Merritt College Technology Apprenticeship

Swift Software Developer A.S. Degree or Certificate of Achievement,
Mobile Applications Developer A.S. Degree or Certificate of Achievement,
Computer Science A.S. Degree or Certificate of Achievement
CA-DIR Application Developer – Alameda County
DOL Developer O*NET Code: 15-1133.00 RAPIDS Code: 1129CB
in Partnership with
Rightvarsity Technology Workforce Immersion Program
the
Consortium of Information Systems Executives (CISE)
and
East Bay Inter-Agency Training Council (EBIATC)

The Department of Labor (DOL) and California Department of Industrial Relations (DIR) have created opportunities to gain technology skills leading to gainful employment while providing employers with a highly skilled and experienced workforce. Because it is funded and driven by industry's needs, the apprenticeship system provides an effective balance between learning by doing and theoretical instruction.

California's DAS promotes apprenticeship training through the creation of partnerships among industry, labor, education and government. It consults with program sponsors and monitors programs to ensure high standards for on-the-job training (OJT) and supplemental classroom instruction. In collaboration with CISE Merritt has created industry-informed courses and programs that serve as pre-apprenticeship training and Related Technical Instruction (RTI) for several state and federal apprenticeships. Merritt has formed a partnership with Right Varsity Technology Workforce Immersion Program, LLC which holds federal and state apprenticeships in technology. Finally, Merritt is part of the East Bay Inter-Agency Training Council (EB/IATC) – a consortium of government and community-based job and workforce development organizations.

A unique code number is used to verify DOL Apprenticeship holders. The code for our Right Varsity partner is:

2018-72095

CA-DIR apprenticeships are identified and verified online using a URL and Web site.
In this document you will find front matter common to all Merritt-Rightvarsity Apprenticeships such as the service letter establishing Merritt as a Local Education Agency (LEA) for Rightvarsity. Toward the end you will find information specific to implementing the apprenticeship named above. This apprenticeship, whether state (CA-DIR) or federal (DOL), will be aligned with the DOL Competency Based Occupational Framework (CBOF) for apprenticeships. The Work Process Schedule (WPS) is where you add detailed information about specific educational and employer components of the apprenticeship.

 Contact: CourtneyBrown@Peralta.edu

Computer Science Stackable Degree and Certificate Pathways with Apprenticeship and Industry Occupational Certifications

Swift Software Developer (pending)		**BYTE** - **B**elieve in **Y**our **T**echnology **E**ducation recruitment prog.	**GOAL:** Get your first job in Tech
Swift Developer		Student Success and Support	SANKOFA
CA-DIR App Developer			PUENTE
		Community Events Digital Literacy Summer Bridge Coaching Workshops	
Mobile Applications Development (pending)			
CA-DIR App Developer			
DOL Developer			

Computer Science A.S. or CoA	No workforce elective selected	
DOL Developer	ONET Code:	15-1133.00
	RAPIDS Code	1129CB
CA-DIR App Developer		

Computer Science & Information Systems Career Readiness		noncredit program building skills in:
Communication		Resume
Conflict Resolution		Tech Pro
Interview Practice		Reflection

Restricted Workforce Electives		
(A) Secure Software	**(C)** Blockchain	**(D)** Build Autom. & CI
(F) Swift Software Dev	**(E)** HPC/AI/DL	
(B) Dev/Sec/Ops.		
DOL Developer	ONET Code:	15-1133.00
	RAPIDS Code	1129CB
DOL Cybersecurity Technician	ONET Code:	15-1151.00
	RAPIDS Code	1059CB
DOL IT Generalist Apprenticeship	ONET Code:	15-1151.00
	RAPIDS Code	1059CB

Color Key	
Merritt Program	11
Industry Certificate	1
Apprenticeship	5

Contact: CourtneyBrown@Peralta.edu

Merritt Program 1 – Swift Software Development

This is the entry level program for the Software Development pathway. Swift is used to write software that runs on iPhones (iOS), Apple Watch (watchOS), Apple TV (tvOS), and Mac computer (macOS). This certificate prepares the graduate to enter the software development workforce having completed instruction in developing software to run on Apple's many platform. 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.

Upon successful completion of this program, students will be able to:

1. Write software applications that run on more than one platform in the Apple ecosystem.
2. Implement classic computer science algorithms and architectures in Swift.
3. Select designs to meet platform performance constraints.

Career Opportunities

Table 1. Employment Outlook for Swift Software Development Occupations in Bay Region

Occupation	2018 Jobs	2023 Jobs	5-Yr Change	5-Yr % Change	5-Yr Open-ings	Average Annual Open-ings	25% Hourly Wage	Median Hourly Wage
Software Developers, Applications	93,728	114,672	20,944	22%	56,893	11,379	$49.56	$63.43

Source: EMSI 2019.4

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

Degree Requirements:

Required Software Development Courses

Credit Hours: (12 Required)

CIS 007 and	Control Structures and Objects	4
CIS 033 and	Software Architectures and Algorithms	4
CIS 093	Cross Platform Mobile Application Development	4

CIS 006 Accepted in place of CIS 007 through substitution

Required program courses
Credit Hours: (14 Required)

CS 025 and	Swift Application Programming	4
CS 026 and	Swift Data Structures and Algorithms	4
CS 027 and	Swift Universal Framework Applications	4
CIS 247 SMA	Swift Multi-Platform Application Development	2

Contact: CourtneyBrown@Peralta.edu

Optional Program Electives
Credit Hours: (2 - 4 Required)

CS 043	High Performance Web Applications and Services	3
CIS 059	Applications in Information Security	3
CS 060	Applications of Artificial Intelligence and Deep Learning	3
CIS 066	XML Documents and Applications	2
CS 080	Software Engineering	3
CIS 098	Database Programming with SQL	4
CIS 100	Introduction to Blockchain, Cryptocurrencies, and Identity	3
CIS 178	Build Automation for DevOps & QA	4
CIS 179	Agile Software Management and Project Automation	3

Total: 28.000 - 30.000

Based on all available data, there appears to be a significant undersupply of Swift Software Development workers compared to the demand for this cluster of occupations in the Bay region and in the East Bay sub-region (Alameda and Contra Costa Counties). There is a projected annual gap of about 11,329 students in the Bay region and 1,097 students in the East Bay Sub-Region.

Contact: CourtneyBrown@Peralta.edu

Merritt Program 2 – Mobile Application Development

This is the is the second program in the Software Development pathway. It adds more broadly applicable skills for the software development workforce through the addition of restricted electives; a group of courses taken together intended to confer skills responsive to workforce sectors. These include Group A – Blockchain and Web Services, Group B – Build and Test Automation, and Group C – Cloud and Micro Services Integration. These elective groups are also complementary to the Swift Software Development competencies provided in the prior program enhancing the ability of the graduate earlier programs to compete for a promotion, wage gain, or membership in new software teams by extending their skill portfolio. This blending of Information Systems curriculum with Software Development enables the candidate to quickly adapt to new environments or to round out their own entrepreneurial efforts with industry-grade operational skills and training.

Catalog Description

Design and implementation mobile software applications. The use of object oriented programming to simplify implementation of complex designs while mapping into mobile device capabilities and software frameworks such as graphics, gaming, Audio/Visual media, Global Positioning Services (GPS) and digital imaging. Instruction in secure programming practices. Techniques of local and remote data persistence to deliver persistent context and enriched interactive experiences.

Upon successful completion of this program, students will be able to:

1. Prepare a development environment and credentials for program execution on mobile devices.
2. Design and implement an application that fulfills interface test specifications.
3. Build and test mobile applications using automation

Career Opportunities

Table 1. Employment Outlook for Computer Science and Information Systems Occupations in Bay Region

Occupation	2018 Jobs	2023 Jobs	5-Yr Change	5-Yr % Change	5-Yr Open-ings	Average Annual Open-ings	25% Hourly Wage	Median Hourly Wage
Software Developers, Applications	93,728	114,672	20,944	22%	56,893	11,379	$49.56	$63.43
Software Developers, Systems Software	45,844	50,797	4,953	11%	21,810	4,362	$52.81	$67.13
Computer Systems Analysts	29,020	33,519	4,499	16%	15,622	3,124	$43.91	$55.80
Information Security Analysts	3,308	4,372	1,064	32%	2,394	479	$41.35	$55.30
TOTAL	**171,900**	**203,360**	**31,460**	**18%**	**96,718**	**19,344**	**$49.31**	**$62.97**

Source: EMSI 2019.4

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

Degree Requirements:

Contact: CourtneyBrown@Peralta.edu

CIS 007 and	Control Structures and Objects	4
CIS 033 and	Software Architectures and Algorithms	4
CIS 093	Cross Platform Mobile Application Development	4

CIS 6 "Introduction to Programming" accepted for CIS 7 through substitution

Restricted Electives
Credit Hours: (16 Required)

Select one group of restricted electives

Group A - Blockchain and Web Services

Courses in Recommended Sequence

CIS 011 and	Discrete Structures and Logic	4
CIS 066 and	XML Documents and Applications	2
CIS 100 and	Introduction to Blockchain, Cryptocurrencies, and Identity	3
CIS 098 and	Database Programming with SQL	4
CS 043	High Performance Web Applications and Services	3

**MATH 11 accepted as a substitute for CIS 11*

Group B - Build and Test Automation

Courses listed in Recommended Sequence

CIS 072 and	Systems and Network Administration	3
CIS 108 and	Scripting for Systems Automation and Data Analysis	3
CS 080 and	Software Engineering	3
CIS 178 and	Build Automation for DevOps & QA	4
CIS 179	Agile Software Management and Project Automation	3

Group C - Cloud and Micro-Services Integration

CIS 062	Introduction to Systems Analysis and Design	3
CIS 107	Administering Cloud Services and Containers	3
CIS 052	Cloud Security Fundamentals	3
CIS 098	Database Programming with SQL	4
CS 043	High Performance Web Applications and Services	3

Practicum or Occupational Work Experience
Credit Hours: (2 Required)

Practicum: Complete a mobile applications development project.
COPED: Work experience in Mobile Software Development

CIS 247 SMB or	Information Systems - Mobile Application Development	2
COPED 469	Occupational Work Experience	2

Total: 30

Contact: CourtneyBrown@Peralta.edu

Merritt Program 3 – Computer Science

This is the is the third program in the Software Development pathway. It adds the international A.S. in Computer Science – a terminal workforce degree where the graduate can choose from groups of restricted electives that prepare them for specific sectors of the software development workforce.

Catalog Description

Graduates of the Computer Science Associate in Science degree will have the skills required for entry level software development. This degree combines both CTE & Transfer outcomes and integrates entry level skills for software development with curriculum in secure coding, hacking techniques, automation of security operations, and DevOps. This Computer Science degree infuses Computer Science competencies with Cybersecurity competencies and is aligned with curriculum guidance from governing bodies such as 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. 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.

This program also prepares students for transfer to four-year colleges for further study in Computer Science or Cybersecurity, as well as related areas such as Computer Engineering. Students who are interested in transferring after completion of the two-year degree program should consult with the departmental faculty chair, read the "Transfer Information" section of the college catalog, and discuss their plans with their program advisor or counselor. If you wish to substitute one class for another because of specific requirements of the transfer institution you will attend, consult with your articulation counselor. Four-year universities may have additional or different course requirements for completion of lower division courses. The website transfer.assist.org can provide additional information about applicable courses for transfer.

Upon successful completion of this program, students 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 problem solving and analysis.
4. Analyze software design and/or implementation and make suggestions to improve security.
5. Design and Implement software to automate security operations.

Contact: CourtneyBrown@Peralta.edu

Career Opportunities

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

Occupation	2017 Jobs	2022 Jobs	5-Yr Change	5-Yr % Change	5-Yr Open-ings	Annual Open-ings	10% Hourly Wage	Median Hourly Wage
Software Developers, Applications	90,031	109,101	19,070	21%	49,809	9,962	$38.71	$62.17
Computer Systems Analysts	32,292	36,023	3,731	12%	14,442	2,888	$33.25	$53.21
Software Developers, Systems Software	40,880	44,555	3,675	9%	17,045	3,409	$40.33	$65.52
Information Security Analysts	3,569	4,521	952	27%	2,254	451	$29.35	$55.56
Network and Computer Systems Administrators	15,697	17,336	1,639	10%	6,669	1,334	$29.79	$49.09
Total	**182,469**	**211,536**	**29,067**	**16%**	**90,219**	**18,044**	**$37.16**	**$60.08**

Source: EMSI 2018.4

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

Degree Requirements

Required Courses

Credit Hours: (31 - 32 Required)

CIS 006 or	Introduction to Computer Programming	5
CIS 007	Control Structures and Objects	4
CIS 011	Discrete Structures and Logic	4
CIS 033	Software Architectures and Algorithms	4
CIS 078	Digital Architectures for Computation	4
MATH 003A	Calculus I	5
MATH 003B	Calculus II	5
PHYS 004A	General Physics with Calculus	5

MATH 011 accepted as substitute for CIS 011

Restricted Electives

Credit Hours: (12 - 17 Required)

Select one Group of Concentration Electives from the List Below

Cybersecurity - Secure Software Development

Recommended Sequence of Courses

CIS 071	Introduction to Information Systems Security	3
CIS 059	Applications in Information Security	3
CIS 056	Secure Coding in Java and .NET	3
CIS 057	Web Application PEN Testing	3

Contact: CourtneyBrown@Peralta.edu

Cybersecurity - DevOps (Dev/Sec/Ops)

Recommended Sequence of Courses

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

CIS 247 requires participation in one round of Ethical Hacking Competition: National Cyber League (NCL), CyberPatriots, CyberDefenders, or equivalent.

Blockchain Services and Mobile Applications

Recommended Sequence of Courses

CIS 066	XML Documents and Applications	2
CIS 093	Cross Platform Mobile Application Development	4
CIS 100	Introduction to Blockchain, Cryptocurrencies, and Identity	3
CS 043	High Performance Web Applications and Services	3

DevOps - Software Engineering Automation and Continuous Integration

Recommended Sequence of Courses

CIS 051	Introduction to Information Technology Project Management	4
CS 020	Python Application Programming	3
CS 080	Software Engineering	3
CIS 178	Build Automation for DevOps & QA	4
CIS 179	Agile Software Management and Project Automation	3

High Performance Computing, Data Science, and Artificial Intelligence

Recommended Sequence of Courses

CIS 098	Database Programming with SQL	4
MATH 003E	Linear Algebra	3
CIS 008	Introduction to Parallel and Cloud Programming	4
CIS 107 and	Administering Cloud Services and Containers	3
CS 060	Applications of Artificial Intelligence and Deep Learning	3

Swift Software Development

Recommended Sequence of Courses

CS 025 and	Swift Application Programming	4
CS 026 and	Swift Data Structures and Algorithms	4
CS 027 and	Swift Universal Framework Applications	4

Contact: CourtneyBrown@Peralta.edu

CIS 247 SMA Swift Multi-Platform Application Development 3

CIS 247 SMA requires creation of a software application that runs on at least two (2) of the following platforms: iOS, tvOS, watchOS, or macOS

Units that may be double counted for General Education
Credit Hours: (7 Required)

Local Degree General Education (PCCD GE PATTERN)
Credit Hours: (12 Required)

Credit Hours:
Total: 62.000 - 68.000

Contact:
CourtneyBrown@Peralta.edu

MERRITT COLLEGE

Office of Instruction

October 14, 2019

Right Varsity Technologies, LLC
P.O. Box 51616
San Jose, CA 95151

TO WHOM IT MAY CONCERN:

This letter confirms that Merritt College will serve as the Local Education Agency (LEA) for the Rightvarsity Technology Workforce Immersion Apprenticeship Program.

This service will cover the following occupations:

- Application Developer
- Cyber Security Technician
- Helpdesk Technician
- IT Project Manager
- Information Assurance Specialist
- E-Commerce Specialist
- Clinical Document Improvement Specialist
- Health Information Data Analyst
- Health Information Management Business Analyst
- Health Information Management Coder
- Health IT Specialist

The geographic area covered by our service is the State of California. This service meets the requirements of the California Educational Code together with oversight guidelines. This letter does not assure Related and Supplemental Instruction funding.

If you have any questions about the IT Apprenticeship Program please contact Courtney Brown at courtneybrown@peralta.edu.

Sincerely,

David M. Johnson, Ph.D.
Vice President of Instruction
Merritt College

The mission of Merritt College is to enhance the quality of life in the communities we serve by helping students to attain knowledge, master skills, and develop the appreciation, attitudes and values needed to succeed and participate responsibly in a democratic society and a global economy.

The United States Department of Labor

Office of Apprenticeship

Certificate of Registration of Apprenticeship Program

Rightvarsity Technology Workforce Immersion Program

Santa Clara, California

For the Occupations – Application Developer, Helpdesk Technician, Health Information Management, Cyber Security Technician, IT Project Manager, Information Assurance Specialist, E-Commerce Specialist, Health IT Specialist, Health Information Management Business Analyst, Health Information Data Analyst, Clinical Documentation Improvement Specialist

Registered as part of the National Apprenticeship System

in accordance with the basic standards of apprenticeship

established by the Secretary of Labor

September 19, 2018

Date

2018-72095

Registration No.

Secretary of Labor

Administrator, Office of Apprenticeship

State of California
Department of
Industrial Relations

Apprenticeship program information - search results

Follow the link to get the information on the trade or occupation

Data is current as of 02/24/2020

Trade or occupation:	Committee:
Application Developer	Rightvarsity Technology Workforce Immersion Program
Computer Support Specialist/Cybersecurity	California Cybersecurity Apprenticeship Project (Ccap);
Computer Support Specialist/Help Desk-Networking	Able-Disabled Advocacy U.A.C.
Computer Support Specialist-Cyber Security	Able-Disabled Advocacy U.A.C.
Cyber Security Technician	Rightvarsity Technology Workforce Immersion Program
E-Commerce Specialist	Rightvarsity Technology Workforce Immersion Program
Geographic Information System Technician (Gis Technician)	Osceola Consulting Geographic Information System Technician Apprenticeship
Health It Specialist	Rightvarsity Technology Workforce Immersion Program
Helpdesk Technician	Rightvarsity Technology Workforce Immersion Program
Information Assurance	Rightvarsity Technology Workforce Immersion Program


Rightvarsity Technologies, LLC.
Rightvarsity
Tech
SBE
DBE
Certified
MBE
Certified
WBE
Women's Business Enterprise
Presented by
Molly Uzoh, CSSGB, CSM, CISM
https://www.Rightvarsity.com/Workforce/

State of California
Department of
Industrial Relations

Apprenticeship program information - search results detail

Data is current as of 03/12/2020

Trade or occupation:	**Application Developer**
Program length:	24 months
Starting wage:	13.00
Minimum age:	18
Education prerequisites:	High School/Ged/Equivalent
Additional prerequisites:	As identified on the Employer Acceptance Agreement
Physical requirements:	Yes
Exams:	Written Test: Yes Oral Exam: Yes
Additional requirements:	Applicants will be physically capable of performing the essential functic of the apprenticeship program, with or without a reasonable accommodation, and without posing a direct threat to the health and s of the individual or others.
Contact information:	**Rightvarsity Technology Workforce Immersion Program** https://rightvarsity.com/Workforce/ P.O. Box 51616 San Jose, CA 95151
Contact person:	Molly (Mary) Uzoh, Chief Executive Officer
Contact phone / e-mail:	(408) 649-5872 molly@rightvarsity.com
Applications taken:	Continuous
List Type:	Seek Hiring Employer
Veteran Benefits Approved:	No

Using the DOL Competency Based Occupational Framework to Develop an Apprenticeship

A comprehensive CBOF full framework apprenticeship document for the Developer follows this section. The Work Process Schedule included in this CBOF provides an overview of the job functions and competencies an expert peer group deemed to be important to this occupation. The Work Process Schedule in this document can be used directly or modified and used to describe your program content and design as part of your registration application.

	Software DEveloper - Work Progress Schedule (WPS) of Job Function and Education for Apprenticeship Training - Related Technology Instruction (RTI) and On-the-Job Training (OJT)		RTI Course	OJT Course
Job Function	Description - Based on Department of Labor Competency Based Occupational Framework (CBOF) for Apprenticeship	CBOF PAGE #		
1	Participates in and supports the creation of product, platform, and/or software development life cycles by assisting Principal Developer and team with initial determination of applicable specifications, requirements, systems and concepts to produce the desired output.	5	CIS 6, 7, 33	
2	Supports the Principal Developer and team with mapping out requirement specifications, communicates with other key team members	6	CIS 6,7,33	
3	Participates in and supports designing software or platform with the appropriate team	6	CIS 6,7,33	TBD
4	Supports the development and assembly of the software, platform, or product	6,7	CIS 178	
5	Supports testing and debugging; participates in integration and deployment	7	CIS 6,7,33	TBD

For this apprenticeship, training for Job function 3 would be determined by the employer who would enroll the apprentice is vendor-supplied training for the software technology and tele-conference/tele collaboration technology used on site. Similarly, for Job function 5 the employer would enroll the apprentice in vendor-supplied training for the testing harness and issue management software used at the employer's site.
Merritt offers a noncredit career preparatory program "Computer Science and Information Systems Career Readiness" that helps students develop the communication skills to be effective as a Technical Professional in the workforce.

Contact: CourtneyBrown@Peralta.edu

COMPETENCY-BASED OCCUPATIONAL FRAMEWORK FOR REGISTERED APPRENTICESHIP

Developer

ONET Code: 15-1133.00

RAPIDS Code: 1129CB

Created: May 2018

Updated: August 2018

This project has been funded, either wholly or in part, with Federal funds from the Department of Labor, Employment and Training Administration under Contract Number DOL-ETA-15-C-0087. The contents of this publication do not necessarily reflect the views or policies of the Department of Labor, nor does mention of trade names, commercial products, or organizations imply endorsement of the same by the U.S. Government.

For more information, contact:

Diana Elliott, PhD, Senior Research Associate, Urban Institute: delliott@urban.org

Robert Lerman, PhD, Institute Fellow, Urban Institute: rlerman@urban.org

ABOUT THE URBAN INSTITUTE

The nonprofit Urban Institute is dedicated to elevating the debate on social and economic policy. For nearly five decades, Urban scholars have conducted research and offered evidence-based solutions that improve lives and strengthen communities across a rapidly urbanizing world. Their objective research helps expand opportunities for all, reduce hardship among the most vulnerable, and strengthen the effectiveness of the public sector.

Acknowledgements

We would like to thank several contributors for their support in creating this framework. First, we would like to thank the group at Interapt Skills, without whom this product would not have been possible. Specifically, we would like to thank Ankur Gopal, Eric Brinley, Doug Lusco, David Klaphaak, and Alyson Goldberg. In addition, we would like to thank many others who have helped in the creating and vetting of this framework. They include: the team at LaunchCode, particularly David Oberting and Daniel Fogarty; David Fulton from CareerWise Colorado; Leon Miller at Singlebrook Technology; and finally Dave D'orio of the Urban Institute's Web-Development team.

We would like to extend an additional thanks to the following, who had helped provide initial guidance and input on an earlier version of this draft. Specifically, we would like to thank John Gadd, Jon Linowes, Jose Vasquez, Joel Greenberg, Vince Wrencher, Girish Seshagiri, Carl Weisman, Brian Bugh, Mike Tang, and a special thanks to Diane Jones.

Contents

Competency-Based Occupational Frameworks

The Urban Institute, under contract by the U.S. Department of Labor, has worked with employers, subject matter experts, labor unions, trade associations, credentialing organizations and academics to develop Competency-Based Occupational Frameworks (CBOF) for Registered Apprenticeship programs. These frameworks defined the **purpose** of an occupation, the **job functions** that are carried out to fulfill that purpose, the **competencies** that enable the apprentice to execute those job functions well, and the **performance criteria** that define the specific knowledge, skills and personal attributes associated with high performance in the workplace. This organizational hierarchy – Job Purpose – Job Functions – Competencies – Performance Criteria – is designed to illustrate that performing work well requires more than just acquiring discrete knowledge elements or developing a series of manual skills. To perform a job well, the employee must be able to assimilate knowledge and skills learned in various settings, recall and apply that information to the present situation, and carry out work activities using sound professional judgement, demonstrating an appropriate attitude or disposition, and achieving a level of speed and accuracy necessary to meet the employer's business need.

The table below compares the terminology of Functional Analysis with that of traditional Occupational Task Analysis to illustrate the important similarities and differences. While both identify the key technical elements of an occupation, Functional Analysis includes the identification of behaviors, attributes and characteristics of workers necessary to meet an employer's expectations.

Framework Terminology	Traditional Task Analysis Terminology
Job Function- the work activities that are carried out to fulfill the job purpose	Job Duties- roles and responsibilities associated with an occupation
Competency- the actions an individual takes and the attitudes he/she displays to complete those activities	Task- a unit of work or set of activities needed to produce some result
Performance Criteria- the specific knowledge, skills, dispositions, attributes, speed and accuracy associated with meeting the employer's expectations	Sub Task- the independent actions taken to perform a unit of work or activity

Although designed for use in competency-based apprenticeship, these Competency-Based Occupational Frameworks also support time-based apprenticeship by defining more clearly and precisely what an apprentice is expected to learn and do during the allocated time-period.

CBOFs are comprehensive to encompass the full range of jobs that may be performed by individuals in the same occupation. As employers or sponsors develop their individual apprenticeship programs, they can extract from or add to the framework to meet their unique organizational needs.

Components of the Competency-Based Occupational Framework

Occupational Overview: This section of the framework provides a description of the occupation including its purpose, the setting in which the job is performed and unique features of the occupation.

Work Process Schedule: This section includes the job functions and competencies that would likely be included in an apprenticeship sponsor's application for registration. These frameworks provide a point of reference that has already been vetted by industry leaders so sponsors can develop new programs knowing that they will meet or exceed the consensus expectations of peers. Sponsors maintain the ability to customize their programs to meet their unique needs, but omission of a significant number of job functions or competencies should raise questions about whether or not the program has correctly identified the occupation of interest.

Cross-cutting Competencies: These competencies are common among all workers, and focus on the underlying knowledge, attitudes, personal attributes and interpersonal skills that are important regardless of the occupation. That said, while these competencies are important to all occupations, the relative importance of some versus others may change from one occupation to the next. These relative differences are illustrated in this part of the CBOF and can be used to design pre-apprenticeship programs or design effective screening tools when recruiting apprentices to the program.

Detailed Job Function Analysis: This portion of the framework includes considerable detail and is designed to support curriculum designers and trainers in developing and administering the program. There is considerable detail in this section, which may be confusing to those seeking a more succinct, higher-level view of the program. For this reason, we recommend that the Work Process Schedule be the focus of program planning activities, leaving the detailed job function analysis sections to instructional designers as they engage in their development work.

a. Related Technical Instruction: Under each job function appears a list of foundational knowledge, skills, tools and technologies that would likely be taught in the classroom to enable the apprentice's on-the-job training safety and success.

b. Performance Criteria: Under each competency, we provide recommended performance criteria that could be used to differentiate between minimally, moderately and highly competent apprentices. These performance criteria are generally skills-based rather than knowledge-based, but may also include dispositional and behavioral competencies.

Using the Competency-Based Occupational Framework to Develop a Registered Apprenticeship Program

When developing a registered apprenticeship program, the Work Process Schedule included in this CBOF provides an overview of the job functions and competencies an expert peer group deemed to be important to this occupation. The Work Process Schedule in this document can be used directly, or modified and used to describe your program content and design as part of your registration application.

When designing the curriculum to support the apprenticeship program – including on the job training and related technical instruction – the more detailed information in Section 5 could be helpful. These more detailed job function documents include recommendations for the key knowledge and skill elements that might be included in the classroom instruction designed to support a given job function, and the performance criteria provided under each competency could be helpful to trainers and mentors in evaluating apprentice performance and insuring inter-rater reliability when multiple mentors are involved.

Developer Occupational Overview

Occupational Purpose and Context

Entry level developers perform a wide variety of job functions that apply relevant theories, methods, tools, and interpersonal skills to design, build, operate, monitor, and control a software program or series of software programs or systems. Apprentices should have some existing knowledge of computer basics and pose the ability to learn and apply tools specific to an organization's unique requirements. Developers contribute to a diverse set of products depending on the architecture and industry needs defined by each organization. Developers utilize their creativity and critical thinking abilities to solve unique problems as they arise, and to serve as a vital support to an organization's evolving needs.

Potential Job Titles

Developer, Application/ "App" Developer, Software Application Developer, Mobile Application Developer, Software Programmer, Web Developer, Front end developer, Full Stack Developer.

Attitudes and Behaviors

Developers have a high attention to detail and have well developed critical thinking skills to monitor and detect a wide range of environments, products, programs and systems. They understand and welcome the need to be flexible, and they are excited to learn new programs and applications as systems, projects, and priorities evolve. They are effective communicators, resilient and are dedicated to being a team player. They are eager to assist with all phases of the software development life cycle; and they should strive to be dependable resources throughout all aspects of the project cycle. Additionally, depending on the nature of the work, they are also adept in secure software development practices, referring to the NIST standards, to ensure that protection and security are built into the application or platform from conception.

Apprenticeship Prerequisites

Some apprenticeship programs may require apprentices to have prior knowledge of a programming language, development framework or an operating system; or a combination of such. It is important to understand the differences in these types of languages and when to use which. You should refer to your company's existing platforms and systems to learn what languages, frameworks, and operating systems that will be applicable to your work. Some successful applicants that wish to begin in this field would also have a portfolio of prior relevant work. Some apprenticeships require this while some may not.

Occupational Pathways

Developers may work in an entry level position for 1-5 years, a junior-mid level position for another 1-7 years, and ultimately may work toward becoming a senior level Developer or Software Engineer/ Principal Developer. Alternatively, similar pathways may lead to focused junior, mid-level, and senior positions that hone in on specific program or application development, resulting in a Subject Matter Expert aligned with such application. In addition to this, the Developer apprentice may ultimately map into Information Technology project administration and, ultimately Software Project Management. An alternative pathway for a Developer apprentice to map to, would be the Cybersecurity Support Technician apprenticeship program - or another Secure-Software Development position that has critical cybersecurity-focused components.

Certifications, Licensure and Other Credential Requirements

CREDENTIAL	Offered By	Before, During or After Apprenticeship
N/A		

Job Functions

JOB FUNCTIONS	Core or Optional
1. Participate in and support the creation of product, platform, and/or software development life cycles by assisting Principal Developer and team with initial determination of applicable specifications, requirements, systems and concepts to produce the desired output	Core
2. Support the Principal Developer and team with mapping out requirement specifications, communicate with other key team members	Core
3. Participate in and support designing software or platform with the appropriate team	Core
4. Support the development and assembly of the software, platform, or product	Core
5. Support testing and debugging; participate in integration and deployment	Core

Stackable Programs

This occupational framework is designed to link to the following additional framework(s) as part of a career laddering pathway.

STACKABLE PROGRAMS	Base or Higher Level	Stacks on top of
1. Cybersecurity Support Technician	Higher	Developer; For those interested in secure-software development.

Options and Specializations

The following options and specializations have been identified for this occupation. The Work Process Schedule and individual job function outlines indicate which job functions and competencies were deemed by industry advisors to be optional. Work Process Schedules for Specializations are included at the end of this document.

Options and Specializations	Option	Specialization
Web Developer	X	
Application Developer	X	
Software Developer	X	

Levels

Industry advisors have indicated that individuals in this occupation may function at different levels, based on the nature of their work, the amount of time spent in an apprenticeship, the level of skills or knowledge mastery, the degree of independence in performing the job or supervisory/management responsibilities. These levels may differ by worksite and can be seen as a path for career advancement depending on the occupation and specialization.

Level	Distinguishing Features	Added Competencies	Added Time Requirements
1	Junior Level Developer		
2	Mid-Level Developer		
3	Principal Developer		

Work Process Schedule

WORK PROCESS SCHEDULE **Developer**		**ONET Code: 15-1133.00** **RAPIDS Code: 1129CB**
JOB TITLE: Developer		
LEVEL: 1	**SPECIALIZATION: N/A**	
STACKABLE PROGRAM ___yes _____no		
Company Contact: Name		
Address:	**Phone**	**Email**
Apprenticeship Type: **_____Competency-Based** **_____Time-Based _____Hybrid**	**Prerequisites**	

JOB FUNCTION 1: Participates in and supports the creation of product, platform, and/or software development life cycles by assisting Principal Developer and team with initial determination of applicable specifications, requirements, systems and concepts to produce the desired output

Competencies	Core or Optional	RTI	OJT
A. Participates in the implementation of development life cycles and specifications, including supporting of mapping out work plans, under supervision	Core		
B. Supports the creation of tools and languages needed per output in the work plan, under supervision	Core		
C. Participates in supporting Principal Developer to establish overall project goals with senior and other key team members primarily, as well as any external project members, as applicable	Optional		
D. Supports project team members with team consultations that determine end product's feasibility in economic, operational, and technical areas	Core		
E. Assists with offering and applicating technical and	Optional		

cost-effective approaches for mitigating risks at the end result, under direction from Principal Developer; and communicates any potential questions or concerns based on preliminary assessments			
JOB FUNCTION 2: Supports the Principal Developer and team with mapping out requirement specifications, communicates with other key team members			
Competencies	Core or Optional	OJT	RTI
A. Coordinates with the Project Manager to communicate desired requirements and objectives clearly to other team members such as the UX team, QA testers, etc.	Core		
B. Ensures proper use of desired Software Requirement Specification (SRS), and clearly defines and documents the product requirements, under supervision	Core		
C. Supports the team/ QA testers in preliminary quality assurance requirements assessments & potential risk assessments, under supervision	Core		
JOB FUNCTION 3: Participates in and supports designing software or platform with the appropriate team			
Competencies	Core or Optional	OJT	RTI
A. Supports the UX team, or appropriate team members, with software design and structure of the software as it relates to implementation, its data models, interfaces between system components, and if applicable, the algorithms used, under supervision	Core		
B. Participates in the identification and development of the best prototype suited for the project, if any; supports identification of appropriate languages, operating systems, and monitoring methods applicable for the final program	Optional		
JOB FUNCTION 4: Supports the development and assembly of the software, platform, or product			
Competencies	Core or Optional	OJT	RTI
A. Applies best practices to the company-specific source code management processes	Core		

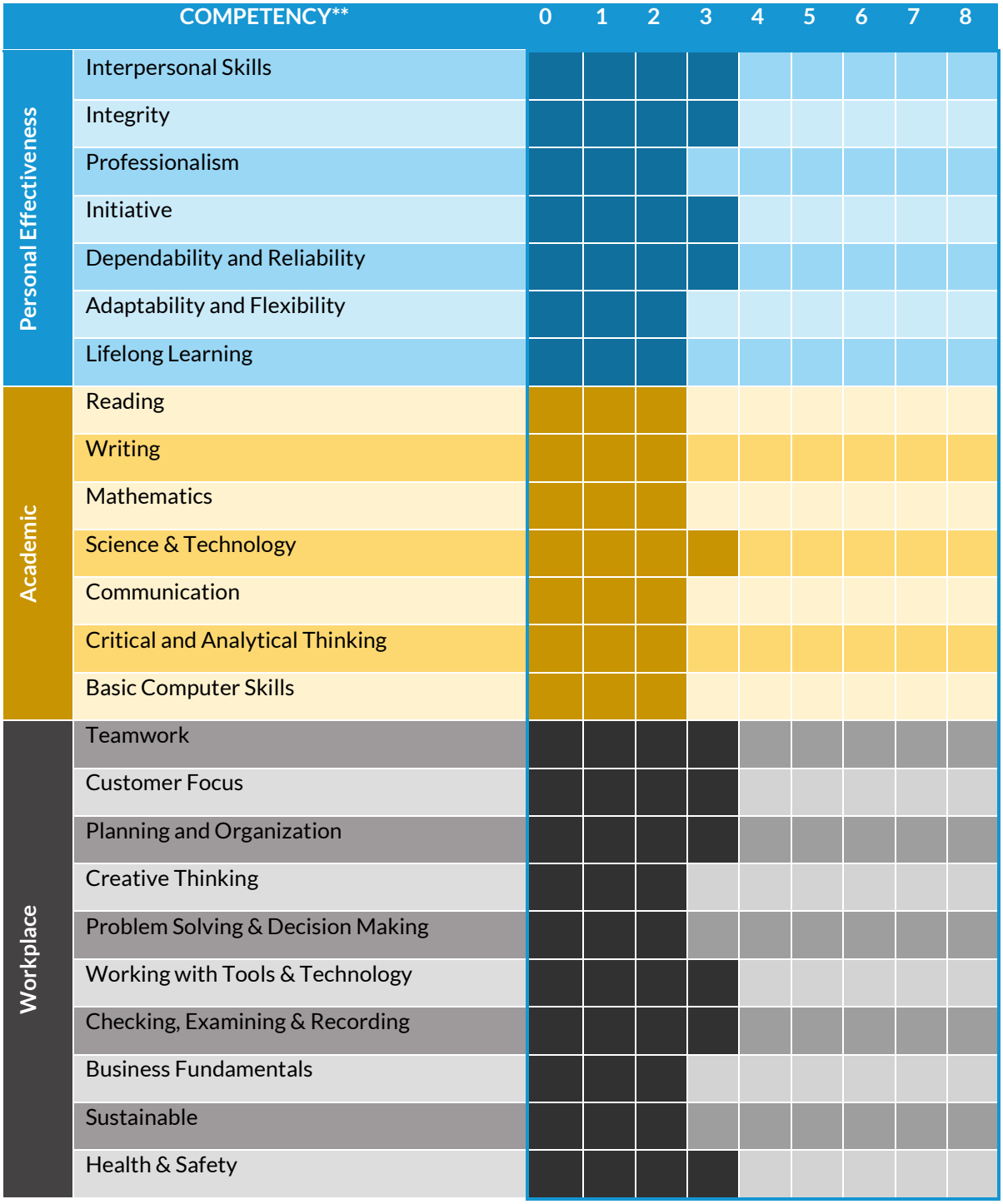
B. Continues to support identifying program and project changes or newfound needs as the software or system is formed, apply such project changes or needs effectively under direction from Principal Developer or applicable team members	Core		
C. Participates in building the program using the appropriate languages and/or applicable development methods	Core		

JOB FUNCTION 5: Supports testing and debugging; participates in integration and deployment			
Competencies	Core or Optional	OJT	RTI
A. Participates in recognizing concepts to determine CI/CD configuration, supports building and applying CI/ CD integrations for manual and/or automated functionalities	Core		
B. Supports application of prototyping methods, if applicable	Core		
C. Supports close monitoring to identify issues and reports them in a clear and concise way to senior team members	Core		
D. After issue is reported, clearly tracks and works with team to fix, and re-test until quality standards are met	Core		
E. Makes extensive, detailed notes when any changes are made and/or to clarify why a function must remain the same in a clear way for other team members	Core		
F. Participates in curating implementation preparation documents and plans	Optional		
G. Supports integration and test phase, properly notes progress relevant to project success	Core		
H. Participates in ongoing monitoring of platform, software, or application under project requirements, and supports with providing maintenance, troubleshooting assistance, and applies problem solving capabilities as applicable, under supervision	Core		

Related Technical Instruction Plan

COURSE NAME	**Course Number**
	Hours
LEARNING OBJECTIVES	
COURSE NAME	Course Number
	Hours
LEARNING OBJECTIVES	

Cross-Cutting Competencies



**Cross-cutting competencies are defined in the Competency Model Clearinghouse: https://www.careeronestop.org/CompetencyModel/competency-models/building-blocks-model.aspx Cross-Cutting Competencies identify transferable skills – sometimes called "soft skills" or "employability skills" – that are important for workplace success, regardless of a person's occupation. Still, the relative importance of specific cross-cutting competencies differs from occupation to occupation. The Cross-Cutting Competencies table, above, provides information about which of these competencies is most important to be successful in a particular occupation. This information can be useful to employers or intermediaries in screening and selecting candidates for apprenticeship programs, or to pre-apprenticeship providers that seek to prepare individuals for successful entry into an apprenticeship program.

The names of the cross-cutting competencies come from the U.S. Department of Labor's Competency Model Clearinghouse and definitions for each can be viewed at https://www.careeronestop.org/CompetencyModel/competency-models/building-blocks-model.aspx

The scoring system utilized to evaluate the level of competency required in each cross cutting skill aligns with the recommendations of the Lumina Foundation's Connecting Credentials Framework. The framework can be found at: http://connectingcredentials.org/wp-content/uploads/2015/05/ConnectingCredentials-4-29-30.pdf

Detailed Job Functions

JOB FUNCTION 1: Participates in and supports the creation of product, platform, and/or software development life cycles by assisting Principal Developer and team with initial determination of applicable specifications, requirements, systems, and concepts to produce the desired output

Related Technical Instruction		
KNOWLEDGE	**SKILLS**	**TOOLS & TECHNOLOGIES**
• Development life cycles • Risk mitigation principles • Programming languages • Application of software tools	• Goal setting/developing work plans • Communication • Logic and the ability to think critically about tradeoffs	• Software to support coding and product development

Competency A: Participates in the implementation of development life cycles and specifications, including supporting of mapping out work plans, under supervision	Core or Optional
PERFORMANCE CRITERIA	
1. Contributes to the selection of a life cycle process model	Core
2. Installs and uses the appropriate tools for a project's designated life cycle model	Core
3. Conducts process activities in a life cycle process model script	Core
4. Contributes to the development of a project's work plan	Core

Competency B: Supports the creation of tools and languages needed per output in the work plan, under supervision	Core or Optional
PERFORMANCE CRITERIA	
1. Identifies the appropriate tools and programming languages necessary to carry out a work plan	Core
2. Contributes to the development of the tools and programming languages needed to execute a work plan	Core
Competency C: Participates in supporting Principal Developer to establish overall project goals with senior and other key team members primarily, as well as any external project members, as applicable	**Core or Optional**
PERFORMANCE CRITERIA	
1. Identifies both long-term goals of a project and the intermediate goals needed to achieve those goals	Optional
2. Communicates effectively with all team members and external stakeholders	Core
3. Works collaboratively with senior and other key team members as well as appropriate external stakeholders	Core
Competency D: Supports project team members with team consultations that determine end product's feasibility in economic, operational, and technical areas	**Core or Optional**
PERFORMANCE CRITERIA	
1. Uses cost-benefit analysis to determine the economic feasibility of a product	Core
2. Determines the operation feasibility of a product by considering the tools, skills, and processes needed to maintain its application	Core
3. Identifies the potential limitations of the technologies involved in a project and determines viable alternatives	Core

Competency E: Assists with offering and applicating technical and cost-effective approaches for mitigating risks at the end result, under direction from Principal Developer; and communicates any potential questions or concerns based on preliminary assessments	Core or Optional
PERFORMANCE CRITERIA	
1. Installs and uses appropriate tools for implementing, managing, and measuring software processes	Core
2. Collects data for software process assessments	Core
3. Analyzes process assessment data and implements improvement of software processes	Core
4. Creates and verifies preliminary hazard lists	Core
5. Uses software tools to build safety models	Core
6. Identifies safety requirements	Core
7. Implements design solutions to assure that the hazards are mitigated and the safety requirements are met	Core
8. Implements large code components and their interfaces using safe coding practices	Core
9. Collects safety QM data and reports the project status	Core

JOB FUNCTION 2: Supports the Principal Developer and team with mapping out requirement specifications, communicates with other key team members

Related Technical Instruction		
KNOWLEDGE	**SKILLS**	**TOOLS & TECHNOLOGIES**
• Internal and external product standards and requirements • Understanding of Software Requirement Specifications • Quality assurance methods • Programming languages • Application of software tools • Survey writing and requirement elicitation tools	• Clear written documentation and record keeping • Communication with team members and external partners • Writing code • Listening and interpreting	• Software to support coding and product development

Competency A: Coordinates with the Project Manager to communicate desired requirements and objectives clearly to other team members such as the UX team, QA testers, etc.	**Core or Optional**
PERFORMANCE CRITERIA	
1. Identifies and engages stakeholders, under supervision, to determine needs and requirements	Core
2. Prepares surveys and other requirements elicitation tools	Core
3. Conducts domain analysis and selects the most appropriate domain analysis methods	Core
4. Develops requirements that ensure consistency with internal and external standards	Core
5. Clearly communicates results and suggestions to team members	Core

Competency B: Ensures proper use of desired Software Requirement Specification (SRS), and clearly defines and document the product requirements, under supervision	Core or Optional
PERFORMANCE CRITERIA	
1. Ensures the appropriate use of the Software Requirement Specification	Core
2. Develops documentation including descriptions of interfaces and requirements	Core
3. Selects the appropriate notations for describing interfaces and requirements	Core
4. Clearly records the product requirements using the appropriate documentation and notations	Core
Competency C: Supports the team/ QA testers in preliminary quality assurance requirements assessments & potential risk assessments, under supervision	**Core or Optional**
PERFORMANCE CRITERIA	
1. Identifies the quality characteristics of a product	Core
2. Ensures that product-quality goals are achieved	Core
3. Collects quality metrics and prepares quality documentation to be distributed to appropriate stakeholders	Core
4. Performs tradeoff analysis of requirements activities	Core
5. Identifies security risks and creates requirements that capture security issues	Core
6. Models threats and associated risks of new systems	Core

JOB FUNCTION 3: Participates in and supports designing software or platform with the appropriate team

Related Technical Instruction		
KNOWLEDGE	**SKILLS**	**TOOLS & TECHNOLOGIES**
• Programming languages • Application of software tools • Understanding of software design structure • Understanding of software data models, system components, and algorithms • Understanding of prototype creation and application	• Clear written documentations and record keeping • Collaborative work • Problem solving and logic • Writing code • Listening and interpreting	• Software to support coding and product development

Competency A: Supports the UX team, or appropriate team members, with software design and structure of the software as it relates to implementation, its data models, interfaces between system components, and if applicable, the algorithms used, under supervision	**Core or Optional**
PERFORMANCE CRITERIA	
1. Selects the appropriate design methodology and strategies	Core
2. Applies enabling techniques in the design of software components	Core
3. Evaluates the effectiveness of the application of software design enabling techniques	Core
4. Applies appropriate design techniques in the areas of concurrency, event handling, data persistence, or distributed software	Core
5. Applies exception handling and fault tolerance techniques in the design of software components	Core
6. Uses restructuring and refactoring methods in the design of software components	Core
7. Contributes to architectural design tasks associated with use of standard notations, diagramming techniques, models, and patterns	Core

Competency B: Participates in the identification and development of the best prototype suited for the project, if any; supports identification of appropriate languages, operating systems, and monitoring methods applicable for the final program	Core or Optional
PERFORMANCE CRITERIA	
1. **Develops and uses prototypes to evaluate software design quality**	Core
2. **Selects appropriate tools and techniques to ensure a software design's quality**	Core
3. **Selects appropriate languages and tools for software development**	Core
4. **Selects appropriate frameworks, platforms, and environments for software development**	Core

JOB FUNCTION 4: Supports the development and assembly of the software, platform, or product

Related Technical Instruction		
KNOWLEDGE	**SKILLS**	**TOOLS & TECHNOLOGIES**
• Programming languages • Code logic • Application of software development tools • Source code management and version control • Understanding of internal and external coding standards	• Writing code • Logic and problem solving • Listening and interpreting • Clear written documentations and record keeping • Collaborative work	• Software to support coding and product development

Competency A: Applies best practices to the company-specific source code management processes	**Core or Optional**
PERFORMANCE CRITERIA	
1. Ensures source code management adheres to company-specific best practices	Core
2. Uses standard tools and processes for version control and configuration management	Core
Competency B: Continues to support identifying program and project changes or newfound needs as the software or system is formed, apply such project changes or needs effectively under direction from Principal Developer or applicable team members	**Core or Optional**
PERFORMANCE CRITERIA	
1. Evaluates the effectiveness of the application of the software design methods	Core
2. Identifies design alternatives and conducts trade-off analysis	Core
3. Facilitates software design reviews	Core
4. Implements static analysis tasks to evaluate design quality	Core
5. Uses result of quality evaluation activities to assess design quality and implement changes as needed	Core

Competency C: Participate in building the program using the appropriate languages and/or applicable development methods	Core or Optional
PERFORMANCE CRITERIA	
1. Applies the designated strategy and methodology to build a program	Core
2. Develops code to implement detailed design	Core
3. Refactors code as needed	Core
4. Applies project and organization standards to code	Core
5. Uses appropriate design patterns	Core
6. Uses defensive coding techniques to minimize errors and threats	Core
7. Thoroughly comments code to support software maintenance	Core

JOB FUNCTION 5: Supports testing and debugging; participates in integration and deployment

Related Technical Instruction		
KNOWLEDGE	**SKILLS**	**TOOLS & TECHNOLOGIES**
• Understanding of CI/CD integration • Understanding of prototype application • Programming languages • Application of software tools	• Writing code • Logic and problem solving • Clear written documentation and record keeping • Listening and interpreting • Clear written documentations and record keeping • Collaborative work • Customer service	• Software to support coding and product development

Competency A: Participates in recognizing concepts to determine CI/CD configuration, supports building and applying CI/ CD integrations for manual and/or automated functionalities	**Core or Optional**
PERFORMANCE CRITERIA	
1. **Determines CI/CD configuration of a product**	Core
2. **Uses the appropriate concepts to build and apply CI/CD integrations for both manual and automated functionalities**	Core
Competency B: Supports application of prototyping methods, if applicable	**Core or Optional**
PERFORMANCE CRITERIA	
1. **Applies prototyping methods to support testing and debugging**	Core
2. **Uses the appropriate languages and operating systems when testing**	Core
3. **Captures and clearly communicates the results of testing suing prototyping methods**	Core
4. **Uses the results of testing to make changes to software as needed**	Core
Competency C: Supports close monitoring to identify issues and reports them in a clear and concise way to senior team members	**Core or Optional**
PERFORMANCE CRITERIA	

1. Gathers measures of code quality and size	Core
2. Creates and conducts unit tests for all code, adhering to project standards	Core
3. Achieves test coverage goals that meet project and organization standards	Core
4. Implements software maintenance processes and plans	Core
5. Monitors and analyzes software maintenance activities	Core
6. Clearly documents and communicates results of tests and monitoring to team members	Core
Competency D: After issue is reported, clearly tracks and works with team to fix, and re-test until quality standards are met	**Core or Optional**
PERFORMANCE CRITERIA	
1. Creates documentation in accordance with the quality management plan	Core
2. Conducts root cause analysis and assessment of review effectiveness	Core
3. Identifies necessary corrections in order to achieve product improvement	Core
4. Collects quality data under statistical control	Core
5. Works collaboratively with team members to implement documentation and improvement processes	Core
Competency E: Makes extensive, detailed notes when any changes are made and/or to clarify why a function must remain the same in a clear way for other team members	**Core or Optional**
PERFORMANCE CRITERIA	
1. Develops standards for documentation	Core
2. Clearly documents and tracks changes to software functions or code	Core
3. Effectively communicates the decision-making processes for changes to software functions or code	Core
Competency F: Participates in curating implementation preparation documents and plans	**Core or Optional**
PERFORMANCE CRITERIA	
1. Develops the criteria for unit test execution completion (e.g., code coverage, defect intensity)	Core
2. Creates unit test plans using the appropriate techniques	Core
3. Establishes criteria for demonstration readiness	Core
4. Develops demonstration test plan using the appropriate techniques	Core

5. Sets the criteria for test completion (e.g., defect arrival rate, defect intensity)	Core
6. Develops criteria for regression testing (e.g. defect density)	Core
7. Designs the necessary setup for testing and demonstration	Core
8. Creates appropriate documentation standards and uses them to track testing progress and outcomes	Core
Competency G: Supports integration and test phase, properly notes progress relevant to project success	**Core or Optional**
PERFORMANCE CRITERIA	
1. Conducts integration testing as part of the integration process	Core
2. Sets up build-and-install environments for software package integration	Core
3. Installs integration tools	Core
4. Creates code inspection packages	Core
5. Schedules code inspections	Core
6. Performs manual test activities (e.g., data entry, test case execution)	Core
7. Monitors customer feedback for product improvement during demonstrations	Core
8. Collects appropriate data associated with test execution	Core
9. Evaluates test execution results and identifies appropriate improvements	Core
Competency H: Participates in ongoing monitoring of platform, software, or application under project requirements, and supports with providing maintenance, troubleshooting assistance, and applies problem solving capabilities as applicable, under supervision	**Core or Optional**
PERFORMANCE CRITERIA	
1. Works collaboratively with other team members in development activities	Core
2. Applies problem solving and critical thinking skills to troubleshoot assistance	Core
3. Collects operational data	Core
4. Diagnoses and responds to reported software defects, anomalies, and operational incidents and events	Core
5. Performs operational software configuration management and assurance	Core
6. Updates software technologies to maintain currency	Core

STATEMENT OF INDEPENDENCE

The Urban Institute strives to meet the highest standards of integrity and quality in its research and analyses and in the evidence-based policy recommendations offered by its researchers and experts. We believe that operating consistent with the values of independence, rigor, and transparency is essential to maintaining those standards. As an organization, the Urban Institute does not take positions on issues, but it does empower and support its experts in sharing their own evidence-based views and policy recommendations that have been shaped by scholarship. Funders do not determine our research findings or the insights and recommendations of our experts. Urban scholars and experts are expected to be objective and follow the evidence wherever it may lead.

2100 M Street NW
Washington, DC 20037

www.urban.org