Program Name: Computer Information Science
Program Contact: Kamran Eftekhari, Hellen Pacheco, Andres Calle
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INTRODUCTION: WHAT IS PROGRAM REVIEW FOR?

The goal of program review is to assess how well our programs are doing. Program review asks us to:

- Reflect on the state of student learning or support in our disciplines and programs, by discussing:
  - efforts to achieve equity across student populations and modes of delivery;
  - results of assessment activities aimed at improving or researching student learning;
  - new challenges or changes to the program.
- Identify resources that we need to change and improve.

Though program review is tied to accreditation, ultimately, we want program review to be meaningful for us. This means we want to use program review to highlight and celebrate what is working, identify what isn't and to figure out what we can do about it. Program review also provides an opportunity to assess how those things work in practice, and work to improve our practices to be able to serve our students even better. It also serves to create cross-campus understanding and dialogue and make more informed decisions in our teaching and programs. Program review is also an opportunity to advocate for change and for resources by showing need and equity issues that we need additional support to be able to address.

1. Description of Program (200-400 words)

The Computer Information Science (CIS) Department offers the following degrees and certificates:

Associate of Science Degrees
1. Computer and Information Science (60 units)
2. Computer Science Applications and Development (60 units)
3. Web and Mobile Application Development (60 units)

Certificates of Achievement
1. Computer Science Applications and Development (30-34 units)
2. Web and Mobile Application Development (34-36 units)
3. DevOps (17 units)
4. Enterprise Cybersecurity Professional (24 units)

Certificates of Specialization
1. C++ Programming (8 units)
2. Database Programming (14-15 units)

3. Data Science and Big Data (14-16 units)
4. Web Programming (13 units)
5. Java Programming (8 units)
6. Web/Mobile App Development (15 units)
7. Applied Python Programming (15 units)
8. Enterprise Cybersecurity (15 units)
9. Internet of things (IoT) Programming (15 units)

CIS courses and programs directly support institutional priorities for student success by offering courses in both the distance and traditional face-to-face mode, and whenever possible, in a predictable scheduling pattern. We are committed to academic excellence and facilitating our students' career goals. All courses are certificate-applicable, associate degree-applicable, and/or university-transferable. Additionally, one course meets the Information Competency and Career Exploration associate degree requirement. CIS faculty have met with industry leaders in our advisory board each Spring and partnered with experts at four-year institutions to maintain a strong and relevant curriculum.

We "ensure equitable opportunities for all our students" by providing high quality instruction that makes use of OER (Open Education Resources) materials whenever possible, as well as subsidized supplemental materials, and equipment through our computer loan program.

Enrollment in our courses has increased 12% from 2020-2021 to 2022-2023. Consistent with our commitment to equity and addressing the broad educational needs of our diverse community, Professor Andres Calle was hired in the fall of 2023. We are committed to supporting Andres in his scholarly pursuits to provide our students with the best possible education while keeping the college and district's mission in mind.

The CIS department *"stands in solidarity with our BIPOC community, condemning all forms of racialized capitalistic violence, injustice and inequity"*. We are committed to creating a socially just program wherein everybody is welcome and celebrated and is an integral part of the program.

2. <u>Results of Previous Program Review (200-500 words)</u>

a) **Describe the results of your previous Program Review's action plan and identified equity gaps.**

There were seven action items listed in the previous Program Review, as follows:

(1) **CVC-OEI Course Design Standards**
   (a) **Previous Goal**: Have some of our courses in the CVC-OEI Exchange.
   (b) **Plans still in progress:** There was a delay in CSM getting accepted into the CVC-OEI Consortium and the process of becoming a home college is still in progress. In the summer of 2022, CIS faculty member Hellen Pacheco was part of a cohort that

underwent 40 hours of training to become Peer Online Course Reviewer. Now, we await next steps.

(2) Design of a new Certificate of Specialization in Mobile Game Design.
   (a) **Previous Goal**: A Certificate of Specialization in Mobile Game Design in collaboration with Digital Media
   (b) **Changes Implemented**: To reduce the equity gap in CIS 137 iOS/Swift Programming, five Macbook computers were brought to our program through SWT funding. Enrollment in this course tripled since 2021 (from 12 in fall of 2021 to 36 currently enrolled this semester). In contrast, there has been little interest in CIS 135 Android Programming, and we need to rethink the makeup of classes for this potential certificate.

(3) Linux -based lab
   (a) **Previous Goal**: CIS 264 plans to have a 30 seat Linux based lab (Mac computers). By providing marginalized students with access to Linux based computers will decrease the equity gap.
   (b) **Changes Implemented**:
      (i) Challenges: Two significant challenges arose: funding and space.
      (ii) Revised Approach: Instead of setting up a physical lab with individual Linux computers, the decision was made to implement a central Linux server. This server would host the Linux operating system and provide remote access to Linux desktop environments.

(4) Revising course SLOs
   (a) **Previous Goal**: imbed "Anti-Racism" into measurable outcomes.
   (b) **Changes Implemented**:
      i. Faculty reviewed the current Learning Outcomes, identified areas where anti-racist perspectives and content can be integrated, and rewrote some of the existing SLOs to incorporate inclusive and anti-racist language.
   (c) Plan is still in progress.

(5) Conferences
   (a) **Previous Goal**: Organize once a year conference on women in computing and another one on pedagogy of teaching for equity and anti-racism in Computer Science.
   (b) **Changes implemented:** CIS faculty member Hellen Pacheco became a member of the Equitable Grading Community of Practice at CSM in an effort to close the achievement gap in Computer Science.

(6) Changes to CIS 110
   (a) **Previous Goal**: Modify content of CIS 110 to become mostly project-oriented and exams mostly in the form of presentation to promote more interaction among students and allow faculty opportunities to discuss issues related to lack of equity in the Computing industry. The course could be in seminar format and allow all three faculty to share responsibility for the course.
   (b) **Changes Implemented**: Recommendation was made to:

        i. Replace traditional exams with presentation-based assessments.
       ii. Integrate equity issues in the computing industry into discussions.
     iii. Adopt a seminar-type structure, fostering active participation.
     iv. Adopt project-based assessments.

(7) Mode of delivery adjustment
   (a) **Previous Goal**: Data shows that CIS students have a higher success rate in online classes. We planned to adjust our mode of delivery accordingly.
   (b) **Changes Implemented**:
     CIS recommends determining the mode of course delivery based on the demand and success rate of our diverse student population.

b) Explain any curriculum or programmatic changes since last program review.

To enrich our student's curriculum in the growing field of data science, a new course (CIS 124 Foundations of Dada Science) was created, modeled after the UC Berkeley Data 8 course. This course was added as a selective in the Data Science & Big Data Certificate along with MATH 200 Elementary Probability and Statistics and CSYC 121 Basic Statistical Concepts.

c) Discipline-level and SLO (Student Learning Outcomes) assessment/Student Services and SAO (Service Area Outcomes) assessment: Describe learning or area assessment plans implemented since last Program Review, including any activities undertaken to address equity or delivery mode gaps. Your summary should explain:

Revisions to course descriptions and SLOs:

- CIS 117 Python Programming: removed requirement for the Django framework, and CIS 117 now aligns with a CS1 level course with C-ID 122. This will help with future articulations with CSU's and UC's increasing opportunities for students to transfer. Due to increased demand for this course, we plan to start offering it in a hybrid mode starting in the Spring of 2024. This will increase opportunities for students who would rather learn in person.
- CIS 137: replaced UKit with SwiftUI development framework, which is the future of app development on Apple's platforms, providing students with state-of-the-art instruction in mobile development. In addition, since this course requires specific equipment (Mac computers), we secured 5 Macbooks thanks to SWP resources. These computers are now being loaned to students taking CIS 137, through the library loan program.

3. Current Program Review (200-400 words)

College Stats 2022-23	Ethnicity	First Gen	Age	Gender	Total
Headcount (unduplicated)	Latinx 32% White 26% Asian 20% Filipino 7% Multiracial 7% Black 3% Pacific Islander 2% Unknown 3% Native American 0%	45% of our students are the first in their family to go to college.	66% 24 yrs. and under 18% Ages 25-34 17% over 35 yrs.	49% Female 48% Male 3% Non-disclosed or non-binary	13,180 students
Enrollments (duplicated)	Latinx 35% White 26% Asian 16% Filipino 6% Multiracial 8% Black 3% Pacific Islander 3% Unknown 3% Native American 0%	47% of enrollments were by students who are the first in their family to go to college.	76% 24 yrs. and under 13% Ages 25-34 11% over 35 yrs.	48% Female 50% Male 2% Non-disclosed or non-binary	37,014 enrollments
CIS Enrollment (duplicated)	Latinx 22.4% White 21.7% Asian-Domestic 25.4% Asian, Int'l 6.6%_ Filipino 7.3% Black 3.0% Other 13.6%	31.9% of enrollments were by students who are the first in their family to go to college.	62.2% 24 yrs. And under 24.7% Ages 25-34 13.2% over 35 yrs.	27.5% Female 68.7% Male 3.8% Non-disclosed or non-binary	1340 enrollments

CIS Stats 2022-23	Ethnicity	Percent Success	Percent Withdraw	Income	performance
Headcount (unduplicated)	Latinx 22.4% White 21.7% Asian-Domestic 25.4% Asian, Int'l 6.6%_ Filipino 7.3% Black 3.0% Other 8.1% Unrecorded 4.6%	67.3% 77.3% 82.6% 87.6% 72.4% 52.5% 79.8% 82.3%	16% 11.3% 9.7% 0.0% 19.4% 25% 9.2% 12.9%	Low Income 11.9% Not Low Income 81.1%	Success 76.3% Retention 87.8%

a) **Student population equity:**

Findings	Analysis	Resources	Plans to Address Opportunity Gaps
1. The Latinx student population has increased from 18.8% to 22.4%. However, the success rate has decreased from 79.1% to 67.3%, and the withdrawal rate has risen from 1.3% to 16.0%.	• Access to free college through AB540 may have helped increase student population. Potential challenges include language barriers and socioeconomic disadvantages affecting academic performance. • Success rate decrease may be due to insufficient support systems or resources for Latinx students. • High withdrawal rates: Indicate potential issues with engagement, retention, and access to support services.	We were able to hire a Spanish-speaking faculty this semester, but it is too early to notice any impact.	Tutoring and Mentoring Programs: • Hiring Spanish-speaking tutors is a valuable step in addressing the opportunity gap for Latinx students, particularly those who may face language barriers or require additional support in their academic journey. • Pair students with mentors who can provide academic and emotional support.
2. The female student population in CIS has seen a modest increase from 25.7% to 27.5%. However, the success rate	The modest rise in female student enrollment may diversify backgrounds,		• **Gender-Specific Support Programs:** Develop support programs tailored to the needs of female students in CIS.

has decreased from 91.9% to 75.9%, and the withdrawal rate has increased from 1.3% to 14.4%.	impacting success. Factors like unequal resource access, gender-related challenges, or academic prep disparities affect rates. To address this, review the curriculum, support systems, and teaching methods for female students' needs. Implementing gender-inclusive strategies may narrow success and retention gaps.		• **Academic Advising:** Strengthen academic advising for female students to address potential disparities in academic preparation. • **Mentorship Opportunities:** Establish mentorship programs that connect female students with experienced peers or faculty members. • **Success Workshops:** Conduct workshops focusing on study skills, time management, and exam preparation, with an emphasis on female student participation. • **Retention Strategies:** Implement targeted retention strategies, such as regular check-ins and early intervention for female students facing academic difficulties. • **Curriculum Review:** Evaluate course content and teaching methods for gender bias or inclusivity issues and make necessary adjustments. • **Cultural Competency Training:** Provide cultural competency training for faculty and staff to create a more inclusive and welcoming environment. • **Community Engagement:** Foster community engagement by collaborating with Latinx community organizations and leaders to create opportunities for students.
3. CIS enrollment has grown by 10%, but the success rate has decreased from 87.0% to 76.3%, and the withdrawal rate has increased from 1.0% to 12.2%.	The 10% growth in CIS enrollment is positive, indicating increased interest. However, the significant decrease in the success rate from 87.0% to 76.3% is concerning and		• **Academic Support Center:** Establish a dedicated academic support center with tutors and study resources accessible to all CIS students. • **Peer Mentorship Program:** Launch a peer mentorship program where experienced CIS students guide and support newcomers.

	suggests potential academic challenges or resource gaps. The substantial rise in the withdrawal rate from 1.0% to 12.2% is alarming and warrants immediate attention, indicating issues related to engagement, retention, or support services. An in-depth analysis is required to identify and address the underlying causes of these declines.		• **Curriculum Review Committee:** Form a committee to review and update the curriculum to ensure it aligns with industry standards and student needs. • **Early Intervention System:** Implement an early intervention system to identify struggling students and provide timely academic support. • **Faculty Development Workshops:** Conduct regular faculty workshops on effective teaching methods and student engagement techniques. • **Student Counseling Services Expansion:** Expand counseling services to address mental health and personal challenges that may affect academic performance. • **Financial Aid Scholarships:** Introduce targeted scholarships for CIS students facing financial barriers.

b) **Modes of Delivery equity:**

Changes since last Program Review	Analysis of Gaps	Plans to Address Opportunity Gaps
1. Sections in face-to-face mode of delivery have the highest achievement rate (88.4%) compared to Online (78.9) and Hybrid (76.8).	• Highest achievement in face-to-face mode may relate to enriched learning environment that allows more direct interaction with instructors and peers. Conversely, online classes might suffer from issues such as technical difficulties, reduced interaction, and the need for greater self-discipline. • The reason why Hybrid sections have the lowest	Explore more authentic forms of assessment to close the gap in achievement across delivery modes.

	achievement rate may be because they are more rigorous than their purely online version in which there is no in-person tests.	
2. Finding: Despite the higher success rate in face-to-face classes at 88.4% compared to 78.9% in online classes, enrollment in online classes remain strong.	The preference for online learning may stem from factors like flexible scheduling and cost considerations, while the hesitation to enroll in face-to-face classes could be due to health and safety concerns, lifestyle constraints, or a growing acceptance of online education as a viable alternative.	Understanding these multifaceted factors is essential for educational institutions to adapt and provide effective learning experiences that cater to diverse student needs and preferences.

(c) Challenges and Opportunities: Describe any other particular challenges, opportunities, or other factors that impact the success of your program (e.g., natural or health disasters, assessing whether a degree program is meeting its learning outcomes, developing new degree programs or courses, adapting to a changing student population, keeping a flagging program alive, starting a learning community, resources, etc.).

The CIS department has encountered challenges in recruiting full-time faculty and one faculty member retired at the end of Fall of 2022. This directly impacts the development of new programs and updating the ones we currently offer, as well meeting the uptick in demand for our courses.

4. Planning

a) **Discipline-level and SLO (Student Learning Outcomes) assessment/Student Services and SAO (Service Area Outcomes) assessment for 2023-2025: Describe learning or area assessment plans for this Program Review cycle, including any activities planned to address equity or delivery mode gaps. Your summary should explain:**

Proposed Student Learning Outcome:

- **Promoting Anti-Racism:**
  - Students should be able to analyze and articulate the potential socio-cultural impact of their computing projects, demonstrating an understanding of how technology intersects with race, inequality, and power, and proposing strategies to address and mitigate racial biases and disparities.

- o They should be able to reflect on the implications of technology in perpetuating or alleviating social inequalities and be conscious creators with a commitment to equity and inclusiveness.

Assessment Method:

- **Impact Statement Requirement:**
    - o As part of their project reports, students will be required to include a comprehensive Impact Statement that delves into the possible societal and cultural implications of the proposed technology or solution.
    - o This statement should specifically address the potential racial implications and how the project acknowledges and addresses racial disparities and inequalities. It must propose strategies or features that aim to mitigate any negative racial impacts.

Assessment Criteria:

- **Depth of Analysis:**
    - o The impact statement should not be a cursory or surface-level exploration but must demonstrate a deep, thoughtful, and comprehensive exploration of societal and racial impacts.
- **Understanding and Application of Anti-racism Principles:**
    - o The statement should demonstrate a clear understanding of anti-racism principles and articulate how they are applied or addressed within the context of the project.
- **Strategies for Mitigation:**
    - o Clearly outlined and feasible strategies for mitigating racial disparities and biases should be included, demonstrating an understanding that addressing racial inequality is integral to the development of technology.

b) **Program goals**

The following are our goals for the next two years. Given that Computer Science is the foundation of a technology field that is constantly reinventing itself, we plan on creating AS degrees in areas that have become important to our students' success as they plan to transfer to pursue a bachelor's degree or advance in their careers. We also plan to update (modernize) the degrees that we currently offer.

a. **AS in Data Science**

Description: an Associate of Science (AS) degree in Data Science that covers foundational data science concepts required to transfer to most universities in the UC system as well as equip students with the knowledge and practical experience necessary to excel in data-driven careers. This AS degree will encompass courses in foundations of data science, statistics, programming languages, database systems and data visualization. The program will emphasize hands-on projects, real-world applications, and collaboration with other academic

institutions and potentially industry partners to ensure our graduates are well-prepared for the demands of the data science field and ready to contribute effectively to data-driven decision-making in various industries.

Action Plan: Implementing the AS degree in Data Science involves curriculum development to provide support courses, faculty professional training in the latest tools and methodologies, and resource allocation to ensure student success. We will collaborate with subject matter experts to design and refine course content, ensuring alignment with Data Science programs at 4-year institutions where students aim to transfer.

Timeline: 2023-2024 academic year

Person Responsible: Hellen Pacheco

Support Needed: A dedicated tutor for students taking CIS 124 Foundations of Data Science and the design of a supporting class for students not yet prepared to take CIS 124.

b. AS in AI and Machine Learning

Description: an Associate of Science (AS) degree in AI and Machine Learning into our department curriculum involves the development of a rigorous program that covers the fundamentals of artificial intelligence and machine learning. This degree will encompass courses in mathematics, statistics, programming languages like Python and TensorFlow, data analysis, and deep learning. We will emphasize hands-on projects and practical applications, enabling students to develop AI models, work with real-world datasets, and gain essential problem-solving skills. Additionally, faculty members will receive specialized training to ensure they are well-equipped to deliver high-quality instruction in these cutting-edge fields. By integrating this AS degree, we aim to empower our students with the knowledge and skills needed to excel in AI and machine learning careers, meet the growing demand for professionals in this domain, and contribute to advancements in technology and automation.

Action Plan: Implementing the AS degree in AI and Machine Learning entails a comprehensive approach. We will collaborate with experts to design a relevant and up-to-date curriculum, focusing on both foundational and advanced AI and machine learning concepts. Faculty development will be a priority, involving training in AI tools, methodologies, and emerging trends. We will secure the necessary computational resources and software licenses for hands-on learning experiences, fostering practical skills in our students. Building industry partnerships will also be crucial, enabling internships and real-world projects. This holistic strategy will ensure that our program equips students with the expertise needed for AI and machine learning careers and contributes to the ongoing innovation in these fields.

Timeline: 2023-2024 academic year

Person Responsible: Kamran Eftekhari

Support Needed: Professional Development for faculty involved.

c. Curriculum Update

Description: A comprehensive update of the three existing AS degrees: Computer Science Applications, Development and Computer and Information Science and Web and Mobile Application Development. We aim to modernize and enhance these programs to better align with current industry demands and technological advancements.

Action Plan: This will include revising course content to incorporate emerging technologies, as well as emphasizing practical, hands-on experiences. Faculty development will be a priority to ensure instructors are well-versed in the latest trends and tools. Moreover, we intend to engage with local businesses and tech organizations to foster internship opportunities, ensuring our students gain real-world experience and are well-prepared for successful careers in the dynamic field of computer science and information technology.

Timeline: 2023-2024 academic year

Person Responsible: Kamran Eftekhari, Hellen Pacheco, Andres Calle

d. Exploration of the design of a cutting-edge certificate program in Virtual Reality

Description: This is an innovative educational initiative designed to equip students with the skills and knowledge needed to excel in the rapidly evolving field of virtual reality (VR). This program combines a comprehensive exploration of VR technologies with hands-on design and development experiences. Students will delve into immersive VR content creation, 3D modeling, and VR software development using cutting-edge tools and techniques. With a strong focus on industry relevance, this program prepares graduates to be at the forefront of VR innovation, positioning them for exciting careers in fields ranging from gaming and entertainment to healthcare and education.

Action Plan: Our action plan for the Cutting-Edge Certificate Program in Virtual Reality entails curriculum development, resource acquisition, faculty training, and industry collaboration. We will design and refine courses, secure state-of-the-art VR equipment and software, provide specialized training for faculty, and establish partnerships with VR industry leaders to ensure students receive hands-on experience and exposure to the latest VR innovations, positioning them for success in this dynamic field.

Timeline: 2023-2024 and 2024-2025 academic years

Person Responsible: Kamran Eftekhari

Support Needed: specific equipment for actual program implementation.

e. Design a certificate on Foundation of Computer Science

Description: This certificate program encompasses four key courses: programming, data structures, discrete mathematics, and computer organization. This comprehensive curriculum equips students with essential computer science skills, enabling them to excel in software development, algorithm design, and computer systems understanding. Graduates of this program will possess a strong foundation for success in a wide range of technology-related careers.

Action Plan: The action plan for implementing this certificate program involves designing and refining the curriculum, acquiring necessary educational resources, providing faculty training, establishing student support services, promoting quality assurance, fostering industry partnerships, implementing effective marketing strategies, offering student advising, defining graduation requirements, and maintaining a feedback loop for ongoing program improvement. This holistic approach ensures a well-rounded and successful implementation of the certificate program in programming, data structures, discrete mathematics, and computer organization.

Timeline: 2023-2024 academic year

Person Responsible: Kamran Eftekhari

f. Design a certificate on Machine Learning and Artificial Intelligence

Description: we aim to design a comprehensive certificate program focusing on Machine Learning and Artificial Intelligence, encompassing three essential courses in probability tailored specifically for computer science, machine learning, and artificial intelligence applications. This certificate program will provide students with a solid foundation in probability theory, a critical component for understanding and excelling in these cutting-edge fields. By integrating probability concepts across these three courses, we intend to equip learners with the necessary mathematical tools to analyze, model, and make informed decisions in complex, data-driven environments.

Action Plan: Our action plan involves collaborating with subject matter experts to develop three tailored probability courses for computer science, machine learning, and artificial intelligence. We'll select experienced instructors, utilize a suitable online platform for course delivery, ensure quality through rigorous review processes, promote the program, gather learner feedback for improvements, and ultimately issue valuable certificates to successful participants, empowering them to excel in these data-driven domains.

Timeline: 2023-2024 academic year

Person Responsible: Kamran Eftekhari

Support Needed: Professional Development for faculty involved.

5. <u>CE Only</u>

a) **Review the program's available labor market data, as applicable, and explain how the program meets a documented labor market demand. Here are two relevant links:**

Following a college trend, course enrollment in CIS has decreased from 1,988 in 2017-2018 to 1,736 in 2022-2023. However, demand for our courses has seen a recent uptick. It is important to note that difficulty recruiting faculty has prevented us from meeting the current demand. Nevertheless, course retention has increased from 82% to 88%, and course success has increased from 71% to 77% in the same period.

All programs we offer relate to the broader Occupational Titles "**Software Developers and Software Quality Assurance and Testers**" and "**Computer Network Support Specialists**" as shown in the State of California Employment Development Department (EDD) website. The occupational data provided by EDD shows that Employment Projections for occupations related to Computer & Information Science continues to be strong in the counties of San Francisco through Santa Clara.

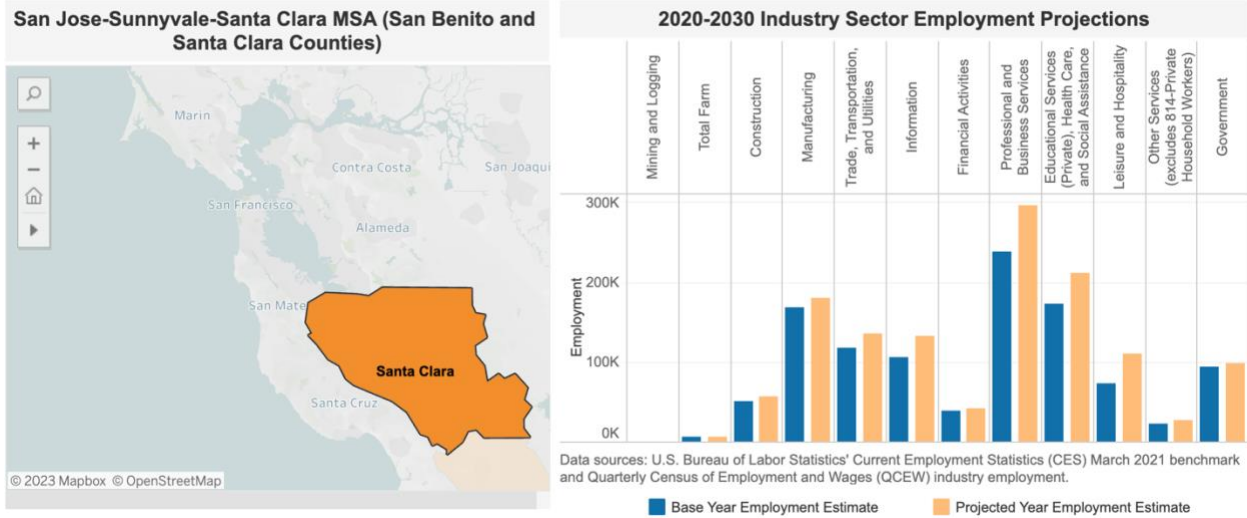**Supporting Data from EDD:**

The following data was gathered from the [State of California Employment Development Department (EDD) Labor Market Information – Employment Projections](#).

The following graphs show employment projections for "Professional and Business Services" and "Information" in the top three in San Francisco and San Mateo counties, and in the top five in Santa Clara County.

San Jose-Sunnyvale-Santa Clara MSA (San Benito and Santa Clara Counties)

2020-2030 Industry Sector Employment Projections

Data sources: U.S. Bureau of Labor Statistics' Current Employment Statistics (CES) March 2021 benchmark and Quarterly Census of Employment and Wages (QCEW) industry employment.

The following tables show that for people holding an **associate degree**, "Computer Network Support Specialists" appear in the top-five list for both Job Openings and Fastest Growing Occupations between 2020 and 2030:

2020-2030 Occupations with the Most Job Openings

Standard Occupational Classification	Occupational Title	Total Job Openings	Median Hourly Wage	Median Annual Wage
25-2011	Preschool Teachers, Except Special Education	5,820	$22.15	$46,063
23-2011	Paralegals and Legal Assistants	5,790	$37.45	$77,900
17-3011	Architectural and Civil Drafters	1,390	$37.86	$78,737
17-3023	Electrical and Electronics Engineering Technicians	1,140	$36.02	$74,925
15-1231	Computer Network Support Specialists	1,020	$39.03	$81,182
29-1292	Dental Hygienists	960	$62.55	$130,110
43-4161	Human Resources Assistants, Except Payroll and Timekeeping	940	$27.47	$57,145
29-2034	Radiologic Technologists	920	$60.87	$126,626
19-4031	Chemical Technicians	740	$29.08	$60,494
19-4042	Environmental Science and Protection Technicians, Including Health	510	$32.04	$66,652

Total job openings are the sum of numeric change, exits, and transfers projected between 2020 and 2030.
Wages are from the 2022 first quarter and do not include self-employed or unpaid family workers. An estimate could not be provided for wages listed as $0.
Excludes "All Other" categories. These are residual codes that do not represent a detailed occupation.

2020-2030 Fastest Growing Occupations

Standard Occupational Classification	Occupational Title	Base Year Employment Estimate	Projected Year Employment Estimate	Percentage Change	Median Hourly Wage	Median Annual Wage
29-1292	Dental Hygienists	990	1,270	28.3%	$62.55	$130,110
25-2011	Preschool Teachers, Except Special Education	4,220	5,310	25.8%	$22.15	$46,063
19-4031	Chemical Technicians	540	650	20.4%	$29.08	$60,494
17-3023	Electrical and Electronics Engineering Technicians	950	1,140	20.0%	$36.02	$74,925
15-1231	Computer Network Support Specialists	1,090	1,270	16.5%	$39.03	$81,182
29-2056	Veterinary Technologists and Technicians	430	490	14.0%	$26.84	$55,839
29-1126	Respiratory Therapists	720	810	12.5%	$58.09	$120,832

The following tables show that for people holding a **bachelor's degree**, "Software Developers and Software Quality Assurance Analysts and Testers" leads the top-ten list for both the Most Job Openings and Fastest Growing Occupations. Although we only offer AS degrees, we prepare students to transfer to programs that will complement their education and prepare them for those occupations.

2020-2030 Occupations with the Most Job Openings

Standard Occupational Classification	Occupational Title	Total Job Openings	Median Hourly Wage	Median Annual Wage
15-1256	Software Developers and Software Quality Assurance Analysts and Testers	85,340	$0.00	$0
11-1021	General and Operations Managers	27,100	$74.49	$154,932
13-1161	Market Research Analysts and Marketing Specialists	23,740	$48.87	$101,662
11-3021	Computer and Information Systems Managers	21,190	$102.84	$213,890
13-2011	Accountants and Auditors	17,150	$48.88	$101,680
11-3031	Financial Managers	14,690	$93.62	$194,728
13-1111	Management Analysts	13,550	$59.53	$123,826
13-1071	Human Resources Specialists	11,450	$46.98	$97,717
11-2022	Sales Managers	11,240	$82.76	$172,153
11-2021	Marketing Managers	10,530	$98.73	$205,348

Total job openings are the sum of numeric change, exits, and transfers projected between 2020 and 2030.
Wages are from the 2022 first quarter and do not include self-employed or unpaid family workers. An estimate could not be provided for wages listed as $0.
Excludes "All Other" categories. These are residual codes that do not represent a detailed occupation.

2020-2030 Fastest Growing Occupations

Standard Occupational Classification	Occupational Title	Base Year Employment Estimate	Projected Year Employment Estimate	Percentage Change	Median Hourly Wage	Median Annual Wage
11-9121	Natural Sciences Managers	2,630	3,710	41.1%	$0.00	$0
15-1256	Software Developers and Software Quality Assurance Analysts and Testers	68,140	94,680	38.9%	$0.00	$0
13-1081	Logisticians	2,060	2,860	38.8%	$44.54	$92,631
15-2031	Operations Research Analysts	910	1,260	38.5%	$50.85	$105,759
13-1161	Market Research Analysts and Marketing Specialists	16,150	21,610	33.8%	$48.87	$101,662
13-1121	Meeting, Convention, and Event Planners	1,510	2,000	32.5%	$37.72	$78,454
19-4021	Biological Technicians	1,590	2,100	32.1%	$30.74	$63,943

Supporting Data from Lightcast:

The following data provided by the **Lightfast** reports confirm that occupations related to Computer and Information Science have strong growth projections, with an average +15.9% expected growth from 2022 to 2029, and median earnings of $77.96/hr or $162.2K/yr.

Target Occupations

Filtered by the proportion of the national workforce in these occupations with an Associate's degree

23,927	+15.9%	$77.96/hr $162.2K/yr	2,421
Jobs (2022)*	% Change (2022-2029)*	Median Earnings	Annual Openings*
176% *above* National average*	Nation: +15.6%*	Nation: $49.65/hr; $103.3K/yr	

Occupation	2022 Jobs*	Annual Openings*	Median Earnings	Growth (2022 - 2029)*	Employment Concentration (2022)*
Software Developers	6,035	644	$87.93/hr	+23.21%	4.30
Computer Occupations, All Other	4,630	403	$70.41/hr	+8.88%	3.20
Computer and Information Systems Managers	3,500	347	$104.74/hr	+14.60%	3.74
Computer Systems Analysts	1,790	172	$68.33/hr	+14.69%	1.92
Management Analysts	1,759	191	$53.37/hr	+9.27%	1.61
Software Quality Assurance Analysts and Testers	1,339	140	$68.60/hr	+18.82%	4.01
Web and Digital Interface Designers	1,000	117	$64.62/hr	+18.60%	4.17
Postsecondary Teachers	879	92	$51.47/hr	+9.22%	1.27
Computer Network Support Specialists	700	80	$42.93/hr	+20.57%	1.16
Computer Programmers	653	48	$63.77/hr	+0.61%	2.45
Data Scientists	508	61	$72.49/hr	+27.36%	3.71
Web Developers	385	45	$53.07/hr	+24.16%	1.64
Natural Sciences Managers	247	26	$103.57/hr	+14.57%	3.32
Database Administrators	189	19	$61.74/hr	+17.99%	1.43
Database Architects	164	17	$82.76/hr	+20.12%	1.61
Computer and Information Research Scientists	93	10	$108.28/hr	+23.66%	5.14
Statisticians	51	6	$76.06/hr	+31.37%	1.81

b) Summarize student outcomes in terms of degrees and certificates. Identify areas of accomplishments and areas of concern.

According to data pulled from the CSM Data Dashboards, the number of AS degrees awarded has increased over time as shown on the table below, but the number of certificates awarded has either declined or disappeared from 2017-2018 to 2022-2023 academic years. Since AS degree requirements include certification requirements, it is likely that students are not applying for certificates because they are taking courses to transfer or apply for an associate degree. We need to encourage our students to apply for certificates when requirements are met.

Number of Awards per academic year (* represents fewer than 5):

Program	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023	Grand Total
Computer & Information Science (AS)		12	17	26	22	25	102
Computer & Information Science: Applications Development (AS)		*	*	6	6	9	24
Computer & Information Science: Web Development (AS)	*						*
CIS: Web & Mobile Application Development (CS)	*						*
CIS: Applications Development (CS)	9	5					14
CIS: C++ Programming (CS)	16	22					38
CIS: Java programming (CS)	37	54					91
CIS: Database Programming (CS)	*	5					6
CIS: Data Science & Big Data (CS)		*					*
CIS: Internet Programming				*			*
CIS: Web Programming	*	*					*

c) **Review and update the program's Advisory Committee information. Provide the date of most recent advisory committee meeting and outcomes of the meeting (updates, changes, new members, etc.).**

The last Advisory Board meeting was held on April 20th, 2023. The board currently consists of the following members:

Last	First	Notes/Attended	Company	Title
Gamez	Francisco		_SMCCD	Dean Business & Technology Division CSM
Chin	David	Organizer	_SMCCD	Instructional Aide at CSM
Eftekhari	Kamran	Organizer/Presenter	_SMCCD	Full-time Faculty at CSM
Kramer	Alex	Organizer/Presenter	_SMCCD	Director of workforce development
Pacheco	Hellen	Organizer/Presenter	_SMCCD	Full-time Faculty at CSM
Martens	Bryce	NOT attended	_SMCCD	Adjunct Faculty at CSM
Stan	Issacs		_SMCCD	Adjunct Faculty at CSM
Abboud	Samir		_SMCCD	Adjunct Faculty at CSM
Maddux	Stormy		County of San Mateo	Deputy Chief Information Security Officer at CSM
Roberts	Kimberly		Google	Chief of Staff to VP for Education and Research Operation
Roldan	Myra		Amazon	Technical Program manager with AWS
Seiden	Gregory	NOT attended	Oracle	(Former VP)
Pieraldi	Stephen		UC Berkeley, Jabil	Engineering Fellow
Tom	Ryan	NOT attended		
Troy	Brian		Qorvo, Inc.	Senior Product Engineer
Wang	Anthony	NOT attended		
Elflving	Daniel	NEW invitee		
Jin	Ziqi Erica	NEW invitee	Guidewire	Former CSM student, software engineer
Latt	Sue	NEW invitee	Guidewire	Former CSM student, software engineer
Wang	Zhilij	NEW invitee		
Zhu	Dadian	NEW / NOT attended		

The committee advised us to explore programs that prepare students to work in operations related to AI and Machine Learning as there are job opportunities in this area for students holding an AS degree. They also gave us leads to connect with industry partners to collaborate in the development of curriculum.

d) What strategies have you discussed in your recent Advisory Committee's meetings to meet the needs and challenges of getting people retrained and back to work?

According to the board members, there is demand for workers in operations related to Artificial Intelligence (AI) and Machine Learning (ML) that only require an associate degree. We were advised to establish partnerships with industry to develop programs in AI & ML. On May 19th Hellen Pacheco and Alex Kramer attended Internet Infrastructure Workshop (I2W) for Educators at AWS, where we had the opportunity to visit the Amazon Data Centers in Santa Clara.

Technical Program Manager at AWS, Myra Rodan, sent us ML resources (including courses and content) that are currently available. These resources are mostly authored by Machine Learning University. In addition, AWS provides a series of tools that institutions are using to help students gain hands-on practice.

Now we are exploring options as we plan a new degree in AI & ML.