



## **Merritt College Computer Science Course Sequence and Advisory Guide**

**Associate in Science Degree (Program Control #37964) or Certificate of Achievement (#37966)**

***Learn Design and Implementation*** – The Computer Science degree or certificate allows students to gain skill in the design of software and the implementation of software designs. It incorporates study in Mathematica and Physics to enable the student to design models of systems that often cannot be directly measured or observed. This enables the creation of algorithms; an unambiguous specification of how to solve a class of problems. This skill is combined with instruction in implementation (coding), analysis of software designs, and use of a strongly typed programming language to create programs. These two distinct skill sets form the basis for continued study in Computer Science, Computer Engineering, or entry into the technology workforce as a software developer. [Software Developer is the #1 out of 100 Best Careers according to US News and World Report.](#)

***Workforce Degree*** – The Associate in Science in Computer Science is a terminal degree. It is a Career Education (CE) degree that enables the student to join the software development workforce at the entry level. This degree incorporates courses that confer skills that are responsive to community and industry needs including: Cybersecurity, DevOps, Blockchain Services, Mobile Applications, Agile Project Automation and Continuous Integration, High Performance Computing (HPC), Data Science and Artificial Intelligence. Universities also consider this degree a transfer degree that may fulfill the lower division course sequence of a Computer Science baccalaureate. This often permits entry to a baccalaureate program as a junior. The 2014 average salary for a software developer with a Bachelor of Science in Computer Science was \$140,000 per year. The Oakland Metropolitan Chamber of Commerce's 2016 Regional Occupational Analysis of the Bay Area Labor Market projected the demand for Software Developers in the East Bay to grow by 78% in the next 5 years, and to continue to be the top occupation for workforce development efforts Bay Area wide.

***Computer Science and Cybersecurity*** - The Merritt College Computer Science A.S. degree infuses Computer Science competencies with Cybersecurity and is aligned with [curricular guidance](#) from the governing bodies; the Association of Computing Machinery (ACM) and the National Initiative for Cybersecurity Education (NICE). The curriculum is mapped to the nationally defined Knowledge Units (KU) and articulates into four-year programs in both Computer Science and Cybersecurity. Cybersecurity Knowledge Units (KU) and course mappings are published by the National Initiative for Cybersecurity Careers and Studies (NICCS) at <https://niccs.us-cert.gov/training/search/merritt-college>. The curriculum includes instruction in the fundamentals of problem solving and analysis, programming, data structures, and architecture. Additional requirements include Calculus, Physics and Discrete Mathematics. This program takes a contextualized approach to the CS major through the choice of language, C++, and the approach to curriculum subjects. It aims to develop skills in the design and implementation of software that operates correctly at extreme scale. Students routinely place in the top 10% in national competition. This merging of Cybersecurity and Computer Science puts Merritt College at the cutting edge of two-year Computer Science programs.

## Required Courses

<a href="#">CIS 006</a>	Introduction to Programming	5
<i>or</i>		
<a href="#">CIS 007</a>	Control Structures and Objects	4
<a href="#">CIS 033</a>	Software Architectures and Algorithms	4
<a href="#">CIS 011</a>	Discrete Structures and Logic	4
<a href="#">CIS 078</a>	Digital Architectures for Computation	4
<a href="#">MATH 03A</a>	Calculus I	5
<a href="#">MATH 03B</a>	Calculus II	5
<a href="#">PHYS 004A</a>	General Physics with Calculus	5
<i>MATH 011 accepted as substitute for CIS 011</i>		

**Optional Restricted**      Courses listed in Recommended Sequence      Select one group (12-17 units)

### Electives

#### **Group A      Cybersecurity – Secure Software Development**

<a href="#">CIS 071</a>	Introduction to Information Systems Security	3
<a href="#">CIS 059</a>	Applications in Information Security	3
<a href="#">CIS 056</a>	Secure Coding in Java and .NET	3
<a href="#">CIS 057</a>	Web Application Penetration Testing	3

#### **Group B      Cybersecurity – DevOps (Dev/Sec/Ops):**

<a href="#">CIS 055</a>	Hacker Techniques, Exploits, & Incident Handling	3
<a href="#">CIS 060</a>	Computer Forensics Fundamentals	3
<a href="#">CIS 247</a>	Information Systems Skills Challenge	1
<a href="#">CIS 052</a>	Cloud Security Fundamentals	3
<a href="#">CIS 053</a>	Intrusion Detection In-Depth: Compliance, Security, Forensics and Troubleshooting	3
<a href="#">CIS 178</a>	Build Automation for DevOps and QA	4

*CIS 247 requires participation in one round of Ethical Hacking Competition: National*

*Cyber League (NCL), Cyberpatriots, Cyberdefenders, or Equivalent.*

<b>Group C</b>	<b>Blockchain services and Mobile Applications</b>	
<a href="#">CIS 066</a>	XML Documents and Applications	2
<a href="#">CIS 093</a>	Cross Platform Mobile Application Development	4
<a href="#">CIS 100</a>	Introduction to Blockchain, Cryptocurrencies, and Identity	3
<a href="#">CS 043</a>	High Performance Web Applications and Services	3

<b>Group D</b>	<b>DevOps – Software Engineering and Continuous Integration:</b>	
<a href="#">CIS 051</a>	Introduction to Information Technology Project Management	4
<a href="#">CS 020</a>	Python Application Programming	3
<a href="#">CS 080</a>	Software Engineering	3
<a href="#">CIS 178</a>	Build Automation for DevOps and QA	4
<a href="#">CIS 179</a>	Agile Software Management and Project Automation	3

*This elective qualifies you for the Agile Certified Practitioner exam*

<https://www.pmi.org/certifications/types/agile-acp>

<b>Group E</b>	<b>High Performance Computing, Data Science, and Artificial Intelligence</b>	
<a href="#">CS 020</a>	Python Application Programming	3
<a href="#">MATH 03E</a>	Linear Algebra	3
<a href="#">CIS 008</a>	Introduction to Parallel and Cloud Programming	4
<a href="#">CIS 060</a>	Applications of Artificial Intelligence and Deep Learning	3

<b>Group F</b>	<b>Swift Software Development</b>	
<a href="#">CS 025</a>	Swift Application Programming	4
<a href="#">CS 026</a>	Swift Data Structures and Algorithms	4
<a href="#">CS 027</a>	Swift Universal Framework Applications	4
<a href="#">CS 247</a>	Swift Multi-Platform Application Development	3

**Major Requirements** 31-32

**Local Degree General Education Requirements\*** 19

**Restricted Electives** 12-17

**Total Units** 55-61

## Recommended Major Course Sequence

<b>1<sup>st</sup> Semester</b>		
CIS 006	Introduction to Programming	5
<i>or</i>		
CIS 007	Control Structures and Objects	4
MATH 03A	Calculus I	5
ENGL 01A	Composition and Reading	4
<i>Or</i>		
	Critical Thinking in Reading and Writing	3
ENGL 005		
	1 <sup>st</sup> Semester Units	16
<b>2<sup>nd</sup> Semester</b>		
CIS 033	Software Architectures and Algorithms	4
MATH 03B	Calculus II	5
PHYS 04A	General Physics with Calculus	5
	2 <sup>nd</sup> Semester Units	14
<b>3<sup>rd</sup> Semester</b>		
CIS 011	Discrete Structures and Logic	4
Restricted Elective Courses		6
General Education Courses		5
	3 <sup>rd</sup> Semester Units	15
<b>4<sup>th</sup> Semester</b>		
CIS 078	Digital Architectures for Computation	4
General Education Courses		5
Restricted Elective Courses		6
	4 <sup>th</sup> Semester Units	15
	<b>Total Units</b>	<b>60</b>

At the end of the document there is a set of 4-Semester Course Completion Patterns showing the recommended course sequence for the Computer Science major and each of the restricted electives.

# MERRITT COLLEGE

# STEM CORE

Will you be a Merritt College Student in Fall 2019?

Interested in Math, Cybersecurity, Computer Science?

Eligible for Math 1 and Trigonometry in the Fall?

Apply to STEM Core!

STEM Core is a cohort-based learning community at Merritt College that seeks to increase the number of students in the field of cybersecurity and computer science. Program participants will take classes together, receive academic counseling, tutoring, intensive math preparation, and a chance to compete in high-quality paid tech internships. Students will explore careers in Cybersecurity and Computer Science and be prepared to transfer to a 4-year computer science program in such as University of California Berkeley, UCLA, Stanford, Cal State East Bay, San Jose and San Francisco States and the like. Women, Veterans and first-generation college students are strongly encouraged to apply.

## STEM CORE PROGRAM BENEFITS

### ACADEMIC & SOCIAL SUPPORT

- Extra tutoring and student support
- Small learning group

### GUARANTEED REGISTRATION FOR ALL STEM CORE COURSES

A.S. Computer Science Calculus Ready		60	A.S. Computer Science Pre-Calculus Ready		60
1st Semester/Fall 2019		15	1st Semester/Fall 2019		15
CIS 7	Introduction to Programming	4	CIS 6	Introduction to Programming	4
ENGL 1A/5	Comp. & Reading/Critical Thinking	4	ENGL 1A/5	Comp. & Reading/Critical Thinking	4
MATH 3A	Calculus I	5	MATH 1	Pre-Calculus	4
	General Education	2	MATH 50	Trigonometry	3
2nd Semester/Spring 2019		14	2nd Semester/Spring 2019		15
CIS 33	Software Architectures and Algorithms	4	CIS 33	Software Architectures and Algorithms	4
MATH 3B	Calculus II	5	MATH 3A	Calculus I	5
PHYS 4A	Gen. Physics with Calculus	5		General Education	6
3rd Semester/Fall 2020		16	3rd Semester/Fall 2020		15
CIS 11	Discrete Structures and Logic	4	CIS 11	Discrete Structures and Logic	4
	General Education	6	MATH 3B	Calculus II	5
	Restricted Electives	6	PHYS 4A	Gen. Physics with Calculus	5
4th Semester/Spring 2021		15	4th Semester/Spring 2021		15
CIS 78	Digital Architectures for Computation	4	CIS 78	Digital Architectures for Computation	4
	General Education	4		General Education	5
	Restricted Electives	7		Electives	6

### FOR MORE INFORMATION

✉ [merritt-stemcore@peralta.edu](mailto:merritt-stemcore@peralta.edu)

☎ (650) 492 8155

🌐 interest form at <https://bit.ly/MerrittSTEMCore> or scan the QR code



### MATH BRIDGE TO CALCULUS

- Complete Precalculus, Trigonometry and Calculus in two semesters
- STEM Core cohorts around the state pass classes at 20-30% higher rates than non-STEM Core students
- Extra tutoring, priority registration, internships limited to STEM Core students

### INTERNSHIP & FIELD TRIPS

- Compete for high quality paid internships at tech and other employers. Field trips to universities, local technology companies and research institutes

### REQUIREMENTS

- Interested in STEM, Cybersecurity and Computer Science
- Full time Merritt College student



## Workforce and Career Opportunities

Graduates of this program who enter the workforce as entry level Software Developer gain access to rewarding jobs and careers. At Merritt, the entry level core skills are enriched by sets of optional restricted electives tailored to specific workforce sectors and job opportunities. These electives enable graduates to compete for positions in which knowledge of the elective subject matter commands a salary premium over baseline compensation. The information below is based on jobs posted on Indeed.com as of 12/2018.

Graduates of the two-year program in Computer Science also meet the qualifications for employment in the California [STEM Core Network](#); a partnership of major scientific/technical employers including NASA and federally funded laboratories, and other employers. Merritt College is a partner in the STEM Core Initiative as well as an awardee in the National Science Foundation Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science ([NSF INCLUDES](#)) initiative. STEM Core Network candidates can start via the Merritt College Computer Science Stem Core Dual Enrollment Program available to Oakland High School students (see page 21)

**Computer Science *and* Cybersecurity** - The Merritt College Computer Science A.S. degree infuses Computer Science competencies with Cybersecurity competencies and is aligned with [curricular guidance](#) from the governing bodies; the Association of Computing Machinery (ACM) and the National Initiative for Cybersecurity Education (NICE). The curriculum is mapped to the nationally defined Knowledge Units (KU) and articulates into four-year programs in both Computer Science and Cybersecurity. Cybersecurity Knowledge Units (KU) and course mappings are published by the National Initiative for Cybersecurity Careers and Studies (NICCS) at <https://niccs.us-cert.gov/training/search/merritt-college>. The curriculum includes instruction in the fundamentals of problem solving and analysis, programming, data structures, and architecture. Additional requirements include Calculus, Physics and Discrete Mathematics. This program takes a contextualized approach to the CS major through the choice of language, C++, and the approach to curriculum subjects. It aims to develop skills in the design and implementation of software that operates correctly at extreme scale. It equips the graduate to select strategies and develop programs that solve complex problems within appropriate constraints such as, time, connectivity, processing, or storage limitations. Students in our Cybersecurity courses have earned national recognition fielding a team that finished #4 in the highest (Gold) bracket of 2017, and #5 in 2018 National Cyber League competition. This merging of Cybersecurity and Computer Science puts Merritt College at the cutting edge of two-year Computer Science programs.

Completing the Computer Science Major without an Optional Workforce Elective prepares you for the role of **Entry Level Software Developer** – A student who does not choose an elective will have the main competencies to develop software as part of a team, for their own business, or for purposes of investigation and invention. They will be able to:

1. Select the appropriate design and implementation to solve a problem within given constraints.
2. Analyze computer architecture to formulate estimates of performance.
3. Explain the fundamentals of a problem-solving approach and analysis.

These competences enable the student to create or interpret software designs, discuss design choices, align their efforts with project goals, and estimate how well the program will perform in the intended computer system. The Entry Level Software Developer has sufficient skill to join a software team and work under the supervision of more senior members. They have the foundation to quickly recognize classes of problems and communicate using appropriate Terms of Art specific to the software domain and contribute to team efficiency and goals.

Entry Level Software Engineer salaries

**\$77,392** per year

Based on 149 salaries



Min

\$26,000

Entry Level Software Engineer salaries

in California

Entry Level software developer					
Salary Est.	# Jobs	Position Types		Location	
\$50,000	160	Full-time	171	San Francisco	18
\$65,000	124	Internship	17	San Jose,	17
\$85,000	94	Temporary	15	California	12
\$100,000	62	Contract	10	Los Angeles	8
\$120,000	33	Part-time	7	San Diego	7
Total		473			

[Source: Indeed.com](https://www.indeed.com) <- click to view

**Elective A – Cybersecurity - Secure Software Developer**

The Secure Software Developer has sufficient skill to join a software team and work under the supervision of more senior members. The elective provides instruction and application of best practices for securing data whether stored (at rest) or in transit. Covers use of public key encryption, secure authentication and authorization (OAUTH), Web Application Penetration testing, and the use of hashes to protect integrity and detect tampering.

Software Engineer salaries in California

**\$119,635** per year

Based on 8,060 salaries



Min

\$40,000

Max

\$241,000

Software Engineer salaries by company in California

Cybersecurity - Secure Software Development					
Salary Est.	# Openings	Position Types		Location	
\$75,000	2824	Full-time	3263	San Francisco	654
\$105,000	2226	Contract	142	San Diego	252
\$120,000	1668	Part-time	87	San Jose	213
\$130,000	1235	Internship	84	Sunnyvale	172
\$145,000	579	Commission	49	Los Angeles	145
Total		Temporary	36		
Total		8532			

[Source: Indeed.com](https://www.indeed.com)

**Elective B Cybersecurity Dev/Sec/Ops**

The Cybersecurity Dev/Sec/Ops Software Developer has completed instruction in Cybersecurity Operations and is prepared to use software **development** skills to implement systems software that automate **security operations** (Dev/Sec/Ops.) They have completed instruction in intrusion detection, systems and network administration, forensics and cloud security. They have taken part in ethical hacking competition which includes practice of skills in network analysis, penetration, and defense.



Cybersecurity - DevOps (Dev/Sec/Ops)							
Salary Est.		# Jobs		Position Types		Location	
\$110,000	105	Full-time	116	Santa Clara	27		
\$125,000	86	Internship	11	San Francisco	20		
\$130,000	70	Contract	6	San Diego	15		
\$140,000	50	Temporary	2	Palo Alto	13		
\$150,000	24	Part-time	1	Sunnyvale	7		
Total		335					

[Source: Indeed.com](https://www.indeed.com)

**Elective C – Blockchain Services and Mobile Applications**

The *Blockchain Services and Mobile Applications Software Developer* has completed instruction in Blockchain – a cryptography based distributed ledger. This technology enables reliable global transactions without intermediaries. The graduate has completed instruction in XML and self-validating documents, cross platform mobile applications development, and implementation of transaction oriented high- performance web services. This enables the graduate to implement an integrated combination of mobile applications and backend services that enables new classes and categories of global applications based on Blockchain technology.



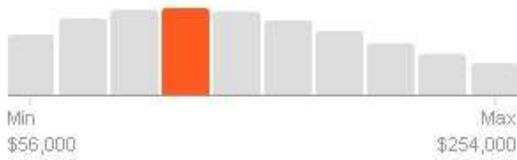
Blockchain Services and Mobile Applications					
Salary Est.	# Jobs	Position Types		Location	
\$95,000	14	Full-time	15	San Francisco	5
\$120,000	11	Internship	1	Los Angeles	3
\$125,000	10	Part-time	1	San Francisco Bay Area	2
\$130,000	5	Temporary	1	Foster City	2
\$135,000	4			Woodland Hills	1
Total		44			
Source: <a href="https://www.indeed.com">Indeed.com</a>					

**Elective D** DevOps for Software Engineering Automation and Continuous Integration

The DevOps – Software Engineering Automation and Continuous Integration Software Developer has instruction in how to automate the build, test, and deployment of software in a Continuous integration (CI) pipeline. They are essential members of a software team, or an independent entrepreneur using automation to streamline their efforts while delivering reliable products. Completing the elective qualifies the graduate to take the [Project Management Institute Agile Certified Practitioner](#)

Development Operations Engineer salaries in California

**\$137,891** per year  
Based on 5,191 salaries



Development Operations Engineer salaries by company in California

DevOps - Software Engineering Automation and Continuous Integration					
Salary Est.	# Jobs	Position Types		Location	
		\$115,000	310	Full-time	355
\$125,000	262	Contract	13	San Diego	41
\$130,000	217	Internship	12	Palo Alto	33
\$140,000	141	Commission	1	San Jose	20
\$145,000	91			Sunnyvale	20
Total		1021			
<a href="https://www.indeed.com">Source: Indeed.com</a>					

**Elective E – High Performance Computing, Data Science, and Artificial Intelligence**

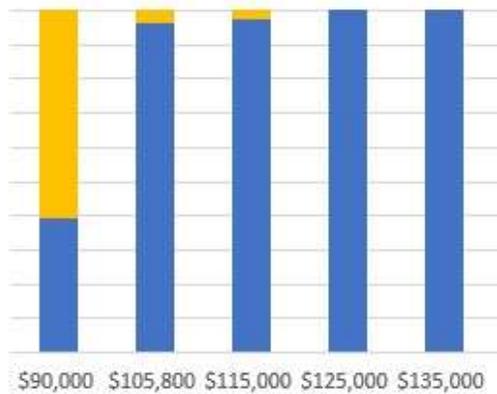
The High-Performance Computing (HPC), Data Science, and Artificial Intelligence (AI) Software Developer has instruction in the use of parallel programming including Graphics Processing Units and cloud computers. They also have instruction in the use of AI Libraries and scripting languages to create systems that learn from data, detect patterns, classify artifacts, and make suggestions.



High Performance Computing, Data Science, and Artificial Intelligence					
Salary Est.	# Jobs	Position Types		Location	
\$90,000	20	Full-time	33	East Palo Alto	10
\$110,000	16	Contract	1	Santa Clara	7
\$130,000	12	Internship	1	Palo Alto	4
\$145,000	8			Sunnyvale	3
\$160,000	4			San Francisco Bay Area	3
Total		60			
Source: <a href="https://www.indeed.com">Indeed.com</a>					

**Elective F Swift Software Development**

The Swift Software Developer writes software that runs on iPhones (iOS), Apple Watch (watchOS), Apple TV (tvOS), and Mac computer (macOS). This elective prepares the graduate to enter the software development workforce having completed instruction in developing software to run on Apple's many platforms. It incorporates instruction in best practices and competencies for the entry level software developer. It incorporates study, analysis, implementation of classic data structures algorithms that lead to applications that perform well within the constraints of the targeted platform. The Swift Software Developer elective will be added to the degree in 2020.



Average: \$114,000

Swift Software Developer						
Salary Est.	# Jobs	Position Types		Location		
\$90,000	373	Full-time	570	Santa Clara Valley	148	
\$105,800	308	Contract	12	San Francisco	124	
\$115,000	246	Internship	7	San Diego	32	
\$125,000	163			Mountain View	25	
\$135,000	82			Los Angeles	23	
Total		1,172				
<a href="https://www.indeed.com">Source: Indeed.com</a>						

## Occupational Demand

A November 2021 report from the [Centers of Excellence for Labor Market Research](#) indicates that there appears to be an “undersupply” of Computer Science workers compared to the demand for this cluster of occupations in the Bay region and in the East Bay sub-region (Alameda, Contra Costa counties). There is a projected annual gap of about 22,082 students in the Bay region and 2,547 students in the East Bay Sub-Region.

**Table 1. Employment Outlook for Computer Science Occupations in Bay Region**

Occupation	2020 Jobs	2025 Jobs	5-yr Change	5-yr % Change	5-yr Total Openings	Annual Openings	25% Hourly Earning	Median Hourly Wage
Computer Systems Analysts	28,583		3,391	12%	15,452	3,090	\$51	\$86
Information Security Analysts	4,636	31,974 5,992	1,356	29%	3,680	736	\$57	\$93
Network and Computer Systems Administrators	12,368	13,879	1,511	12%	6,352	1,270	\$46	\$80
Software Developers and Software Quality Assurance Analysts and Testers	141,472	166,280	24,807	18%	85,491	17,098	\$63	\$101
<b>Total</b>	<b>187,059</b>	<b>218,125</b>	<b>31,066</b>	<b>17%</b>	<b>110,975</b>	<b>22,194</b>		

Source: EMSI 2021.3

**Bay Region includes:** Alameda, Contra Costa, Marin, Monterey, Napa, San Benito, San Francisco, San Mateo, Santa Clara, Santa Cruz, Solano and Sonoma Counties

**Table 4a. Top Job Titles for Computer Science Occupations for latest 12 months (Oct 2020 - Sep 2021) Bay Region**

Title	Bay	Title	Bay
Software Engineer	2,861	Android Developer	525
Senior Software Engineer	2,548	Salesforce Developer	490
Devops Engineer	1,292	Full Stack Developer	487
Java Developer	936	Python Developer	440
Software Engineer - Remote	656	Principal Software Engineer	388
Business Systems Analyst	628	Lead Software Engineer	386
Software Developer	584	Staff Software Engineer	385
Ios Developer	561	Full-Stack Software Engineer	374
Senior Devops Engineer	558	Full Stack Engineer	373

Source: Burning Glass

## Employment, Salary, Economic Impact Multiplier – Merritt College Technology Department Programs

The table below indicates the costs, tuition and fees exclusive of textbook costs of completing the flagship programs available in each the Technology disciplines:

1. Computer Information Systems – DevOps
2. Cybersecurity – Application Security and Infrastructure Security
3. Computer Science – Computer Science Degree

The salary data is provided in a November 2021 Labor Market Report provided by the Centers of Excellence for Labor Market Research. This Labor Market Information (LMI) is required for program approval by the California Community Colleges Chancellor’s Office (CCCCO.) ***The economic impact metric indicates the amount of annual compensation earned for each dollar spent on tuition and fees.*** The employment outlook information provided indicates strong demand: In 2020 there were 141,472 jobs for Software Developers and Software Quality Assurance Analysts and Testers, occupations served by Merritt’s Computer Science and DevOps programs, and 33,219 jobs for Information Security Analysts and Computer Systems Analysts; occupations served by our Cybersecurity programs.

Merritt Technology Disciplines - CIS, Cybersecurity, CS Resident student enrolled in more than 9 units each semester		Technology Department Gainful Employment Information						
Program Name	Type of Award	Num. of Units Sems		Total Program Cost	Job Title	Med. Hourly Wage	Median Annual Salary	Economic Impact Multiplier (Salary/Tuition)
Computer Science	AS	60	4	\$3,008	Software Developer	\$101	\$210,080	70
Computer Science	CA	32	4	\$1,720	Software Developer	\$101	\$210,080	122
Application Security	AS	60	4	\$3,008	Info. Sec. Analyst	\$83	\$172,640	57
Application Security	CA	30	4	\$1,628	Info. Sec. Analyst	\$83	\$172,640	106
Infrastructure Security	AS	60	4	\$3,008	Info. Sec. Analyst	\$83	\$172,640	57
Infrastructure Security	CA	30	4	\$1,628	Info. Sec. Analyst	\$83	\$172,640	106
DevOps (CIS)	AS	60	4	\$3,008	DevOps Engineer	\$67	\$140,000	47
DevOps (CIS)	CA	38	4	\$1,996	DevOps Engineer	\$67	\$140,000	70
Computer Project Management	CA	21	4	\$1,214	Project Manager	\$68	\$141,440	117

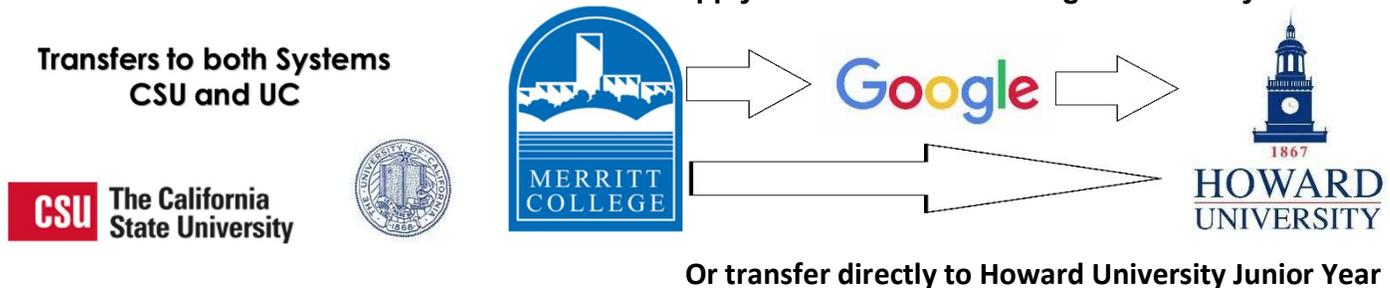
## Transfer Opportunities

Graduates of this program are considered to have completed preparation to transfer to a baccalaureate program in the Computer Science major, or related fields of study. They will have completed instruction in the subjects found in the lower division courses of a Computer Science baccalaureate:

1. Writing programs in an object-oriented language
2. The Implementation and use of abstract data types, libraries, and frameworks.
3. Formal logic, proofs, estimation of algorithm completion, estimates of run time magnitude
4. Machine architecture, assembly language, combinatorial logic, and sequential logic
5. Calculus 1 – Including: Differential Equations, Limits, Theorems
6. Calculus 2 – Including: Definite integrals, Methods of integration, series, parametric equations
7. Physics - Topics including: Motion, forces, gravity, energy, momentum, equilibrium, oscillations

The required major courses are accepted for transfer to the University of California (UC) system, the California State University (CSU) system, Cal Poly systems, and Howard University. [Merritt's participation in the Howard West initiative](#) enables transfer students to apply for a residency with Google as part of their baccalaureate program. Transfer General Education (GE) requirements are different from local GE requirements; see a counselor for specific details. A mapping of transfer courses can be found on Page 20.β

**Transfer into local Bachelor of Science or Apply for Howard West/Google Residency**



## Transfer Preparation

The individual courses in the program are aligned with the Computer Science Transfer Model Curriculum (TMC) and the enumerated C-ID system. Each campus in the UC system and The CSU system makes final determination on what courses fulfill their lower division requirements. Merritt College Computer Science courses have been accepted as fulfilling the lower division courses in both UC and CSU systems. Reports from assist.org indicate 100% of Merritt Computer Science course are accepted into Computer Science Baccalaureate programs for the University of California (UC), California State University (CSU), and California Polytechnic University systems. There are two aspects of transfer to consider:

1. **Q: Course-to-Course transfer** – is a course accepted for transfer into a baccalaureate program in the system? **A:** All courses in Merritt's Computer Science program are accepted for transfer into baccalaureate programs in the UC, CSU, and CalPoly university systems.
2. **Q: Program-to-Program transfer** – is the entire program accepted as fulfilling the first two (2) years of a baccalaureate program?  
**A:** Several campuses accept the Merritt College program as fulfilling the first two years of their Bachelor of Computer Science program.

Program-to-Program Transfer – Fulfillment the Lower Division of Computer Baccalaureate Programs - CSU

**Articulation Agreement by Major**

*Effective during the 2021-2022 Academic Year*

To: California State University, Northridge  
2021-2022 General Catalog, Semester

From: Merritt College  
2021-2022 General Catalog, Semester

**COMPUTER SCIENCE, B.S.**

**TRANSFER IMPACTION**

CSU Northridge is an impacted campus. Refer to impaction information at: [Transfer Impaction](#)

**GENERAL INFORMATION**

**This agreement displays all lower-division courses required in the major:** CSU Northridge courses on the left, approved (articulated) transfer courses to the right. General education (CSU-GE Breadth or IGETC or CSU Northridge GE) and upper-division courses are also required to complete the bachelor's degree.

Completion of all coursework listed in this agreement is not mandatory prior to admission. For CSU Northridge Undergraduate **Admission Requirements**, refer to [Upper Division Transfer](#).

Some coursework may be satisfied by Advanced Placement exams completed in high school. Visit [AP Credit](#) for information. Additional information about the major is available in the [CSUN University Catalog](#).

Questions regarding this agreement may be directed to Jonathan Charres, the CSUN Articulation Officer, by e-mail at: [jonathan.charres@csun.edu](mailto:jonathan.charres@csun.edu)

**COMPUTER SCIENCE - CSU NORTHRIDGE GENERAL EDUCATION**

Engineering and Computer Science majors may benefit by following CSU Northridge GE Plan instead of CSU-GE Breadth or IGETC. Computer Science students are required to take courses in the following CSU GE areas: [CSU Northridge GE](#)

- Oral Communication (3 units) = CSU GE-Breadth Area A1
- Written Communication (3 units) = CSU GE-Breadth Area A2
- Mathematics/Quantitative Reasoning (3 units) = CSU GE-Breadth Area B4
- Arts (3 units) = CSU GE-Breadth Area C1
- Humanities (3 units) = CSU GE-Breadth Area C2
- Social Sciences (6 units) = CSU GE-Breadth Area D
- Comparative Cultural Studies (3 units)
- U.S. History and Government (6 units) = CSU US History, Constitution, and American Ideals

**All other General Education requirements are met through completion of courses in the major. Students applying to majors in the College of Engineering and Computer Science do not need CSU GE-Critical Thinking A3 prior to admission.**

**MINIMUM "C" GRADE REQUIREMENT**

No grade lower than a "C" will be accepted on transfer from another institution to satisfy requirements for the major.

**LOWER DIVISION MAJOR PREPARATION COURSES**

**COMP 110** - Introduction to Algorithms and Programming (3.00)  
--- And ---  
**COMP 110L** - Introduction to Algorithms and Programming Laboratory (1.00)

← **CIS 6** - Introduction to Computer Programming (5.00)  
--- Or ---  
**CIS 7** - Control Structures and Objects (4.00)

**COMP 122** - Computer Architecture and Assembly Language (1.00)  
--- And ---  
**COMP 122L** - Computer Architecture and Assembly Language Lab (1.00)

← **CIS 78** - Digital Architectures for Computation (4.00)

**COMP 182** - Data Structures and Program Design (3.00)  
--- And ---  
**COMP 182L** - Data Structures and Program Design Lab (1.00)

← **CIS 33** - Software Architectures and Algorithms (4.00)

<b>COMP 222</b> - Computer Organization (3.00)	← No Course Articulated
<b>COMP 256</b> - Discrete Structures for Computer Science (3.00) --- And --- <b>COMP 256L</b> - Discrete Structures for Computer Science Lab (1.00)	← <b>CIS 11</b> - Discrete Structures and Logic (4.00)
<b>COMP 282</b> - Advanced Data Structures (3.00)	← No Course Articulated
<b>MATH 150A</b> - Calculus I (5.00)	← <b>MATH 3A</b> - Calculus I (5.00)
<b>MATH 150B</b> - Calculus II (5.00)	← <b>MATH 3B</b> - Calculus II (5.00)
<b>MATH 262</b> - Introduction to Linear Algebra (3.00)	← <b>MATH 3E</b> - Linear Algebra (3.00)
<b>PHIL 230</b> - Introduction to Formal Logic (3.00)	← No Course Articulated

**SELECT ONE OF THE FOLLOWING SCIENCE SEQUENCES**

<b>BIOL 106</b> - Biological Principles I (3.00) --- And --- <b>BIOL 106L</b> - Biology Laboratory I (1.00)	← <b>BIOL 1B</b> - General Biology (5.00)
<b>BIOL 107</b> - Biological Principles II (3.00) --- And --- <b>BIOL 107L</b> - Biology Laboratory II (1.00)	← <b>BIOL 1A</b> - General Biology (5.00)

--- Or ---

<b>CHEM 101</b> - General Chemistry I (4.00) --- And --- <b>CHEM 101L</b> - General Chemistry I Laboratory (1.00)	← <b>CHEM 1A</b> - General Chemistry (5.00)
<b>CHEM 102</b> - General Chemistry II (4.00) --- And --- <b>CHEM 102L</b> - General Chemistry II Laboratory (1.00)	← <b>CHEM 1B</b> - General Chemistry (5.00)

--- Or ---

<b>PHYS 220A</b> - Mechanics (3.00) --- And --- <b>PHYS 220AL</b> - Mechanics Laboratory (1.00)	← <b>PHYS 4A</b> - General Physics with Calculus (5.00)
<b>PHYS 220B</b> - Electricity and Magnetism (3.00) --- And --- <b>PHYS 220BL</b> - Electricity and Magnetism Laboratory (1.00)	← <b>PHYS 4B</b> - General Physics with Calculus (5.00)

**SCIENCE ELECTIVE WITH LAB**

Select 1 Course(s) from the following Course is acceptable if not used previously	
<b>BIOL 106</b> - Biological Principles I (3.00) --- And --- <b>BIOL 106L</b> - Biology Laboratory I (1.00)	← <b>BIOL 1B</b> - General Biology (5.00)

<b>CHEM 101</b> - General Chemistry I (4.00) --- And --- <b>CHEM 101L</b> - General Chemistry I Laboratory (1.00)	← <b>CHEM 1A</b> - General Chemistry (5.00)	
<b>GEOG 101</b> - The Physical Environment (3.00) --- And --- <b>GEOG 102</b> - Physical Geography Laboratory (1.00)	← <table border="1"> <tr> <td> <b>GEOG 1</b> - Physical Geography (3.00)          --- And ---  <b>GEOG 1L</b> - Physical Geography Laboratory (1.00)       </td> </tr> </table>	<b>GEOG 1</b> - Physical Geography (3.00) --- And --- <b>GEOG 1L</b> - Physical Geography Laboratory (1.00)
<b>GEOG 1</b> - Physical Geography (3.00) --- And --- <b>GEOG 1L</b> - Physical Geography Laboratory (1.00)		
<b>GEOG 103</b> - Weather (3.00) --- And --- <b>GEOG 105</b> - Weather Lab (1.00)	← No Course Articulated	
<b>GEOL 101</b> - Geology of Planet Earth (3.00) --- And --- <b>GEOL 102</b> - Geology of Planet Earth Laboratory (1.00)	← <b>GEOL 1</b> - Introduction to Physical Geology (4.00)	
<b>GEOL 110</b> - The Fossil Record of Ancient Life on Earth (3.00) --- And --- <b>GEOL 112</b> - Earth and Life Through Time Lab (1.00)	← No Course Articulated	
<b>PHYS 220A</b> - Mechanics (3.00) --- And --- <b>PHYS 220AL</b> - Mechanics Laboratory (1.00)	← <b>PHYS 4A</b> - General Physics with Calculus (5.00)	

**END OF AGREEMENT**

Program-to-Program Transfer – Fulfillment the Lower Division of Computer Baccalaureate Programs – UC

**Articulation Agreement by Major**

Effective during the 2021-2022 Academic Year

To: University of California, Riverside  
2021-2022 General Catalog, Quarter

From: Merritt College  
2021-2022 General Catalog, Semester

**Computer Science, B.S.**

**GENERAL REQUIREMENTS**

All majors in the Bourns College of Engineering are selective, based on academic preparation and GPA in all transferable coursework, with a minimum GPA of 2.80. This is a baseline GPA for consideration and not a guarantee of admission.

Prior to transfer, a minimum GPA of 2.50 is required for two major-specific course sequences.

Note: Proficiency in C++ is a required prerequisite to UCR's CS141 "Intermediate Data Structures and Algorithms", as well as most other upper division CS courses. Transfer students who complete the equivalent of UCR's CS 10 and 12 but still lack proficiency in C++ may be required to complete a C++ course at UCR or elsewhere, prior to enrolling in upper division courses at UCR.

**AP Exam - Satisfy Course Requirement Section**

**Computer Science: A Exam**

Minimum score of 4 satisfies CS 10A

**Mathematics: AB Exam or AB Subscore from BC Exam**

Minimum score of 3 satisfies MATH 9A or MATH 7A

**Mathematics: BC Exam**

Minimum score of 3 satisfies MATH 9A and MATH 9B or MATH 7A and MATH 7B

Minimum score of 4 satisfies MATH 9A, MATH 9B, MATH 9C or MATH 7A, MATH 7B, MATH 9C

If the sending institution offers honors courses, the articulation for the same course number will be used.

For more information regarding this major and UCR's transfer selection process, please visit [Bourns College of Engineering General Requirements](#).

For information about the UC Transfer Admission Guarantee (TAG) program, please visit [Transfer Admission Guarantee](#).

**IGETC and General Education/Breadth Information**

The Bourns College of Engineering (BCOE) accepts completion of IGETC as satisfying the college's lower division general education/breadth requirements for transfer students. Additional upper division breadth requirements may be required after enrollment in BCOE. Please visit "[GE Areas - Transfer Institution](#)" for the complete list of required GE/Breadth Articulation Agreement. For more information on BCOE breadth requirements, go to [Bourns College of Engineering Breadth Requirements](#). Prospective applicants are strongly encouraged to focus instead on preparatory course work for the major, such as the mathematics, science and other technical preparatory course work listed below, rather than IGETC. Strong technical preparation is essential for success in the admissions process, and subsequently, in all coursework at BCOE.

**LOWER DIVISION MAJOR REQUIREMENTS**

Required for admission  
All courses in this section are required

<p><b>CS 10A</b> - Intro to Computer Science for Science, Mathematics, and Engineering I (4.00)</p> <ul style="list-style-type: none"> <li>An AP exam may be used to satisfy this course requirement</li> </ul>	←	<p><b>CIS 6</b> - Introduction to Computer Programming (5.00)</p>
<p><b>CS 10B</b> - Intro to Computer Science for Science, Mathematics, and Engineering II (4.00)</p>	←	<p><b>CIS 7</b> - Control Structures and Objects (4.00)</p> <p>--- And ---</p> <p><b>CIS 33</b> - Software Architectures and Algorithms (4.00)</p>
<p><b>MATH 9A</b> - First-Year Calculus (4.00)</p> <p>--- And ---</p> <p><b>MATH 9B</b> - First-Year Calculus (4.00)</p> <p>--- And ---</p> <p><b>MATH 9C</b> - First-Year Calculus (4.00)</p> <ul style="list-style-type: none"> <li>An AP exam may be used to satisfy this course requirement</li> </ul>	←	<p><b>MATH 3A</b> - Calculus I (5.00)</p> <p>--- And ---</p> <p><b>MATH 3B</b> - Calculus II (5.00)</p>
<p><b>PHYS 40A</b> - General Physics (5.00)</p>	←	<p><b>PHYS 4A</b> - General Physics with Calculus (5.00)</p>

Select 3 Course(s) from the following

<p><b>CS 11</b> - Intro to Discrete Structures (4.00)</p> <p>Same-As: MATH 11</p>	←	<p><b>CIS 11</b> - Discrete Structures and Logic (4.00)</p>
---	---	---

<b>CS 10C</b> - Intro to Data Structures and Algorithms (4.00)	← No Course Articulated			
<b>CS 61</b> - Machine Organization and Assembly Language Programming (4.00)	← <b>CIS 78</b> - Digital Architectures for Computation (4.00)			
<b>MATH 10A</b> - Calculus of Several Variables (4.00)	← No Course Articulated			
<b>PHYS 40B</b> - General Physics (5.00)	← <table border="1" style="margin-left: 20px;"> <tr> <td><b>PHYS 4A</b> - General Physics with Calculus (5.00)</td> </tr> <tr> <td style="text-align: center;">--- And ---</td> </tr> <tr> <td><b>PHYS 4B</b> - General Physics with Calculus (5.00)</td> </tr> </table>	<b>PHYS 4A</b> - General Physics with Calculus (5.00)	--- And ---	<b>PHYS 4B</b> - General Physics with Calculus (5.00)
<b>PHYS 4A</b> - General Physics with Calculus (5.00)				
--- And ---				
<b>PHYS 4B</b> - General Physics with Calculus (5.00)				
<b>PHYS 40C</b> - General Physics (5.00)	← <b>PHYS 4B</b> - General Physics with Calculus (5.00)			

**STRONGLY RECOMMENDED COURSES**

Recommended	
<b>MATH 31</b> - Applied Linear Algebra (5.00)	← <b>MATH 3E</b> - Linear Algebra (3.00)

**END OF AGREEMENT**

## Course-to-Course Transfer – Baccalaureate Applicable Courses

**ASSIST is best used in combination with seeing a counselor on your campus.** It is intended to help students and counselors work together to establish an appropriate path toward transferring from a public California community college to a public California university.

### CSU Baccalaureate Level Course List - Computer Information Systems Merritt College

Academic Year 2021-2022 Academic Year 2021-2022

#### Computer Information Systems

Course	Title	Semester Units
CIS 1	Introduction to Computer Information Systems	4.00
CIS 5	Introduction to Computer Science	5.00
CIS 6	Introduction to Computer Programming	5.00
CIS 7	Control Structures and Objects	4.00
CIS 8	Introduction to Parallel and Cloud Programming	4.00
CIS 11	Discrete Structures and Logic	4.00
CIS 33	Software Architectures and Algorithms	4.00
CIS 40	Introduction to Data Base Management	4.00
CIS 42	Spreadsheet Applications	4.00
CIS 48NA-TZ	Selected Topics in Computer Information Systems	0.50 - 9.00
CIS 49	Independent Study in Computer Information Systems	0.50 - 5.00
CIS 51	Introduction to Information Technology Project Management	4.00
CIS 52	Cloud Security Fundamentals	3.00

CIS 53	Intrusion Detection In-Depth: Compliance, Security, Forensics and Troubleshooting: Compliance	3.00
CIS 54	IT Security Goals, Strategy, Policy, and Leadership	3.00
CIS 55	Hacker Techniques, Exploits & Incident Handling	3.00
CIS 56	Secure Coding in Java and .NET	3.00
CIS 57	Web Application PEN Testing	3.00
CIS 58	Hacker Guard - Baseline Training for IT Administrators and Operations	3.00
CIS 59	Applications in Information Security	3.00
CIS 60	Computer Forensics Fundamentals	3.00
CIS 62	Introduction to Systems Analysis and Design	3.00
CIS 71	Introduction to Information Systems Security	3.00
CIS 72	Systems and Network Administration	3.00
CIS 73	Networking Concepts	4.00
CIS 78	Digital Architectures for Computation	4.00
CIS 93	Cross Platform Mobile Application Development	4.00
CIS 98	Database Programming with SQL	4.00
CIS 100	Introduction to Blockchain, Cryptocurrencies, and Identity	3.00
CIS 106A	Routing and Switching Networks	3.00
CIS 106B	Scaling Networks	3.00
CIS 106C	Connecting Networks	3.00
CIS 107	Administering Cloud Services and Containers	3.00
CIS 108	Scripting for Systems Automation and Data Analysis	3.00
CIS 110	Information and Communication Technology Essentials	4.00
CIS 178	Build Automation for DevOps and QA	4.00
CIS 179	Agile Software Development and Project Automation	3.00

**END OF LIST**

## CSU Baccalaureate Level Course List (Computer Science)

**Merritt College**

Academic Year 2021-2022

### Computer Science

Course	Title	Semester Units
CS 20	Python Application Programming	3.00
CS 25	Swift Application Programming	4.00
CS 26	Swift Data Structures and Algorithms	4.00
CS 27	Swift Universal Framework Applications	4.00
CS 43	High Performance Web Applications and Services	3.00
CS 60	Applications of Artificial Intelligence and Deep Learning	3.00
CS 80	Software Engineering	3.00

**END OF LIST**



## UC Transfer Course Agreement - Computer Information Systems

Merritt College

Academic Year 2021-2022

### Computer Information Systems

Course	Title	IGETC Areas	Semester Units	UC Areas
CIS 1	Introduction to Computer Information Systems		4.00	
CIS 5	Introduction to Computer Science		5.00	
CIS 6	Introduction to Computer Programming		5.00	
CIS 7	Control Structures and Objects		4.00	
CIS 11	Discrete Structures and Logic		4.00	
CIS 33	Software Architectures and Algorithms		4.00	
CIS 62	Introduction to Systems Analysis and Design		3.00	
CIS 78	Digital Architectures for Computation		4.00	
CIS 93	Cross Platform Mobile Application Development		4.00	
CIS 98	Database Programming with SQL		4.00	
	Effective S2022			
CIS 108	Scripting for Systems Automation and Data Analysis		3.00	
CIS 110	Information and Communication Technology Essentials		4.00	

**END OF LIST**

# UC Transfer Course Agreement (Computer Science)



## Merritt College

Academic Year 2021-2022

This agreement lists courses transferable for unit credit at all UC campuses.

It is based on information from the current California community college catalog and is valid for the academic year indicated at the top of this agreement.

Courses marked with "UC-" will satisfy the five areas of the seven-course requirements:

E = English, M = Math, H = Humanities, B = Behavioral and Social Sciences, S = Biological and Physical Sciences.

### INFORMATION ABOUT UC'S TRANSFERABLE COURSE AGREEMENTS

#### *Honors Course Credit Limitation*

- Duplicate credit will not be awarded for both the honors and the regular versions of a course.
- Credit will be awarded only to the first course completed with a grade of C or better.

#### *Course Repeatability*

- An "ea" after the unit value of a course on this agreement is meant to indicate that the course may be repeated for credit under CCC campus policies.
- Since campus policies on repeatability vary, the "ea" indicator does not guarantee that UC will grant credit for every course that appears multiple times on a student's transcript. See the UC TCA for possible credit limitations.

## Computer Science

Course	Title	IGETC Areas	Semester Units	UC Areas
CS 20	Python Application Programming		3.00	
CS 25	Swift Application Programming Effective S2022		4.00	
CS 26	Swift Data Structures and Algorithms Effective S2022		4.00	
CS 27	Swift Universal Framework Applications Effective S2022		4.00	
CS 43	High Performance Web Applications and Services		3.00	
CS 60	Applications of Artificial Intelligence and Deep Learning		3.00	
CS 80	Software Engineering		3.00	

**END OF LIST**

## Merritt – Howard Transfer Course Mapping – Computer Science Baccalaureate Degree

MERRITT COLLEGE COURSE <i>Rising Juniors/Seniors can take bridge courses Free under Dual Enrollment</i>	MATCHING HOWARD UNIVERSITY COURSE
<b>Summer Bridge to Merritt Computer Science</b>	<b>Summer Bridge to Howard Computer Science</b>
SANKOFA open to all students who desire the nurturing services	
COUN 24 College Success and	
ENGL 1A Composition and Reading	
or	
MATH 203 Intermediate Algebra	
or	
MATH 1 Pre-Calculus with Support Course	
or	
CIS 5 Introduction to Computer Science	
<b>AS Computer Science Major Courses</b> 59	<b>2015 BS Computer Science Major Lower Division</b> 59
CIS 7 Control Structures and Objects	CSCI135 Computer Science I 4
CIS 33 Software Architectures and Algorithms	CSCI136 Computer Science II 3
CIS 11 Discrete Structures and Logic	MATH181 Discrete Structures 3
CIS 78 Digital Architectures for Computation	CSCI354 Computer Science III 3
MATH 3A Calculus I	MATH156 Calculus I 4
MATH 3B Calculus 2	Calculus 2 4
PHYS 4A General Physics with Calculus 1	Science Lec A   Science Lab A 4
	EGPP 101 Intro to Engineering 2
CIS 8 Introduction to Parallel and Cloud Computing Covers Aspects of CSC 201 202 & 363 Does not include: Java, RMI, Web Apps Linux aspects covered in CIS 72	CSCI 363 Large Scale Programmimg 3 CSCI 201 Principles of Software Development 4 CSCI 202 Object Oriented Programming 3 CSCI100 Introduction to Computer Science 2
CIS 72 Systems and Network Administration	CSCI 211 UNIX Lab 1
MATH 3E Linear Algebra	MATH 180 Intro to Linear Algebra 3
<u>Select 1 Required Science Elective</u>	
PHYS 4B General Physics with Calculus 2 incl. Lab	Science Lec B 4
BIOL 1A General Biology incl. Lab	Science Lab B 0
CHEM 1A General Chemistry with Lab	
<b>General Education Courses</b>	<b>General Education Courses</b>
Area 1 - Natural Science <i>Fulfilled by program courses</i>	
Area 2 - Social and Behavioral Science <i>Select one of the courses below</i>	
SPCH 1A Introduction to Speech	SLMC 101 Principles of Speech 3
SPCH 45 Public Speaking	
Area 3 - Humanities	
ENGL 1A Composition and Reading	ENGW Frosh Fall Semester 3
ENGL 5 Critical Thinking in Reading and Writing	ENGW Frosh Spring Semester 3
Area 4 - Language and Rationality <i>Fulfilled by program courses</i>	
Area 5 - Ethnic Studies	
HIST,HUMAN,M/LAT[...]	Non-technical Elective 3

## Completion Patterns for Computer Science Major and Electives

The following patterns reflect a recommended sequence of classes to complete the program in as close to 4 semesters as possible. These represent the planned offerings over 4 semesters that are likely to meet enrollment targets based on faculty availability. They are currently based on starting in the fall as a calculusready freshman. There is a sequence for students who enter at the Pre-calculus ready stage. All students are eligible to participate in the STEM CORE support and success program.

	<b>A.S. Computer Science</b>	60
	<i>Calculus Ready</i>	
<b>1st Semester/Fall</b>		15
CIS 7	Control Structures and Objects	4
ENGL 1A/5	Comp. & Reading/Critical Thinking	4
MATH 3A	Calculus I	5
	General Education	2
<b>2nd Semester/Spring</b>		14
CIS 33	Software Architectures and Algorithms	4
MATH 3B	Calculus II	5
PHYS 4A	Gen. Physics with Calculus	5
<b>3rd Semester/Fall</b>		16
CIS 11	Discrete Structures and Logic	4
	General Education	6
	Restricted Electives	6
<b>4th Semester/Spring</b>		15
CIS 78	Digital Architectures for Computation	4
	General Education	4
	Restricted Electives	7

<b>A.S. Computer Science</b> <i>Pre-Calculus Ready</i>		58
<b>1st Semester/Fall</b>		13
CIS 7	Control Structures and Objects	4
MATH 215	Support for Pre-Calculus	2
MATH 1	Pre-Calculus	4
MATH 50	Trigonometry	3
<b>2nd Semester/Spring</b>		15
CIS 33	Software Architectures and Algorithms	4
MATH 3A	Calculus I	5
	General Education	6
<b>3rd Semester/Fall</b>		15
CIS 11	Discrete Structures and Logic	4
MATH 3B	Calculus II	5
PHYS 4A	Gen. Physics with Calculus	5
	General Education	1
<b>4th Semester/Spring</b>		15
CIS 78	Digital Architectures for Computation	4
	General Education	5
	Electives	6

Elective A Cybersecurity – Secure Software Development

<b>A.S. w/ Secure Software Development</b>		<b>59</b>
<b>1st Semester/Fall</b>		<b>16</b>
CIS 7	Control Structures and Objects	4
ENGL 1A/5	Comp. & Reading/Critical Thinking	4
MATH 3A	Calculus I	5
CIS 71	Intro to Info Systems Security (6wk)	3
<b>2nd Semester/Spring</b>		<b>16</b>
CIS 33	Software Architectures and Algorithms	4
MATH 3B	Calculus II	5
PHYS 4A	Gen. Physics with Calculus	5
	General Education	2
<b>3rd Semester/Fall</b>		<b>16</b>
CIS 11	Discrete Structures and Logic	4
	General Education	6
CIS 59	Applications in Security (6wk)	3
CIS 56	Secure Coding in Java and .NET (6wk)	3
<b>4th Semester/Spring</b>		<b>11</b>
CIS 78	Digital Architectures for Computation	4
	General Education	4
CIS 57	Web Application PEN Testing (6wk)	3

<b>A.S. Computer Science w/ Dev Sec Ops</b>		<b>67</b>
<b>1st Semester/Fall</b>		<b>13</b>
CIS 7	Control Structures and Objects	4
ENGL 1A/5	Comp. & Reading/Critical Thinking	4
MATH 3A	Calculus I	5
<b>2nd Semester/Spring</b>		<b>17</b>
CIS 33	Software Architectures and Algorithms	4
MATH 3B	Calculus II	5
PHYS 4A	Gen. Physics with Calculus	5
<b>Summer</b>	General Education	<b>3</b>
<b>3rd Semester/Fall</b>		<b>16</b>
CIS 11	Discrete Structures and Logic	4
	General Education	9
CIS 72	Systems and Network Administration (6wk)	3
<b>4th Semester/Spring</b>		<b>14</b>
CIS 78	Digital Architectures for Computation	4
CIS 178	Build Automation for DevOps and QA	4
CIS 55	Hacker Tech/ Exploits & Incident Handling (6wk)	3
CIS 60	Computer Forensics (6wk)	3
<b>5th Semester/Fall</b>		<b>7</b>
CIS 53	Intrusion Detection in-Depth (6wk)	3
CIS 52	Cloud Security Fundamentals (6wk)	3
CIS 247	Info. Systems. Skills Challenge - NCL Competition	1

Elective C Blockchain and Mobile Applications

	<b>A.S. w/Blockchain and Mobile Application</b>	60
1st Semester/Fall		15
CIS 7	Control Structures and Objects	4
ENGL 1A/5	Comp. & Reading/Critical Thinking	4
MATH 3A	Calculus I	5
	General Education	2
<b>2nd Semester/Spring</b>		15
CIS 33	Software Architectures and Algorithms	4
MATH 3B	Calculus II	5
PHYS 4A	Gen. Physics with Calculus	5
	General Education	1
<b>3rd Semester/Fall</b>		15
CIS 11	Discrete Structures and Logic	4
CIS 100	Intro. Blockchain, Cryptocurrency, Identit	3
CIS 66	XML Documents and Applications	5
	General Education	3
<b>4th Semester/Spring</b>		15
CIS 78	Digital Architectures for Computation	4
CIS 93	Cross Platform Mobile App. Devlopment	4
CS 43	High Performance Web Apps and Services	3
	General Education	4

## Elective D - DevOps for Software Engineering Automation and Continuous Integration

<b>A.S. w/Software Eng. Automation &amp; CI</b>		<b>64</b>
<b>1st Semester/Fall</b>		<b>16</b>
CIS 7	Control Structures and Objects	4
ENGL 1A/5	Comp. & Reading/Critical Thinking	4
MATH 3A	Calculus I	5
	General Education	3
<b>2nd Semester/Spring</b>		<b>16</b>
CIS 33	Software Architectures and Algorithms	4
MATH 3B	Calculus II	5
PHYS 4A	Gen. Physics with Calculus	5
	General Education	2
<b>3rd Semester/Fall</b>		<b>16</b>
CIS 11	Discrete Structures and Logic	4
CS 20	Python Application Programming	3
CS 80	Software Engineering	3
CIS 51	Intro. To IT Project Management	4
	General Education	2
<b>4th Semester/Spring</b>		<b>16</b>
CIS 78	Digital Architectures for Computation	4
	General Education	5
CIS 178	Build Automation for DevOps and QA	4
CIS 179	Agile Software Management and Project Automation	3

## Elective E - High Performance Computing, Data Science, and Artificial Intelligence

<b>A.S. w/HPC, Data Science, and Artificial Intelligence</b>		<b>64</b>
<b>1st Semester/Fall</b>		<b>15</b>
CIS 7	Control Structures and Objects	4
ENGL 1A/5	Comp. & Reading/Critical Thinking	4
MATH 3A	Calculus I	5
	General Education	2
<b>2nd Semester/Spring</b>		<b>20</b>
CIS 33	Software Architectures and Algorithms	4
MATH 3B	Calculus II	5
PHYS 4A	Gen. Physics with Calculus	5
<b>Summer</b>	General Education	<b>6</b>
<b>3rd Semester/Fall</b>		<b>14</b>
CIS 11	Discrete Structures and Logic	4
CS 20	Python Application Programming	3
MATH 3E	Linear Algebra	3
CIS 98	Database Programming in SQL	4
<b>4th Semester/Spring</b>		<b>15</b>
CIS 78	Digital Architectures for Computation	4
	General Education	4
CIS 8	Intro. To Parallel and Cloud Computing	4
CS 60	Applications of Artificial Intelligence & Deep Learning	3

Elective F – Swift Software Development

<b>A.S. w/ Swift Software Development</b>		46
<b>1st Semester/Fall</b>		15
CIS 7	Control Structures and Objects	4
ENGL 1A/5	Comp. & Reading/Critical Thinking	4
MATH 3A	Calculus I	5
	General Education	2
<b>2nd Semester/Spring</b>		14
CIS 33	Software Architectures and Algorithms	4
MATH 3B	Calculus II	5
PHYS 4A	Gen. Physics with Calculus	5
<b>Summer</b>		
CS 25	Swift Application Programming	3
<b>3rd Semester/Fall</b>		7
CIS 11	Discrete Structures and Logic	4
CS 26	Swift Data Structures and Algorithms	3
<b>4th Semester/Spring</b>		10
CIS 78	Digital Architectures for Computation	4
CIS 27	Swift Universal Framework Applications	3
CIS 247 SMA	Swift Multi-Platform Application Dev.	3

## Start Where You Are Today



Merritt College offers the rare opportunity to learn Computer Science and Cybersecurity from the world's leading industry experts — for a fraction of the cost of bootcamps or 4-year universities. And with the California Promise Grant, first year registration fees are free. Our accredited 2-year program offers a mix of inperson and online learning, allowing students to prepare for a new career while maintaining other obligations. The Cybersecurity program is now in its fourth year of helping students win national competitions and find jobs with top companies. [Your AC Transit EasyPass](#) makes it easy to reach our campus located in the beautiful rolling hills of Oakland, CA. Merritt College welcomes people from all backgrounds to...

### **[Apply and Enroll!](#)**

<http://www.merritt.edu/wp/steps/>

## Mobile Game Programming Sequence

First Person / AR / VR / GPS / Local

Using SF /Oakland/ Bay Area Street Maps and



**UNREAL  
ENGINE**



1. [CIS 6 or 7](#) – Control Structures and Objects
2. [CIS 33](#) – Software Architectures and Algorithms
3. [CIS 93](#) – Cross Platform Mobile Applications

Unreal Engine 4 is a complete suite of game development tools made by game developers – From mobile games to console blockbusters Unreal 4 Engine gives you everything you need to build a [high performance game that runs everywhere](#). **Free** downloads give **all engine features**, the full suite of integrated tools, and **the C++ source code for the entire engine**. You'll find documentation, tutorials and support resources, plus tons of free content, including templates, sample games and complete projects to quickly get on your way to building anything you want! In this course you will **learn the correct set up for your development environment on Windows, Mac, or Linux**. You must provide your own hardware that meets [recommended specifications](#) details can be found at [https://wiki.unrealengine.com/Recommended Hardware](https://wiki.unrealengine.com/Recommended_Hardware) <https://www.unrealengine.com>

