



RESEARCH REPORT

Apprenticeship Comes to Campus

A Playbook for Building a Consortium-Driven Degree-Based Apprenticeship

Rayanne Hawkins

John Marotta

Myca San Miguel

Jacqueline Rayfield

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Contents

Acknowledgments	iv
Apprenticeship Comes to Campus	1
Why Was a HBCU Consortium-Driven Degree-Based Apprenticeship Needed?	1
A Step-By-Step Guide to Creating a Degree-Based Registered Apprenticeship Consortium	4
Technical Assistance Is Critical for Success	12
What Can You Do to Bring Apprenticeship to Your Campus?	13
Appendix A. Work Process Schedule	15
Appendix B. Roles and Responsibilities	24
Appendix C. Curriculum Crosswalk	27
Notes	28
About the Authors	29
Statement of Independence	30

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Apprenticeship Comes to Campus

Preparing graduates to be strong applicants in a competitive job market has become an increasingly important goal for university administrators, faculty, and staff. Expanding apprenticeship to nontraditional industries and occupations has been a key focus of the workforce system for nearly a decade. Many industries, including information technology (IT), are grappling with the consequences of economic inequality and the responsibility to be more equitable and inclusive in their hiring and operations.

Amid these trends and forces, a consortium of South Carolina historically Black colleges and universities (HBCUs), the Urban Institute, and businesses forged an innovative collaboration. The HBCU consortium developed and launched a degree-based apprenticeship program in secure software development. The program will empower students to gain meaningful paid work experience while they advance toward a degree, link employers to a diverse and often-overlooked pool of promising talent, and serve as an example throughout the workforce and education systems for bridging the gap between the classroom and workplace. This playbook is for postsecondary institutions that want to replicate this consortium model and launch degree-based apprenticeships that create rewarding opportunities for students.

Why Was a HBCU Consortium-Driven Degree-Based Apprenticeship Needed?

The Urban Institute and partners at South Carolina State University (SCSU) began laying the foundation for a degree-based apprenticeship program in 2020 to address the lack of workforce diversity in tech and low recruitment of students from HBCUs into the industry. Despite the tech industry's innovative and forward-thinking reputation, its workforce is characterized by significant representational disparities across race, gender, and ethnicity. With an IT workforce that's only 25.2 percent female and 17.5 percent Latinx or Black, leaders in tech are eager to adopt solutions to diversify their workforce.¹

Degree-based apprenticeships are distinct and valuable because HBCUs and other minority-serving institutions (MSIs) are producing high-caliber computer science and information technology (IT) students eager to excel in their chosen field, but firms need help connecting with them. The HBCU apprenticeship consortium addresses diversity and inclusion by creating a pipeline for talented computer science and IT majors in HBCUs and other MSIs to enter fast-growing tech occupations.

Officially launched in late 2021, the HBCU consortium-driven degree-based apprenticeship is innovative on several fronts. First, this apprenticeship program culminates with a computer science–related bachelor’s degree for apprentices. This helps remove multiple barriers for underrepresented students of color to enter tech occupations. Tech employers often seek to hire entry-level software engineers with four-year degrees and often prefer candidates with one-to-three years of experience.² With a degree and portfolio of work, apprentices will be stronger applicants in the face of pervasive biases in the labor market and are more likely to have career success beyond their apprenticeship.

Second, the earnings apprentices make during their apprenticeship program, as well as the potential for tuition help from their employers, can counter financial pressures that many underrepresented students face.³ This helps them persist through their programs and complete a degree, minimizing their student debt overall.

Finally, this model is a joint employer-college partnership, meaning that the training students receive—called related technical instruction (RTI) in registered apprenticeship programs—is based on a rigorous competency-based academic and on-the-job training (OJT) plan vetted by multiple computer science and IT departments as well as employers. This partnership has produced a high-quality training program and standards.

BOX 1

What Is the Apprenticeship Expansion and Modernization Fund Initiative?

The US Department of Labor (DOL) launched the Apprenticeship Expansion and Modernization Fund (AEMF) initiative to support national intermediaries that provide foundational and tailored outreach and technical assistance to prospective and current registered apprenticeship program sponsors and other stakeholders to facilitate the development, implementation, and growth of registered apprenticeship programs.^a The Urban Institute was one of three awardees selected to implement innovative AEMF efforts. Urban’s AEMF project has provided employers with important services to prepare them for hosting registered apprenticeship programs.

Technical assistance ranges from answering intermittent questions to longer-term, one-on-one work, including working with employers to select occupations and develop the training plans, connecting employers with community colleges and other organizations for recruiting and training apprentices, supporting employers in registering programs, and providing modest funding to help employers offset costs related to training and mentoring apprentices.^b Since 2019, Urban’s efforts on the AEMF project have helped more than 2,000 apprentices enter programs, supported the launch of 21 new programs, and provided more than 400 distinct technical assistance activities to employers, sponsors, and other stakeholders.

^a“Apprenticeship Expansion and Modernization Fund,” US Department of Labor, accessed April 25, 2022, <https://www.apprenticeship.gov/investments-tax-credits-and-tuition-support/apprenticeship-expansion-and-modernization-fund>.
^b“Apprenticeship Expansion and Modernization Fund Project,” Urban Institute, accessed April 25, 2022, <https://www.urban.org/apprenticeship-expansion-and-modernization-fund-project>.

A Brief History of the Initiative

SCSU is a land-grant HBCU located in Orangeburg, South Carolina, and is one of 12 public, postsecondary educational institutions in the state, and the only historically Black, public, four-year institution. In February 2020, SCSU, through its computer science department, convened a group of representatives from government, industry, and academia to educate attendees about the value of degree-based apprenticeships, resources available to support cybersecurity apprenticeships, employer demand for cybersecurity competencies, and other related topics. Shortly after this event, SCSU collaborated with Urban staff to develop a degree-based registered apprenticeship program in secure software development and submit it for registration to the US Department of Labor’s (DOL’s) Office of Apprenticeship (OA) in South Carolina.

As part of the pilot development phase, SCSU conducted a needs-assessment survey of tech employers in the greater Columbia, Orangeburg, and Charleston areas to determine the skills gap between the hardest-to-fill occupations and those most in-demand in these regions. The results showed that cybersecurity software developers were most needed. Through SCSU’s and Urban’s numerous presentations and conversations, the effort gained steam by attracting strong support from several industry champions. Integer Technologies, an applied research and product development company, was the first employer to formally sign on to participate in the program. Recently, a staffing firm has signed on and the consortium is working to add more employers to hire apprentices from the first and future cohorts.

Overall, three schools (SCSU, Vorhees College, and Benedict College) have formally signed on to be a part of the consortium. They have all worked together to align standards to their existing curricula, participate in recruiting students, and work with their institutions to share program information with employer partners. Additional HBCUs in South Carolina are exploring participation in coming years to connect their students with these opportunities.

BOX 2

Key Apprenticeship Acronyms

- DOL: US Department of Labor
- HBCUs: historically Black colleges and universities
- MOU: memorandum of understanding
- MSIs: minority-serving institutions
- NICE: National Initiative for Cybersecurity Education
- NIST: National Institute of Standards and Technology
- OA: Office of Apprenticeship
- OJT: on-the-job training
- RAP: registered apprenticeship program
- RAPIDS: Registered Apprenticeship Partners Information Data System
- RTI: related technical instruction
- SAA: state apprenticeship agency
- WPS: work process schedule; also referred to as an Appendix A form

A Step-By-Step Guide to Creating a Degree-Based Registered Apprenticeship Consortium

The process for creating a degree-based apprenticeship consortium involved several steps and various participating partners' expertise. The following section describes the steps and decisions those seeking to replicate this model could make.

Deciding Partners' Roles and Responsibilities

A consortium-driven degree-based apprenticeship program requires having a sponsor, engaging with other schools that offer similar programs of study, coordinating with employers, and hiring apprentices. Each partner has an important role in the consortium and separate responsibilities. Below, we describe the four main roles in the apprenticeship program: sponsor, training providers (related technical instruction, or RTI, providers), employers, and student apprentices.

SPONSOR

Every Registered Apprenticeship Program (RAP) has a single organization responsible for its successful registration and implementation—the program sponsor or standards-holder of the apprenticeship program. Sponsors can be employers, trade associations, education providers, or workforce intermediaries. In the HBCU degree-based apprenticeship consortium we describe here, SCSU is the program sponsor. The program sponsor is responsible for

- registering the program,
- collecting and submitting apprenticeship agreements,
- tracking apprentices' progress against the training plan or work process schedule (WPS),
- coordinating employer recruitment, and
- collecting and submitting employer acceptance agreements from employers.

A program's sponsor is the organization ultimately responsible for ensuring that the program is run properly and in accordance with their registered standards and federal or state regulations. Each program needs a sponsor. In a consortium model, members implement systems for sharing required information so the sponsor can fulfill its reporting duties and ensure the program is compliant in the registered apprenticeship system. The roles for other schools participating in the consortium have less responsibility overall but should be documented and clarified in a formal agreement—like a memorandum of understanding (MOU).

RTI PROVIDERS

Every RAP requires an established curriculum that supports, builds on, and aligns with the occupation and on-the-job training outline, or the RTI. There is no requirement to use only one RTI provider or curriculum, as long as each RTI provider's curriculum aligns with the learning objectives in the WPS and the educational sequence fits with the RTI provided across the program. In the HBCU consortium, SCSU, Benedict College, and Voorhees College are the RTI providers.

EMPLOYERS

Employers are responsible for reviewing and agreeing to the RAP standards, which is the paperwork submitted to the DOL or SAA to register an apprenticeship program. The standards include the WPS, and employers agree to hire apprentices and follow program requirements by signing an Employer Acceptance Agreement and returning this to the sponsor (in this case, SCSU). These agreements become appendixes to the registered program standards. Employers also develop internal policies

related to apprentice recruiting and hiring and support the program sponsor with tracking and reporting the apprentices' progress.

STUDENT APPRENTICES

The student apprentices are responsible for taking courses specified in the WPS—the document defining the apprenticeship's learning objectives. They are also responsible for working the hours specified by their employer and necessary to achieve competency in the skills defined in the WPS. When apprentices complete this program, they will have a degree, relevant work experience, and the potential for continued employment with the company that provided their on-the-job training (OJT). Further, some apprentices may find that their employers' tuition reimbursement benefits cover some or all of their academic training costs.

Solidifying Roles and Responsibilities through an MOU

Once the schools agree on the roles, the lead or sponsoring institution can draft a memorandum of understanding (MOU) to document them. The MOU will be used by participating schools and to secure future commitments from schools. It should be signed by someone with sufficient authority to commit the school to the activities and responsibilities outlined in the agreement, such as a department chair, dean, or provost.

Because MOUs are similar to partnership agreements for joint grant proposals, most universities have research offices (such as an Office of Sponsored Research) that may have a template for an MOU. In SCSU's HBCU consortium, the MOU was created by SCSU and signed by the member schools. However, if an intermediary organization or employer serves as the program sponsor, they would likely create the MOU and obtain signatures from all of the schools providing RTI.

Convening the Consortium

As soon as the schools are ready, the sponsor should take the lead to set up regular recurring meetings. This can be done before the MOUs are signed so that everyone can be kept up to date with any employer engagements and questions raised by faculty, chairs, or deans about the program.

A representative from the sponsoring school should share invitations, organize, and facilitate the recurring meetings. It is a good practice for the sponsor school to draft and share agendas before each

meeting. A vital activity the consortium will undertake is comparing course objectives for documenting the RTI in the WPS.

Designing the Program: Developing the Work Process Schedule

In addition to figuring out how the consortium will be organized, it is important to be thoughtful and deliberate when developing and designing the program and its content. A work process schedule (WPS) details the training plan for a specific apprenticeable occupation. Generally, participating consortium members will have already agreed on the occupation(s) they seek to register. When this has not been decided, there may be some discussion about the ideal occupation for registration that meets both the training goals of the participating colleges and employer needs of the local region.

A WPS is only one part of the overall application submitted to the relevant registration agency to obtain apprenticeship program approval. The WPS has two main parts: the related technical instruction (RTI) outline and the on-the-job-training (OJT) component. The RTI lays out the courses apprentices must complete to develop the knowledge needed to be an entry-level employee. The OJT section documents the skills and abilities an apprentice needs to master to be competent. Each occupation has its own WPS that combines the knowledge, skills, and abilities apprentices need to complete to graduate from the program.

When developing a new WPS, sponsors can seek out national guideline standards and competency-based occupational frameworks (CBOFs) to guide the selection of RTI courses and OJT. Urban's DOL-funded project to build more than 30 CBOFs across 7 different industries is a great resource for creating a new WPS.⁴ Each CBOF underwent a rigorous vetting process with at least 9 industry stakeholders before being approved by the DOL. This background work provided the consortium team with a foundation of competencies to draw from in designing the program's curriculum.

Apprentices can advance through a WPS in three different ways: time based, competency based, and hybrid. The RAP launched by the HBCU consortium described in this playbook chose a competency-based model, meaning that apprentices advance through the program as they demonstrate competency in particular skills, rather than by time spent learning or practicing certain skills.

The SCSU-led apprenticeship consortium used Urban's CBOFs for software developers and cyber security support technicians as its foundation, which are based on the National Institute of Standards and Technology's (NIST) National Initiative for Cybersecurity Education (NICE) framework.⁵ The NICE framework provides knowledge, skills, and abilities (KSAs) needed to perform a secure software

developer role. These KSAs, combined with key tasks for each role, make up the competencies required for software developers. The resulting secure software developer WPS has 6 job functions and 11 courses total.

When working with a consortium-driven degree-based apprenticeship program, it is important that all schools agree on what courses will go in the WPS. Ideally all schools will offer the courses on a timetable that will allow the apprentices to complete the program within their normal course of studies. Urban's team worked with the lead sponsor school, SCSU, to draft a curriculum that would be required for the program's apprentices. This course list covered basic coding skills and more advanced courses relevant to the occupation. For each course, the team drafted a list of key skills that apprentices would learn in the course.

As SCSU and Urban began conversations with partner schools, the team built an integrated curriculum "crosswalk" (see a sample in appendix C) matching each school's courses and major requirements to SCSU's courses—the RTI plan. Schools' websites and course catalogues served as Urban's guide. Where requirements were missing or unclear, Urban staff reached out to schools directly and discussed options for amending curricula or adding courses to meet the RTI requirements. The detailed objectives for each SCSU course allowed the team to find courses or combinations of courses to gain the needed skills, even when a school did not offer a course required for the program. For example, all apprentices needed to cover basic assembly language programming. Although SCSU had an Introduction to Assembly Language Programming course, many member schools did not. Instead, students from these schools would gain the same skills from courses like Computer Organization and Architecture, mapped in the crosswalk.

Once the WPS and crosswalk were complete, the consortium shared the WPS with employer stakeholders and potential partners to ensure it aligned with specific employers' recruitment needs and wages. It is important that employers review the WPS because they will be responsible for assigning work that will enable apprentices to master the competencies during their tenure on the job. Employers are also responsible for tracking the apprentices' progress as they demonstrate competencies.

Other Programmatic Decisions

In addition to deciding what skills apprentices will gain throughout the program, other decisions need to be made when filling out the registration paperwork. Most notably, the progressive wage scale is a core component that rewards apprentices for knowledge and skills development. The starting wage must be at least minimum wage for the state in which the apprentices are working and should be some portion of

the entry-level wage for the occupation. Urban has created guidance on how to adjust apprentice wages.⁶

The other decisions are related to how many apprentices can be supervised by a single fully skilled worker, the program duration, and length of the probationary period. Some states have a limit on the ratio of apprentices per fully skilled worker, and the secure software developer WPS allows up to three apprentices per fully skilled worker. The program term is calculated by adding up the actual hours of coursework and the estimated time spent in OJT. No more than 25 percent of the apprenticeship term can be designated as a probationary period.

Centralized Employer Outreach

Employers use RAPs as way to recruit and train new staff. You cannot have a degree-based RAP without employers who hire apprentices and provide the mentored OJT.

Finding employer partners can be challenging though, so centralizing employer outreach for the entire consortium is helpful. This way employers will have one primary contact from the consortium who corresponds with the employers' points of contact. Further, this consortium point of contact should be responsive and knowledgeable about the program and the benefits employers will realize through their participation. To facilitate a centralized outreach process, participating schools need to contribute to a consolidated list of employer points of contact for future engagement and meeting requests.

A project manager for the consortium can create a spreadsheet with a unified contact list or input the contact information into a mutually accessible customer relationship management (CRM) tool. To collect the information, the project manager can draft an email message to request contact lists from each school's faculty and career services departments. That information can be saved in the consortium's employer contact list.

Engaging Employers in the Model

Because registered apprenticeship programs are regulated by the DOL and SAAs, employer engagement is often focused within the community, state, or region where the program is registered. The benefit of working with local employers is that they understand the local economy and create and sustain jobs that support the region surrounding each school.

As more jobs are performed remotely, it may be possible to focus on engaging firms with a national footprint. However, for now the primary focus should remain on recruiting businesses with a local or state presence. Schools should work with their institutional business engagement departments to cultivate lists of local employers who may be open to learning more about the consortium and opportunities to hire and train apprentices.

Before reaching out to employers, it is helpful to develop a fact sheet about the program, underscoring the benefits to employers and presenting them in a concise and engaging way. Emails explaining the program clearly to employers are also helpful, and these should highlight the benefits employers will realize from participating in the program. For example, the fact sheet Urban developed for employers briefly describes the program and the issues it seeks to address, conveys the demonstrable benefits of hiring apprentices—such as a positive return on investment, the immediate productivity value created, and higher retention rates—and describes the employer’s responsibilities and steps they would take to participate in the program.⁷

Once the consortium has connected with companies that have existing relationships with member schools, it can additionally conduct email and phone outreach with different intermediaries—or organizations who play a connecting role in the workforce development context—in the state or region. Such organizations may include

- local chapters of national associations like the Society for Human Resources Management (SHRM),
- economic development organizations,
- chambers of commerce, and
- workforce development boards.

Workforce boards can also determine whether local funding is available to apprentices and employers. Chambers of commerce can be great partners for hosting meetings or webinars with employers on the benefits of using apprenticeship as a recruitment and training tool. Finally, attending relevant industry conferences is an effective way to meet local employers that might be interested in learning more and joining the apprenticeship program.

Registration Process

The apprenticeship program registration process is generally standardized across the country. RAPs can be local or national in their service area. For local programs, the first step is to identify the correct

approval office⁸ to submit your program standards to via email. National programs⁹ are submitted to the DOL and must be operating in at least three states serving 20 or more apprentices within two years of launch, with a plan to expand to five states in three years.

When submitting your program materials to the appropriate point of contact, sponsors will always include the boilerplate program standards and an occupational Appendix A form for each occupation they seek to register. Submitting your program for registration with one-to-three employer partners who have committed to participate in the program via Appendix D forms (employer acceptance agreements) is recommended. An employer acceptance agreement does not obligate an employer to hire an apprentice—it simply states that the employer has agreed to consider hiring apprentices under this program should they receive promising applicants for the role and organization. If your program will be sponsored by an employer, rather than a college or university, the employer sponsor will also include the New Employer Factsheet and New Employer Checklist in the program registration application.

Certain states use the Registered Apprenticeship Partners Information Data System (RAPIDS) to track programs' and apprentices' progress. Once a program is approved, sponsors will receive a RAPIDS code and access to RAPIDS as the sponsor from the registering body. Sponsors will then need to enter employer partners into RAPIDS, as well as apprentices as they are hired by employers. In this case, the application and review processes involve employer and consortium school engagement so SCSU can remain updated and enter apprentices into the RAPIDS system as they are hired.

Student Application Process

The initial draft for the student application process and requirements drew from Urban's past work with community college-based apprenticeship programs. The Urban team created a preliminary process document, outlining the basic qualifications and application materials required for each applicant. The team focused specifically on students who would most likely thrive in an experiential learning environment, not necessarily those at the top of their class.

As part of the process, a panel of faculty from consortium member schools reviews students' application materials, including CVs, unofficial transcripts, GPAs, cover letters, and professional references. The application materials from the top-rated candidates are then passed along to employers. Employers then decide if they want to interview any of the candidates shared by the consortium. Ultimately, participating employers decide whether to hire an apprentice. Hired students sign ETA 671 forms (apprenticeship agreements) to formally enroll in the RAPs.

A key step in this process includes a contingency plan for students who meet the minimum program requirements but are not hired by an employer. These students will be placed on a waitlist for future apprenticeship openings. If necessary, students might also need to apply to a company job posting to follow the employers' human resources policy.

When students are more advanced in their studies and have already completed some required coursework as stipulated in the apprenticeship program, they may receive credit for prior learning that enables them to advance through the program more quickly. This option may be attractive to both students and employers.

Technical Assistance Is Critical for Success

Throughout the process of setting up the degree-based consortium, Urban provided extensive technical assistance to support the launch of SCSU's program. Some technical assistance services provided are described below to support the launch of similar programs.

Implementation Technical Assistance

In addition to the technical assistance Urban provided to develop and register the program standards, Urban staff created the processes and procedures to launch the consortium. Regular check-ins with university faculty and staff, and employers ensured that the program maintained momentum and the Urban team could answer questions from consortium members as they arose. The biweekly consortium meetings with schools could be repurposed for employer and advisor information sessions when needed. The implementation technical assistance may be particularly useful in the start-up phase of consortia as schools determine their roles and responsibilities, build relationships for collaboration and partnership, and determine internally how to support the initiative's implementation.

Documentation Developed

Documentation can be an important element of program success. Many audiences—including employers and students—may be unfamiliar with apprenticeship and need to be introduced to its concepts and benefits. For example, Urban developed a fact sheet for employers that focused on the value apprentices provide to businesses and a fact sheet for students highlighting the benefits they would get from completing an apprenticeship.¹⁰ Urban staff also helped draft the MOU and its

complementary roles and responsibilities document (see appendix B) to help establish the consortium. Playbooks, such as this document, are also helpful for sharing the step-by-step process and supporting the start of other registered apprenticeship consortia.

Information Sessions

Additional technical assistance support can include hosting information sessions for various interested audiences. For example, Urban hosted information sessions for career advisors from consortium schools to explain the value that degree-based apprenticeship provides students and offered an opportunity to ask questions about the program. A similar session with potential employers launched conversations with partner employers and served as a starting point for future technical assistance activities.

It's critical to note that many employers need more than a single pitch to commit to the program. The team held regular check-ins and information sessions with potential employer sponsors as they considered joining the program. By providing sample student résumés, work process schedules, and information about the application process, the team was able to walk employers through their questions and logistical concerns about incorporating apprenticeship in their existing hiring and training systems.

Once the team identified two employer partners, Integer Technologies and the staffing firm, for the pilot program, we held an information session to introduce students to the program and participating employers. This session built on resources from the previous information sessions and focused on the program's opportunities for students.

Information sessions have been critical for information sharing and bringing interested parties—from school officials to employers to apprentices—along in the process.

What Can You Do to Bring Apprenticeship to Your Campus?

This playbook summarizes how you can set up an apprenticeship program with a consortium of local colleges and universities. Box three below simplifies that process into the key steps taken to set up the HBCU consortium and develop and launch the apprenticeship program.

BOX 3

Recapping the Steps to Launch a New Consortium-Driven Degree-Based RAP

- Connect with local employers, industry associations, or workforce intermediaries to determine which occupations are most needed.
- Search for National Guideline Standards, CBOFs, and other high-quality sources to determine what KSAs are necessary for a specific occupation.
- Find and engage training providers and educational institutions that can deliver the classroom instruction for the selected occupation.
- Execute MOUs with those training entities to establish the consortium.
- Develop the full program standards and WPS.
- Reach out to relevant local employers and have them review the program standards before submission to the DOL, OA, or SAA.
- Get interested employers to sign employer acceptance agreements committing to participate in the program.
- Submit the program standards to the DOL or appropriate SAA.
- Obtain program approval from the DOL or SAA.
- Recruit additional employers (if needed) to join the program by signing employer acceptance agreements.
- Advertise the program to students through email, posters on campus, and class announcements to get students to apply.
- Screen applicants using criteria necessary to succeed in the program.
- Select students to interview with participating employers.
- Register students who are hired as apprentices with the program by signing an ETA form 671, the standard DOL apprenticeship agreement.

A few key takeaways for setting up and organizing a successful program are (1) make sure to create clear roles and responsibilities within the consortium; (2) have a project manager so tasks can be delegated and tracked in a timely manner; and (3) engage employer partners early and often so they develop an understanding of apprenticeship and its benefits. It often requires multiple interactions with employers to help them feel comfortable with the approach and model before they commit to participating.

Appendix A. Work Process Schedule



Appendix A

(Sponsor(s) with multiple occupations must complete an Appendix A for each occupation)

WORK PROCESS SCHEDULE

AND

RELATED INSTRUCTION OUTLINE



Appendix A
WORK PROCESS SCHEDULE
Software Developer

O*NET-SOC CODE: 15-1252.00 RAPIDS CODE: 1129CB

This schedule is attached to and a part of these Standards for the above identified occupation.

1. APPRENTICESHIP APPROACH

Time-based Competency-based Hybrid

2. TERM OF APPRENTICESHIP

The term of the apprenticeship is 2 years with an OJL attainment of 21 competencies supplemented by the minimum required 360 hours of related instruction.

3. RATIO OF APPRENTICES TO JOURNEYWORKERS

The apprentice to journeyworker ratio is: 3 Apprentice(s) to 1 Journeyworker(s).

4. APPRENTICE WAGE SCHEDULE

Apprentices shall be paid a progressively increasing schedule of wages based on either a percentage or a dollar amount of the current hourly journeyworker wage rate, which is dependent on the local average in the location an apprentice is working. You can find your local average at the following link: <https://www.onetonline.org/link/summary/15-1252.00>. Then, see below for further guidance.

Wage Schedule:

1. 1st Wage, Starting Apprentice Wage = 50% of starting journeyworker salary in selected region.
2. 2nd Wage = 75% of starting journeyworker salary earned after demonstrating competency for 50% of job functions.
3. 3rd Wage, Final, or "Exit" Wage = starting journeyworker salary earned after demonstrating competency for 100% of job functions.

5. PROBATIONARY PERIOD

Every applicant selected for apprenticeship will serve a probationary period of 26 weeks (6 months).

6. SELECTION PROCEDURES

Please see page A-9.



Appendix A
ON-THE-JOB LEARNING OUTLINE
Software Developer
O*NET-SOC CODE: 15-1252.00 RAPIDS CODE: 1129CB

- **Beginner** indicates that the apprentice has completed training and observation of listed skill/task but cannot yet independently perform this task.
- **Intermediate** indicates that the apprentice can perform the task with coaching and assistance
- **Proficient** means that the apprentice consistently demonstrates proficiency in performance of the task
- **Completion Date** means the date apprentice completes final demonstration of competency

JOB FUNCTION 1: PARTICIPATION IN THE DEVELOPMENT OF NEW PLATFORM – COLLECTING AND ANALYZING USER NEEDS. <i>Participates in and supports the collection and analysis of user needs for the development of a new secure software platform by assisting the Principal Developer and the team.</i>				
	Beginner	Intermediate	Proficient	Completion Date & Initials of Reviewer
A. Analyze user needs and software requirements to determine feasibility of design within time and cost constraints				
B. Analyze information to determine, recommend, and plan the development of a new application				
C. Prepare detailed workflow charts and diagrams that describe input, output, and logical operation				
D. Clearly communicates (both written and oral) with internal team members and external stakeholders, as needed				

JOB FUNCTION 2: SUPPORTING NEW PLATFORM DEVELOPMENT. <i>Participates in and support designing a of new software platform by assisting the Principal Developer and the team.</i>				
	Beginner	Intermediate	Proficient	Completion Date & Initials of Reviewer
A. Supports the team, or appropriate team members, with secure 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				
B. Participates in the identification and development of the best prototype suited for the project, if any; supports identification of appropriate languages, operating systems, security principles and monitoring methods applicable for the final program and developing secure codes for the selected prototype				



C. Applies Cybersecurity and privacy principles and organizational requirements (relevant to confidentiality, integrity, availability, authentication, and non-repudiation)				
D. Supports the team, or appropriate team members, with secure 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				

JOB FUNCTION 3: MODIFYING AN EXISTING PLATFORM. <i>Participates in and supports the analysis of performance issues and limitations of an existing platform and identifies needs for modification of an existing platform by assisting the Principal Developer and the team.</i>				
	Beginner	Intermediate	Proficient	Completion Date & Initials of Reviewer
A. Analyze the existing software platform and identify potential flaws in codes to mitigate vulnerabilities				
B. Correct errors by making appropriate changes and rechecking the program to ensure that desired results are produced				

JOB FUNCTION 4: TESTING, DEBUGGING, AND DEPLOYMENT. <i>Supports the team or Principal Developer in the testing, debugging and deployment of the new or modified secure software platform.</i>				
	Beginner	Intermediate	Proficient	Completion Date & Initials of Reviewer
A. Supports the team, or appropriate team members, with secure 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				
B. Participates in the identification and development of prototype suited for the project, if any; supports identification of appropriate languages, operating systems, security principles and monitoring methods applicable for the final program				
C. Participates in recognizing concepts to determine Continuous Integration/Continuous Deployment configuration, supports building and applying continuous Integration/Continuous Deployment configuration, integrations for manual and/or automated functionalities				
D. Supports integration and test phase, properly notes progress relevant to project success				



JOB FUNCTION 5: MONITORING AND MAINTENANCE. <i>Supports the team or Principal Developer in the monitoring and maintenance of the new or modified secure software platform.</i>				
	Beginner	Intermediate	Proficient	Completion Date & Initials of Reviewer
A. Participates in ongoing monitoring of platform, software, or application, under project requirements				
B. Assists with providing maintenance, troubleshooting, and applies problem solving capabilities as applicable, under supervision				
C. Communicates with the team of any issues discovered during routing monitoring and/or maintenance process				
D. After issue is reported, clearly tracks and works with team to fix, and re-test until quality standards are met				

JOB FUNCTION 6: CUSTOMER SUPPORT AND DOCUMENTATION. <i>Supports the team or Principal Developer in providing technical support to customers who need assistance utilizing client-level hardware and software in accordance with established or approved organizational process components.</i>				
	Beginner	Intermediate	Proficient	Completion Date & Initials of Reviewer
A. Consult with the project team and provide technical assistance to customers needing assistance				
B. 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				
C. Write documentation of program development and subsequent revisions, inserting comments in the coded instructions so others can understand the program				
D. Document software patches or the extent of releases that would leave the software platform vulnerable.				



Appendix A
RELATED INSTRUCTION OUTLINE
Software Developer
O*NET-SOC CODE: 15-1252.00 RAPIDS CODE: 1129CB

COURSE NAME: Advanced Programming Techniques (or similar title)	Course Number: 1
	Hours: 45
Learning Objectives By the end of this course you'll be able to: <ul style="list-style-type: none">• Study advanced object-oriented features and convert different algorithms into working application programs, and applets.• Apply analysis and design methods to various algorithms.• Understand design graphics and user interfaces concepts.• Understand and apply secure coding techniques.• Recognize various aspects of software engineering.	
COURSE NAME: Introduction to Assembly Language Programming (or similar title)	Course Number: 2
	Hours: 45
Learning Objectives By the end of the course, you will be able to: <ul style="list-style-type: none">• Perceive the structure, design, and operational components of the computer.• Understand the computer representation of integers and floating-point numbers, as well as algorithms for computer arithmetic.• Create, debug, and execute assembly programs, gain an understanding of the relationship between assembly code and the source code in a high-level language.	
COURSE NAME: Introduction to Discrete Mathematics (or similar title)	Course Number: 3
	Hours: 45
Learning Objectives By the end of this course, you will be able to: <ul style="list-style-type: none">• Determine proofs of various properties using Mathematical Induction.• Determine and solve recurrence relations. Translate everyday problems into discrete structures such as graphs, trees and networks and solve them whenever possible or feasible.	



COURSE NAME: Introduction to Computer Networks (or similar title)	Course Number: 4
	Hours: 45

Learning Objectives	
<p>By the end of this course you'll be able to:</p> <ul style="list-style-type: none"> • Understand network architecture concepts, the OSI reference model and the TCP/IP architecture. • Demonstrate proficiency in analyzing LAN technologies (including Ethernet, Token Ring, ATM-based LANs and wireless LANs). • Understand the basic principles of error, flow, and congestion control at various levels of the protocol stack. • Understand circuit-switching and packet-switching technologies. • Demonstrate proficiency in analyzing and verifying communication protocols (such as IP, IPv6, ICMP, UDP and TCP). • Demonstrate an understanding of routing principles and algorithms, and routing protocols used on the Internet (RIP, OSPF, BGP etc.). • Demonstrate an understanding of application-layer protocols (DNS, SMTP, FTP, HTTP) and their interaction with underlying services. • Demonstrate an ability to design and analyze simple computer networks. • Demonstrate proficiency in network programming in either Java or Python. • Establish a thorough understanding of network-related security threats and solutions. 	

COURSE NAME: Introduction to Network Security (or similar title)	Course Number: 5
	Hours: 45

Learning Objectives	
<p>By the end of this session you will be able to:</p> <ul style="list-style-type: none"> • Develop an understanding of cryptography and key component of cryptographic systems. • Know important encryption algorithms and their applications. • Learn techniques to enforce security policies (such as authentication and data integrity). • Develop familiarity with prevalent network attacks, their countermeasures, and tools used. • Begin verifying integrity and providing confidentiality to electronic communications and digital systems. 	

COURSE NAME: Software Engineering (Software Design and Development) (or similar title)	Course Number: 6
	Hours: 45

Learning Objectives	
<p>By the end of this session you will be able to:</p> <ul style="list-style-type: none"> • Understand the Agile process models. • Understand requirements. • Understand software design using UML. • Understand implementation, testing, configuration management and user support. • Apply design and development principles in the construction of software systems of varying complexity in a team environment with special attention to secure and agile development techniques. 	



COURSE NAME: Management of Information Security (Risk analysis, laws, policies, ethics) (or similar title)	Course Number: 7
	Hours: 45

Learning Objectives By the end of this course, you will be able to: <ul style="list-style-type: none">• Demonstrate knowledge on key concepts of information security.• Demonstrate knowledge on security policies & procedures.• Demonstrate knowledge on risk management process.

COURSE NAME: Introduction to Application, Data and Web Security (or similar title)	Course Number: 8
	Hours: 45

Learning Objectives By the end of this course, you will be able to: <ul style="list-style-type: none">• Discuss the basic techniques used to perform reconnaissance.• Explain various types of scanning.• Recognize buffer overflow and provide countermeasures.• Identify different types of malware.• Identify appropriate tools/techniques for a given security scenario.• Explain the vulnerabilities that exist in web applications and the countermeasures.
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TOTAL MINIMUM HOURS 360



SELECTION PROCEDURES

- A. The local program Sponsor ("Sponsor"), HBCUs and MSIs included in the regional consortium, and participating employers will promote the opportunity online and at in-person events inviting eligible applicants to apply. All persons requesting an application will have one made available.
- B. Completed applications submitted that meet programmatic minimum qualifications and contain all required documentation will be reviewed and assessed by the Sponsor against the following criteria to determine the apprentice's eligibility:
 - a. Must be a student in good academic standing seeking a B.S. degree in Computer Science, Computer Engineering, Cybersecurity, Information Technology, or other relevant degree-program at a participating HBCU or other MSI included in the regional consortium.
- C. If applicant meets all minimum qualifications, meets the above criteria, and submits the required documentation, Sponsor will continue the application process by contacting applicant to administer an assessment of choice, as needed, and may be subject to having their materials reviewed by a panel.
- D. If the applicant successfully completes the assessment and receives a high rating from the panel review, Sponsor will refer applicant to participating employers for their consideration. If applicant does not meet the above criteria or program requirements, Sponsor will either reject or waitlist apprentice application.
- E. Participating employers interested in the eligible candidate will contact applicant to schedule an interview and to initiate the screening, recruitment, and hiring process, consistent with employer existing hiring practices.
- F. Participating employers will inform Sponsor about accepting and hiring applicants into the apprenticeship program.
- G. The selected apprentices will be registered by Sponsor upon receipt and acknowledgement of the completed Employer Participation Agreement and the Apprenticeship Agreement.

Appendix B. Roles and Responsibilities

Roles and Responsibilities of Key Consortium Members in a Degree-based Apprenticeship Program¹¹

Key Role 1: SCSU as the DOL Registered Apprenticeship Sponsor (and RTI Provider)

Every DOL Registered Apprenticeship Program (RAP) has a single organization responsible for its successful registration and implementation. This organization is called the **program sponsor** or standards-holder of the apprenticeship program. Sponsors can be employers, trade associations, education providers, or nonemployer intermediaries. A program's sponsor is the organization ultimately responsible for ensuring that the program is run properly and in accordance with their registered standards and DOL regulations. In a consortium model, it is understood that members will implement systems for sharing required information.

Program Sponsors' Main Responsibilities Include (but Are Not Limited To):

- Before Program Approval, develop program standards, RTI, and Work Process Schedule (see appendix A). Once approved, update and maintain program standards and appendices, as needed.
- Register apprentices in RAPIDS (DOL online tracking system).
- Maintain records in accordance with DOL regulations, including records documenting
 - » apprentices' completion of RTI
 - » apprentices' progress through the program's work process schedule (OTJ outline)
 - » proof of required wage increases
 - » employer EEO policy (due after the program has been operating for two years), and
 - » employer hiring procedures and HR records.
- Report apprentice progress to DOL through RAPIDS.
- Prepare for, participate in, and resolve DOL program audits on rare occasions.

Key Role 2: Consortium School Responsibilities (including SCSU)

Every DOL Registered Apprenticeship Program requires the delivery of an established curriculum that supports, builds on, and aligns with the occupation and OJT outline. No requirement exists to use only one RTI provider or curriculum, as long as each RTI provider's curriculum aligns with the learning objectives and sequence of education fits with the RTI being provided across the program,

- Attend consortium meetings throughout the program year.
- Review the course requirements and make sure they will be offered at your school on a timeline that supports completion of the apprenticeship program, which must be three years or fewer, to support graduation in approximately four years.
- Use existing networks to recruit employers to host apprentices for the program.
- Promote the opportunity to eligible or potentially eligible students.
- Recruit students who are rising sophomores to participate.
- Maintain records in accordance with DOL regulations, including records documenting apprentices' completion of RTI.
- Continue offering the required courses listed for at least three years on the apprenticeship program's Work Process Schedule.

Key Role 3: Employer Responsibilities

- Review the Work Process Schedule and agree to employ apprentice and conduct program requirements by signing an Employer Acceptance Agreement and returning to SCSU.
- As needed, develop internal, employer-specific policies related to apprentice recruiting and hiring.¹²
- Review RAP reporting requirements and SCSU tracking procedures, adjusting internal reporting procedures if needed.
- Using leads from Consortium School(s), select apprentices (new hires or existing employees attending the consortium schools) according to HR policies and defined apprentice selection procedures (see appendix A).
- Have apprentices review the Work Process Schedule and all relevant program policies.

- Share apprentice information with SCSU for entry into RAPIDS. SCSU (as the sponsor) will enter apprentice(s) into RAPIDS and generate form 671. Have apprentice(s) sign 671 and return it.
- Identify apprentice mentor(s) and have them review the Work Process Schedule and all relevant program policies.
- Complete mentor training for apprentice mentors, if needed.
- Connect the apprentice with the SCSU Apprenticeship Coordinator (or relevant HBCU contact) to arrange apprentices' RTI registration and schedule.
- Assess apprentices' previous experience and determine whether to grant advance standing, including RTI coursework on the work process schedule that was completed previously.
- Share apprentice information with SCSU for entry into RAPIDS.
- Generate pay stub or other documentation showing apprentice starting wage, as well as for each incremental wage increase, and send to SCSU for records.

Appendix C. Curriculum Crosswalk

TABLE 1

Curriculum Crosswalk

This “crosswalk” matches courses from SCSU’s curriculum to the courses needed in the other two consortium schools.

SCSU		Benedict College		Voorhees	
Course name	Hours	Course name	Hours	Course name	Hours
Introduction to Computer Science	45	CSC 132 Introduction to Computing and Programming Concepts	45	CMP 150 Introduction to Computer Science	45
Introductory Programming	45	CSC 135 Principles of Programming I with C++	45	CMP 224 Computer Programming I	45
Introduction to Cybersecurity	45	CYBER 230 Introduction to Cybersecurity Threats	45	CMP 431 Fundamentals of Cyber Security	45
Advanced Programming	45	CSC 136 Algorithm Design and Programming with C++, I	45	CMP 225 Computer Programming II	45
Introduction to Assembly Language Programming	45	CSC 231 Assembly Language	45	CMP 333 Computer Organization/Assembly Language	45
Introduction to Discrete Mathematics	45	MATH 336 Discrete Mathematics	45	MATH 343 Discrete Mathematics	45
Introduction to Computer Networking	45	CSC 339 Data Communication and Networking	45	CMP 382 Computer Networks	45
Introduction to Network Security	45	CYBR 338 Introduction to Cryptography	45	CMP 432 Advanced Cyber Security	45
Software Engineering (Software Design and Development)	45	CSC 435 Software Engineering Principles	45	CMP 442 Software Engineering	45
Management of Information Security (Risk analysis, laws, policies, ethics)	45	CYBER 334 Cybersecurity Risk Analysis	45	Covered in additional courses	0
Introduction to Application, Data, and Web Security	45	CYBR 438 Web, Cloud, and Media Security	45	Topics covered in CMP 432 Advanced Cyber Security	0

Sources: Author’s analysis of computer science courses from each HBCU’s course catalogue: “SCSU Undergraduate Catalog 2021–2021, last updated February 22, 2021, <https://scsu.edu/wp-content/uploads/2021/07/Revised-2222021-2019-2020-Undergraduate-Catalog-SCSU8720-WHW.pdf>; Benedict College Catalogue 2020–2022, October 13, 2020, <https://www.benedict.edu/wp-content/uploads/2020/10/2020-2022-Benedict-College-Catalogue-Master-File-11-7162020-Autosaved1.pdf>; “Voorhees College 2021–2023 College Catalog,” August 3, 2021, https://www.voorhees.edu/Content/Uploads/voorhees.edu/files/UPDATE_VOORHEES%20COLLEGE%20ACADEMIC%20CATALOG%202019-2021.pdf.

Notes

- ¹ “Labor Force Statistics from the Current Population Survey,” US Bureau of Labor Statistics (BLS), last updated January 20, 2022, <https://www.bls.gov/cps/cpsaat11.htm>.
- ² “Computer and Information Technology Occupations,” BLS, last updated April 18, 2022, <https://www.bls.gov/ooh/computer-and-information-technology/home.htm>.
- ³ Lauren Musu-Gillette, Jennifer Robinson, Joel McFarland, Angelina KewalRamani, Anlan Zhang, Sidney Wilkinson-Flicker, “Status and Trends in the Education of Racial and Ethnic Groups 2016,” US Department of Education, August 2016, <https://nces.ed.gov/pubs2016/2016007.pdf>.
- ⁴ “Competency-Based Occupational Frameworks for Registered Apprenticeships,” Urban Institute, accessed May 18, 2022, <https://www.urban.org/policy-centers/center-labor-human-services-and-population/projects/competency-based-occupational-frameworks-registered-apprenticeships>.
- ⁵ “Application Developer (Alternate Title: Software Developer, Applications),” Urban Institute, last updated February 2019, https://test-urban1.pantheonsite.io/sites/default/files/2019/04/05/full_framework_developer_software_and_app_0.pdf
“Cybersecurity Support Technician,” Urban Institute, last updated December 2017, https://test-urban1.pantheonsite.io/sites/default/files/2020/04/08/cbof_full_cyber-security-support-tech_0.pdf
“Draft Refactored Knowledge and Skills Statements for Public Comment,” National Institute of Standards and Technology, accessed May 18, 2022, <https://www.nist.gov/itl/applied-cybersecurity/nice/nice-framework-resource-center>.
- ⁶ Matthew Eldridge and Zach Boren, “Setting Wages in Your Registered Apprenticeship Program,” Urban Institute, June 28, 2021, <https://www.urban.org/research/publication/setting-wages-your-registered-apprenticeship-program>.
- ⁷ Michael Pruitt, Rayanne Hawkins, Myca San Miguel, and Jacqueline Rayfield, “Diversify Your Talent,” Urban Institute, April 22, 2022, <https://www.urban.org/research/publication/diversify-your-talent>.
- ⁸ To identify the approval contact for your state, visit “State Offices,” US Department of Labor (DOL), accessed May 18, 2022, <https://www.apprenticeship.gov/about-us/state-offices>.
- ⁹ “Applicable National Program Standards (NPS) Sponsor Eligibility Criteria,” DOL, February 25, 2022, <https://www.apprenticeship.gov/sites/default/files/bulletins/National%20Program%20Standards%20Checklist.pdf>.
- ¹⁰ Employer fact sheet: Pruitt et al., “Diversify Your Talent”; Student fact sheet: Rayanne Hawkins, John Marotta, and Diana Elliott, “Launch Your Career with a Degree-Based Cybersecurity Apprenticeship,” Urban Institute, June 21, 2022, <https://www.urban.org/research/publication/launch-your-career-degree-based-cybersecurity-apprenticeship>.
- ¹¹ The information in this appendix all comes from the following source: “Registered Apprenticeship Process Guide,” MI Apprenticeship, April 2019, <https://miapprenticeship.org/wp-content/uploads/2019/04/20190417-Apprenticeship-Guide-v2.pdf>.
- ¹² See page 30 of the “Registered Apprenticeship Process Guide,” MI Apprenticeship.

About the Authors

Rayanne Hawkins is a manager in the Research to Action Lab at the Urban Institute, where she works on apprenticeship and upward mobility projects. She is launching a consortium of five South Carolina HBCUs offering a degree-based apprenticeship program in the technology sector and directing three counties as they go through a strategic planning process to increase mobility from poverty. Previously, she developed a performance-based contracting payment model for the Colorado Office of Community Corrections, provided training and technical assistance (TA) to pay for success projects, and studied new methods for equitable benefits delivery. Hawkins holds an MBA degree from Georgetown University's McDonough School of Business.

John Marotta is a senior policy associate in the Center on Labor, Human Services, and Population at the Urban Institute with more than nine years of experience in workforce development. He studies economic opportunity and skills, particularly how job training and work-based learning programs can lead to family-sustaining wages and viable career pathways. Mr. Marotta has coauthored numerous reports on the conception, development, and implementation of apprenticeship expansion efforts. Mr. Marotta holds an MPP from Georgetown University and a BA in economics from Hofstra University.

Myca San Miguel is a policy coordinator in the Center on Labor, Human Services, and Population, nearly six years' experience in apprenticeship and workforce development. She supports numerous labor and economic development initiatives that leverage innovative models to improve the workforce environment and its policies in nontraditional ways. San Miguel has extensive experience engaging industry, policy, and academia stakeholders, cultivating strategic partnerships, and providing technical assistance to optimize and diversify systems and outcomes for workers and industry. She also conceptualizes, writes, and disseminates content to facilitate conversations with practitioners and policymakers to broaden the reach of this work. She received her BA in communications at the University of North Carolina at Chapel Hill.

Jacqueline Rayfield is a former policy analyst in the Center on Labor, Human Services, and Population where she worked on apprenticeships and labor force development. Her earlier research analyzed education and job training programs for Syrians in Istanbul. She graduated from Boston University with a degree in international relations and minors in computer science and French.

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500 L'Enfant Plaza SW
Washington, DC 20024

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