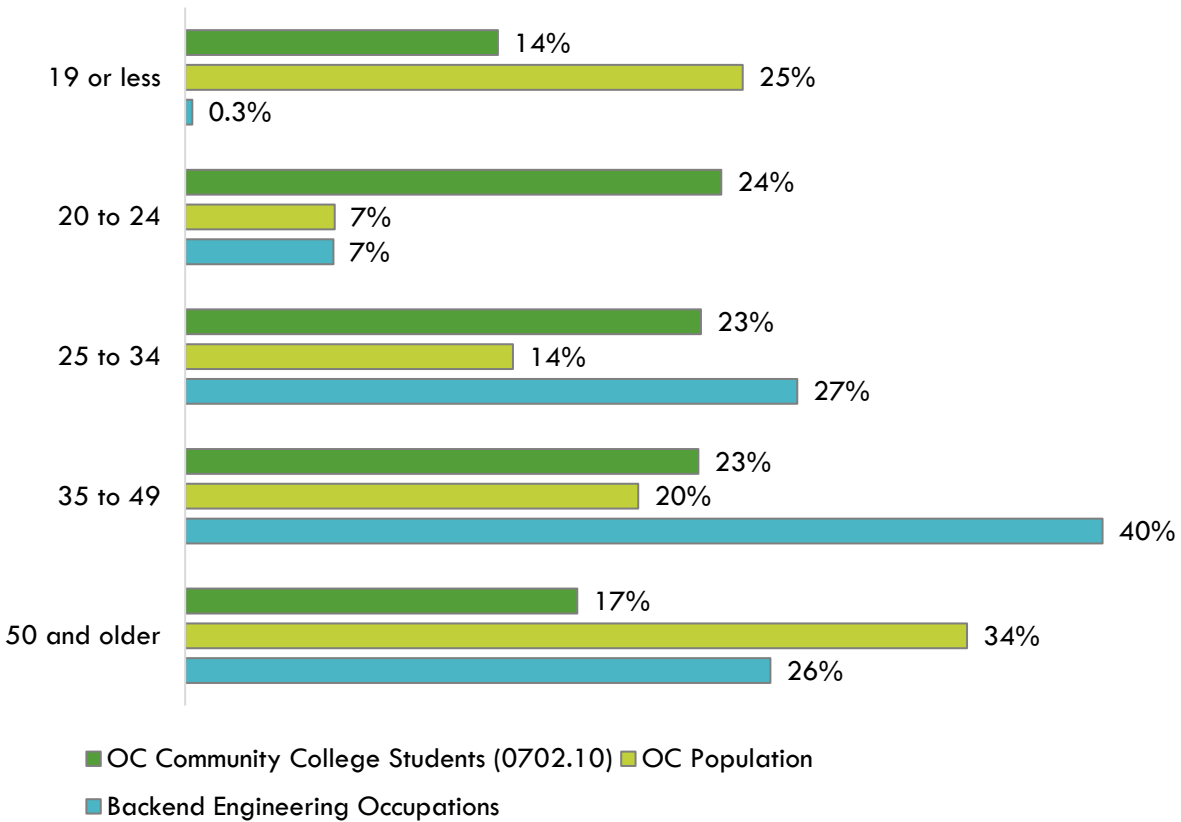
Exhibit 14: Program and County Demographics by Ethnicity



Age:

Exhibit 14 shows the age of the overall Orange County population, as well as the four backend engineering occupations included in this report. The plurality (40%) of workers in these backend engineering occupations are 35 to 49, which is double the population (20%) and nearly double community college software applications students (23%).

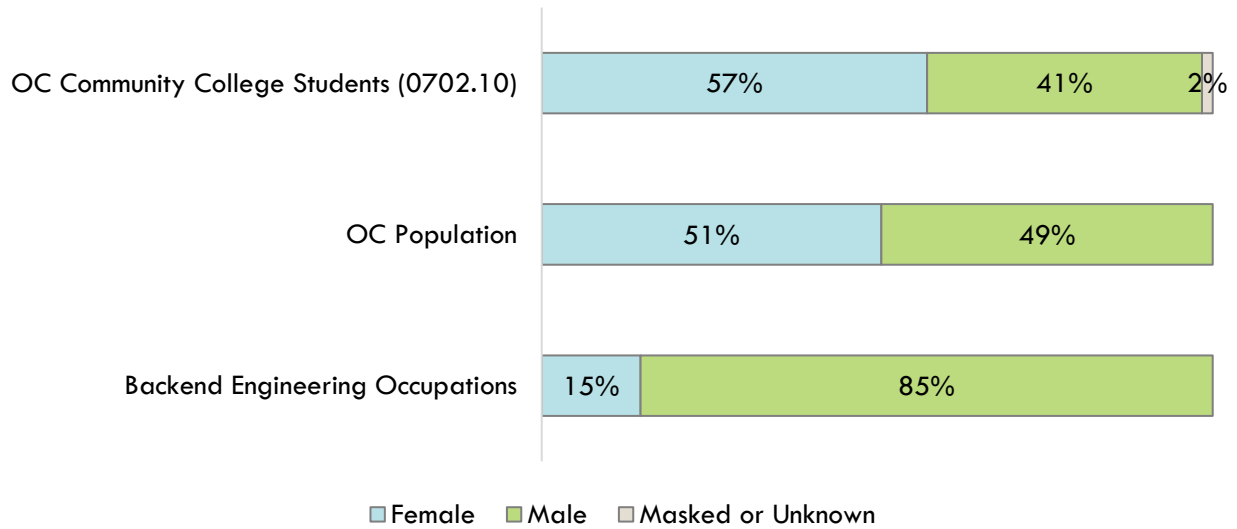
Exhibit 14: Program and County Demographics by Age



Sex:

Exhibit 15 shows the sex of the overall Orange County population as well as these backend engineering occupations. Though the population is split nearly evenly between women and men, 85% of workers in these backend engineering occupations are men. Conversely, 57% of community college software applications students are women.

Exhibit 15: Program and County Demographics by Sex



Appendix A: Methodology

The OC COE prepared this report by analyzing data from occupations and education programs. Occupational data is derived from Lightcast, a labor market analytics firm that consolidates data from the California Employment Development Department (EDD), U.S. Bureau of Labor Statistics (BLS) and other government agencies. Program supply data is drawn from two systems: Taxonomy of Programs (TOP) and Classification of Instructional Programs (CIP).

Using a TOP-SOC crosswalk, the OC COE identified middle-skill jobs for which programs within these TOP codes train. Middle-skill jobs include:

- 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.

The OC COE determined labor market supply for an occupation or SOC code by analyzing the number of program completers or awards in a related TOP or CIP code. The COE developed a “supply table” with this information, which is the source of the program supply data for this report. TOP code data comes from the California Community Colleges Chancellor's Office MIS Data Mart (datamart.cccco.edu) and CIP code data comes from the Integrated Postsecondary Education Data System (nces.ed.gov/ipeds/use-the-data), also known as IPEDS. TOP is a system of numerical codes used at the state level to collect and report information on California community college programs and courses throughout the state that have similar outcomes. CIP codes are a taxonomy of academic disciplines at institutions of higher education in the United States and Canada. Institutions outside of the California Community College system do not use TOP codes in their reporting systems.

Data included in this analysis represent the labor market demand for relevant positions most closely related to the proposed program as expressed by the requesting college in consultation with the OC COE. Traditional labor market information was used to show current and projected employment based on data trends, as well as annual average awards granted by regional community colleges. Real-time labor market information captures job post advertisements for occupations relevant to the field of study which can signal demand and show what employers are looking for in potential employees, but is not a perfect measure of the quantity of open positions.

All representations have been produced from primary research and/or secondary review of publicly and/or privately available data and/or research reports. The most recent data available at the time of the analysis was examined; however, data sets are updated regularly and may not be consistent with previous reports. Efforts have been made to qualify and validate the accuracy of the data and findings; however, neither the Centers of Excellence for Labor Market Research (COE), COE host district, nor California Community Colleges Chancellor's Office are responsible for the applications or decisions made by individuals and/or organizations based on this study or its recommendations.

Appendix B: Data Sources

Data Type	Source
Occupational Projections, Wages, and Job Postings	<p>Traditional labor market information data is sourced from Lightcast, a labor market analytics firm. Lightcast occupational employment data are based on final Lightcast industry data and final Lightcast staffing patterns. Wage estimates are based on Occupational Employment Statistics and the American Community Survey. For more information, see https://lightcast.io/</p>
Living Wage	<p>The living wage is derived from the Insight Center’s California Family Needs Calculator, which measures the income necessary for an individual of family to afford basic expenses. The data assesses the cost of housing, food, child care, health care, transportation, and taxes. For more information, see: https://insightccd.org/family-needs-calculator/</p> <p>The living wage for one adult in Orange County is \$20.63 per hour (\$42,910.40 annually). This figure is used by the CCCCCO to calculate the percentage of students that attained the regional living wage.</p>
Typical Education and Training Requirements, and Educational Attainment	<p>The Bureau of Labor Statistics (BLS) provides information about education and training requirements for hundreds of occupations. BLS uses a system to assign categories for entry-level education, work experience in a related occupation, and typical on-the-job training to each occupation for which BLS publishes projections data. For more information, see https://www.bls.gov/emp/documentation/education/tech.htm</p>
Emerging Occupation Descriptions, Additional Education Requirements, and Employer Preferences	<p>The O*NET database includes information on skills, abilities, knowledges, work activities, and interests associated with occupations. For more information, see https://www.onetonline.org/help/online/</p>
Educational Supply	<p>The CCCCCO Data Mart provides information about students, courses, student services, outcomes and faculty and staff. For more information, see: https://datamart.cccco.edu</p> <p>The National Center for Education Statistics (NCES) Integrated Postsecondary Integrated Data System (IPEDS) collects data on the number of postsecondary awards earned (completions). For more information, see https://nces.ed.gov/ipeds/use-the-data/survey-components/7/completions</p>
Student Metrics and Demographics	<p>LaunchBoard, a statewide data system supported by the California Community Colleges Chancellor's Office and hosted by Cal-PASS Plus, provides data on progress, success, employment, and earnings outcomes for California community college students. For more information, see: https://www.calpassplus.org/LaunchBoard/Home.aspx</p>

Data Type	Source
Population and Occupation Demographics	<p>The Census Bureau's American Community Survey (ACS) is the premier source for detailed population and housing information. For more information, see: https://www.census.gov/programs-surveys/acs</p> <p>Data is sourced from IPUMS USA, a database providing access to ACS and other Census Bureau data products. For more information, see: https://usa.ipums.org/usa/about.shtml</p>

This labor market analysis was supported by Strong Workforce Program funds through the Orange County Regional Consortium.

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August 2023

