

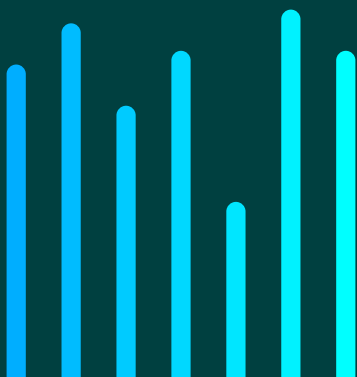


STATE OF ILLINOIS

Model Programs of Study Guide

Information Technology

PATHWAYS



EdSystems
EDUCATION SYSTEMS CENTER at
NORTHERN ILLINOIS UNIVERSITY

DRAFT FOR PUBLIC COMMENT | MAY 2024

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About ICCB

In 1965, the Illinois General Assembly established the Illinois Community College Board to create a system of public community colleges that would be within easy reach of every resident. Today, the Illinois Community College System covers the entire state with 48 colleges and one multi-community college center in 39 community college districts. Community colleges serve nearly one million Illinois residents each year in credit and noncredit courses and many more through their public service programs.

Illinois' community colleges meet both local and statewide needs for education and workforce development through high-quality, affordable, accessible, and cost-effective programs and services. Learn more at iccb.org.



About EdSystems

Education Systems Center (EdSystems) is a mission-driven policy development and program implementation center based within Northern Illinois University. We work at the state level to create ecosystem and policy change while simultaneously working at the local level to create organizational change. This bi-directional approach allows us to align local efforts to state policy while elevating local experiences and learnings to state tables. Learn more at edsystemsniu.org.

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I. About the Model Programs of Study Guide

The Illinois Community College Board (ICCB) sponsored the development of the State of Illinois Model Programs of Study Guides in crucial industry areas as part of the [Illinois State Plan for Strengthening Career and Technical Education for the 21st Century Act](#) (also known as the Perkins V plan). This guide was developed in consultation and collaboration with the Illinois State Board of Education (ISBE) through a process led and facilitated by Education Systems Center at NIU (EdSystems). As further detailed in this guide, the process involved extensive research into labor market information and credential programs, and dialogue across secondary, postsecondary, and employer stakeholders.

The primary purposes and goals for the Model Programs of Study are to:

1. **Provide guidance and exemplars** for local pathway programs to adopt or customize as they develop programs of study for approval as part of Perkins V or Illinois' College and Career Pathway Endorsements.
2. **Establish a framework** for state agencies to develop and implement program supports.
3. **Identify priority dual credit courses** that are foundational to the industry sector's program of study and well-situated for statewide scaling and articulation.
4. **Define the competencies** that should be sequenced across a program of study course sequence to prepare students for the future of work in that industry area.
5. **Identify entry points** for employers to support coursework and work-based learning experiences.

Model Programs of Study supplement and complement other State of Illinois career and technical education and career pathway resources, including the [ISBE Career Guide](#), [State of Illinois Career Pathways Dictionary](#), [Career Development Experience Toolkit](#), [Recommended Technical and Essential Employability Competencies](#), [State of Illinois Workforce Development Strategic Plan](#), and related state and regional data resources. School districts, community colleges, and their partners are encouraged to use this guide, state resources, and local program and course information to develop materials for student and family outreach.

The Model Programs of Study Guide in Information Technology can be used as a reference in local planning processes. The guide presents and describes in detail each component of the sequence, including descriptions of the underlying research, analysis, and Advisory Committee input. In addition to the complete guide, a [pathway map](#) depicting the diagrams of the secondary and postsecondary sequences, as well as a table of the selected occupations, wages, and job growth, is available at the end of this document or at edsystemsniu.org/guides.

II. Development of the Model Programs of Study

Programs of study are a coordinated, non-duplicative sequence of academic and technical content at the secondary and postsecondary levels that culminate in a recognized postsecondary credential. The State of Illinois Model Programs of Study Guides are aligned with broader state policy goals to promote college and career readiness, including the state's Perkins V and ESSA plans (in particular, the College and Career Readiness Indicator), the Postsecondary and Workforce Readiness Act, the Dual Credit Quality Act, and the Illinois Career Pathways Dictionary.



Process for Development

Each Model Programs of Study was developed using a data-driven, backward-mapping approach that extended from the areas of job growth down through to the high school course sequence. The specific steps in this analysis included:

1. **Identifying high-priority occupations** in the industry sector that are high-skill, high-wage, and in-demand based on federal Department of Labor data for Illinois.
2. **Identifying promising postsecondary credentials** (degrees or certificates) that are broadly accessible to and through the Illinois community college system, and lead to high-priority occupations.
3. **Mapping the stackable degrees and certificates** that progress to promising credentials.
4. **Identifying strategic community college courses** that appear broadly among promising credentials, provide a solid foundation of knowledge essential to that industry sector, and are feasible for dual credit delivery.
5. **Mapping a course sequence from secondary through the first year of postsecondary** that incorporates strategic early college credit (including at least six early college credits in the career-focused course sequence) and is applicable to both Illinois secondary and postsecondary Perkins V requirements.
6. **Defining related technical competencies** for the foundational program of study courses that can be utilized to guide course development and postsecondary articulation.

Using data from the Department of Labor, Illinois Department of Employment Security, and MIT's Living Wage Calculator for the State of Illinois as a reference, the project team identified "high-priority occupations" as jobs with a positive growth outlook over the next 10 years, of high relative volume within that industry sector, and with median salaries that could sustain various family sizes within Illinois.¹ Occupations with median salaries higher than the living wage for 1 adult + 1 child (\$39.63/hour) are considered as having a "high" living wage potential. Occupations with median salaries only higher than the living wage of 1 adult, no children (\$22.86/hour) are considered as having a "medium" living wage

¹ U.S. Department of Labor, Employment and Training Administration (n.d.). "Explore Careers." CareerOneStop. Retrieved December 2023, from careeronestop.org/explorecareers. Illinois Department of Employment Security, "Long-Term Occupational Projections 2020-2030" and "Wage Information: Occupational Employment and Wage Statistics (OEWS) Statewide." Retrieved December 2023, from ides.illinois.gov. Amy K. Glasmeier, "Living Wage Calculator," Massachusetts Institute of Technology, 2024. Retrieved December 2023, from livingwage.mit.edu.



potential, and occupations with median salaries below the living wage of 1 adult, no children (less than \$22.86/hour) are considered as having a “low” living wage potential.

The team identified as a “promising credential” any degree or certification that immediately prepares an individual for entry into or is a stackable for the identified high-priority occupations, then analyzed community college programs leading to these credentials from a sampling of six to ten colleges from across Illinois, representing a mix of urban, suburban, and rural institutions.² EdSystems analyzed and categorized all the career-focused and general education courses across the full sampling of the promising credential programs to determine which of these courses:

- are broadly common across multiple college programs in the sample,
- are likely accessible for dual credit opportunities considering student prerequisites and teacher credentialing requirements, and
- are generally transferable through Illinois Articulation Initiative or various articulation agreements.

This analysis and categorization process led to a recommended set of strategic career-focused and general education courses that provide a critical foundation for the program of study sequence.

Following this internal analysis, EdSystems and ICCB convened a stakeholder Advisory Committee of secondary, postsecondary, and private sector representatives to vet the recommendations and provide expertise and guidance on the development of the Model Programs of Study (see [Appendix B](#)). Over multiple webinars and feedback sessions across four months, the Advisory Committee and smaller working groups provided information about industry trends that may not be reflected in the Department of Labor or IDES data, credentials and degrees that are emerging as most promising in the field, on-the-ground implementation considerations for secondary and postsecondary programs, and future of work implications for the sector. The Advisory Committee further informed important decision-points, including adjusting the course map and promising credential endpoints, selecting strategic early college credit courses, and identifying key competencies for target courses lacking broad statewide articulation. The culmination of EdSystems’ analysis and the input of the Advisory Committee is reflected in this guide.

² For the analysis of this guide, EdSystems surveyed City Colleges of Chicago, Elgin Community College, Harper College, Heartland Community College, Illinois Central College, Joliet Junior College, Rock Valley College, and Sauk Valley Community College.

III. Priority Occupations and Promising Credentials

Information technology (IT) is a diverse industry poised for growth in Illinois. According to P33, software engineering and data and analytics roles are leading the tech job growth in Illinois, while some more accessible tech careers (e.g., network and systems administration, tech support) will lag.³ Supply is rising to meet current demand, with Illinois community colleges graduating nearly 6,000 IT graduates, across more than 400 certificate and degree programs.⁴ Work remains, however, to ensure that the state can prepare today's learners with the fundamental and technical skills to contribute in an evolving industry where fields emerge and fade, and where algorithms and artificial intelligence are growing in influence.

Promising Credential Program Categories

The project team's analysis of promising credentials in the IT sector led to an identification of four credential program categories or pathways:

1. **Guided transfer** programs in computer science and programming, preparing for bachelor's degrees and roles across computer science, programming, and software development.
2. **Computer information systems and programming** credentials leading to roles such as a computer systems analyst or database administrator.
3. **Web development** credentials leading to roles such as web developers or digital interface designers.
4. **Networking, cloud computing, and cybersecurity** credentials leading to roles such as network administrators and network support specialists.

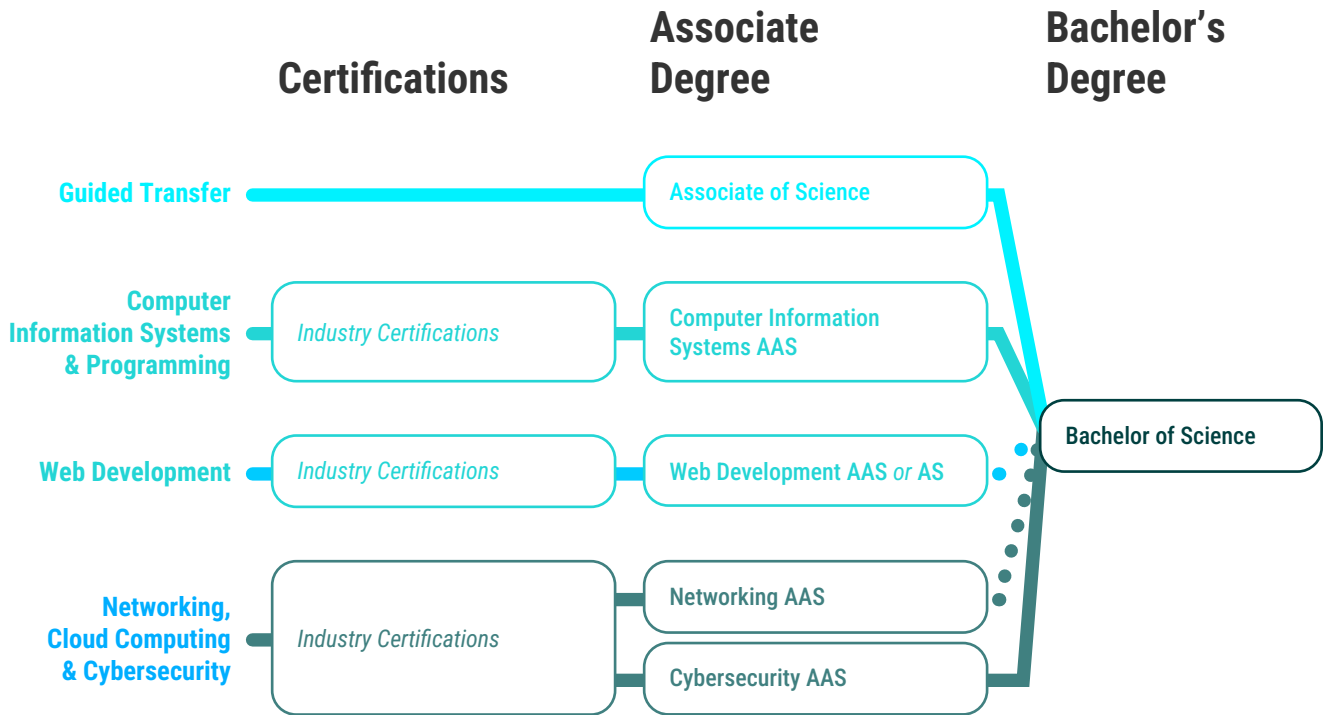
Advisory Committee Considerations

Across the four focus areas, the Advisory Committee highlighted the diversity of IT occupations, with many blended roles and skill sets. Committee members emphasized the necessity of solid foundations in mathematics and statistics as well as reading comprehension, regardless of a student's focus area. They noted the value that certifications and work-based learning experiences—whether through industry credentials, prior learning assessments, or otherwise—can add for high school students. They stressed the importance of foundational skills and adaptive competencies such as critical thinking, ethical thinking, problem solving, and creativity, which will be vital for learners in a rapidly evolving industry and broader economy. These considerations are reflected in the included course sequences and competencies.

³ P33 (2021, November). "The State of Chicago Tech Talent." Retrieved April 2023, from p33chicago.com/tech-talent-report/.

⁴ Illinois Department of Commerce and Economic Opportunity (2019, October 9). "A Plan to Revitalize the Illinois Economy and Build the Workforce of the Future." Retrieved April 2024, from dceo.illinois.gov/econplan2019.html.

Diagram: Postsecondary Opportunities



••••• Bachelor's degree is not required for employability

Table: Selected Occupations, Wages, and Job Growth

Program	Typical Job(s)	Living Wage Potential*	Median Hourly Wage**	IL Growth: Change over 10 years ***	IL Annual Job Openings***	Typical Educational Requirements
Guided Transfer	Computer and Information Systems Managers	High	\$78.01	8.0%	1,828	Bachelor's Degree
	Software Developers or Software Quality Assurance Analysts and Testers	High	\$52.44	18.0%	6,256	
	Database Architects	High	\$66.32	5.6%	526	
Computer Information Systems & Programming	Computer User Support Specialists	Medium	\$27.93	4.1%	1,539	Some College
	Database Administrators	High	\$49.18	5.6%	526	Bachelor's Degree
	Computer Systems Analysts	High	\$49.45	4.2%	2,306	
Web Development	Web and Digital Interface Designers	Medium	\$35.94	7.3%	548	Bachelor's Degree
Networking, Cloud Computing, & Cybersecurity	Computer Network Support Specialists	Medium	\$33.95	3.4%	999	Associate Degree
	Network and Computer Systems Administrators	High	\$42.72	3.1%	804	Bachelor's Degree
	Information Security Analysts	High	\$54.18	25.3%	428	

* Living wage potential is based on MIT's Living Calculator (livingwage.mit.edu) for Illinois in 2024. Occupations with median salaries higher than the living wage for 1 adult + 1 child (\$39.63/hour) are considered as having a "high" living wage potential. Occupations with median salaries only higher than the living wage of 1 adult, no children (\$22.86/hour) are considered as having a "medium" living wage potential, and occupations with median salaries below the living wage of 1 adult, no children (less than \$22.86/hour) are considered as having a "low" living wage potential.

** Illinois Department of Employment Security (2022). Wage Information: Occupational Employment and Wage Statistics (Statewide). Retrieved April 2, 2024, from ides.illinois.gov/resources/labor-market-information/oews.html

*** Illinois Department of Employment Security. Employment Projections (Long-Term Occupational Projections 2020-2030). Retrieved April 2, 2024, from ides.illinois.gov/resources/labor-market-information/employment-projections.html

High-Priority Occupations

The high-priority occupations associated with each of the promising credential program areas are identified in the table entitled Select Occupations, Wages, and Job Growth. Occupations associated with guided transfer programs, computer information systems and programming, web development, and networking, cloud computing, and cybersecurity all meet the job growth and living wage threshold described in this guide.

The IT industry is rapidly developing, and occupations continue to emerge. Analysis and consultation of the Advisory Committee indicate that occupations such as cloud data architect or artificial intelligence researcher could meet both living wage and high growth criteria in Illinois. However, these occupations and others do not currently have an affiliated profile from the U.S. Department of Labor and thus are not explicitly included. However, the roles often require a bachelor's degree or greater and could be considered part of a guided transfer pathway.

Levels of Education Needed

Each of the IT pathways in this guide incorporates stackable credentials, various industry-recognized certificates, an Associate of Applied Sciences (AAS) degree or a guided transfer Associate of Science (AS) degree, and can lead to a bachelor's degree. These credential types offer students the means and flexibility to enter the industry directly from their postsecondary experience.

Several public Illinois universities offer bachelor's degrees and concentrations in IT. These degree programs vary in name—information technology or systems, computer science, information science, computer or software engineering, cybersecurity, etc.—and focus. Whenever possible, community colleges should ensure that IT-related AAS degrees align with bachelor's degree programs at Illinois public universities and include prior-learning articulation with major industry certifications.

Many entry-level occupations in computer science and other computational fields require a bachelor's degree or an overwhelming percent of employees have a bachelor's or higher. Most public universities in Illinois offer a Bachelor of Science in Computer Science and some offer bachelor's programs in data science or analytics. These related paths are depicted as a guided transfer from an associate to a bachelor's degree. The web development focus area also offers a guided transfer.

Associate degree to bachelor's degree articulation options in networking, cloud computing, and cybersecurity are currently developing. Already, a limited number of Bachelor of Science in Cybersecurity degree programs are available. The postsecondary opportunities in this guide include a bachelor's degree option for this broad area with the expectation that additional degree programs will be available at more Illinois universities in the near future.

All IT students should build academic and work-based learning experiences while earning in-demand industry credentials. If intending to pursue a bachelor's degree, students may need targeted instructional supports to complete the math sequence requirements typical of bachelor's degrees.

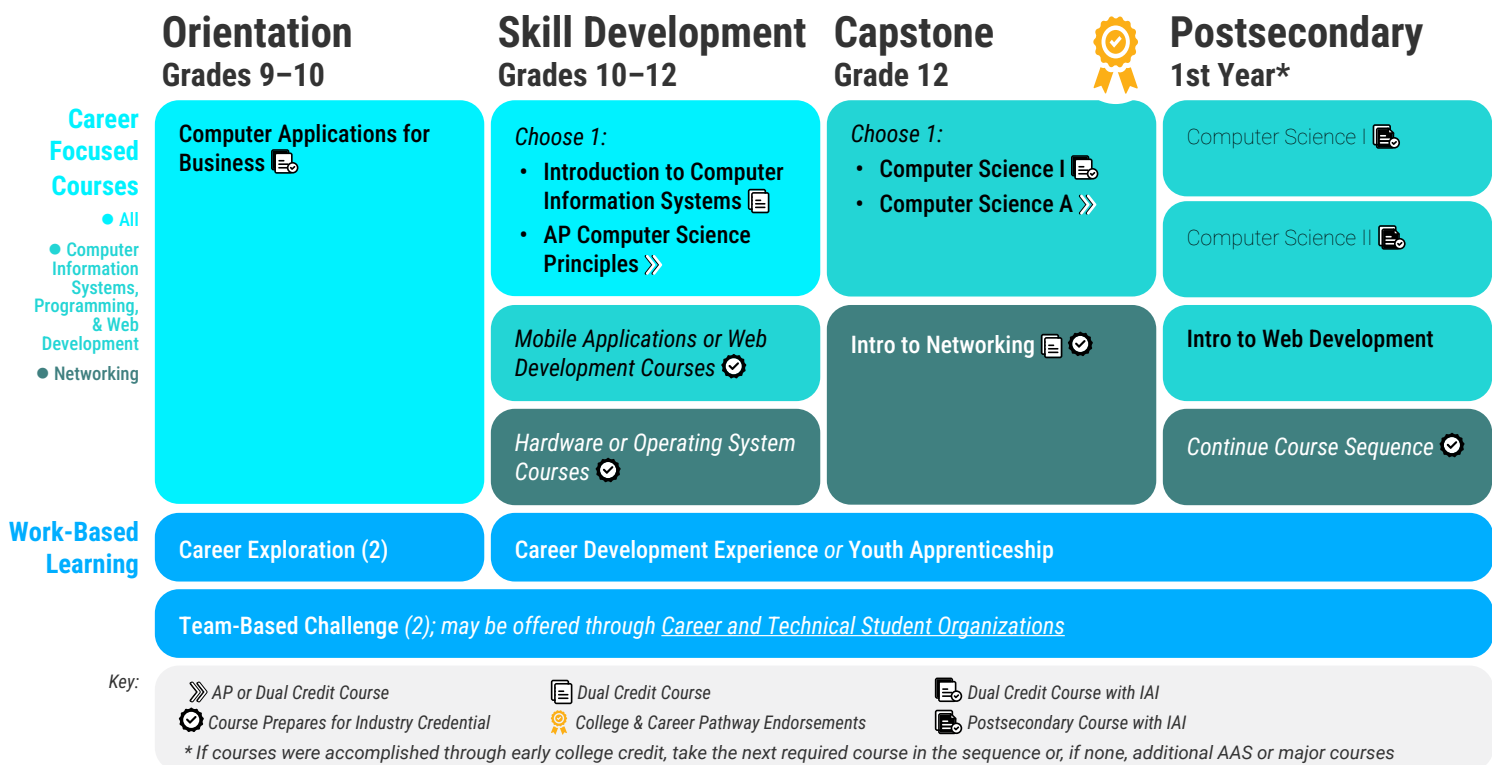
IV. Programs of Study Sequence Description

Students should start a career-focused instructional sequence with an orientation course in 9th or 10th grade, with students engaging in career awareness and exploration in the middle school grades if possible. With this early start, students have more openings in their schedule to complete skill development and capstone options, obtain significant early college credits, earn valuable industry credentials, and potentially acquire a [College and Career Pathway Endorsement](#) before high school graduation.

As school districts and their community college partners develop a program of study sequence, they should ensure that the high school coursework enables all students in the pathways to attain Illinois' [Recommended Essential Employability and Technical Competencies](#) and the top relevant technical competencies (see [Appendix A](#)).

The Model Programs of Study in Information Technology begin in high school by introducing students to the broad range of careers in the industry. Introductory and early college coursework combined with stackable credentials and work-based learning opportunities prepare IT students to demonstrate knowledge in fundamental areas such as hardware, software, networking, and programming. At the postsecondary level, students are prepared to pursue promising credentials. In all IT pathways, students can pursue the Model Program of Study sequence through the bachelor's level.

Diagram: Career-Focused Instructional Sequence



High School Career-Focused Instructional Sequence and Work-Based Learning

The high school career-focused instructional sequence builds from an orientation course in basic computer business applications towards skill development and capstone coursework in programming and networking. Throughout, the sequence offers complementary courses and opportunities for all students, in particular for the [ISBE CIP Codes](#) of 11.0201, 11.0701, and 11.0901. It includes dual credit opportunities, such as Introduction to Computer Information Systems and the Illinois Articulation Initiative (IAI)-affiliated Computer Science I, alongside the Advanced Placement (AP) sequence of Computer Science Principles and Computer Science A. These courses will prepare students for continued IT coursework at the postsecondary level as well as provide foundational knowledge for industry certifications. Students interested in computer programming can start with introductory courses in mobile application or web development. Students interested in computer networking can move from introductory courses in computer hardware and operating systems to the dual-credit-aligned Introduction to Networking course, a targeted introduction to networking that will prepare students to pursue an industry-recognized networking certification.

Ideally, students will start the career-focused instructional sequence with an orientation course in ninth grade. With an early start, students will have more openings in their schedule to complete skill development and capstone options, obtain significant early college credits, and earn valuable industry credentials all prior to high school graduation.

Orientation Coursework

The Model Programs of Study in Information Technology commence at the orientation level with a suggested 9th or 10th grade course focused on computer applications and technology, such as the IAI-affiliated Computer Applications for Business. This course is designed for prospective business majors but applicable to all, aiming to train students in general software applications including word processing, spreadsheets, internet access methods, and others. These applications are foundational in professional work environments and serve as entry to the more technical coursework to follow. School districts can offer alternative orientation courses, such as the Computer Concepts and Software Applications course in [ISBE's Career and Technical Education \(CTE\) program matrix](#) for Information Technology, as well as seek out dual or articulated credit opportunities for students.

To begin preparing for the College and Career Pathway Endorsements, students should also participate in multiple virtual and in-person visits to employer sites to better understand authentic industry environments and engage with professionals in the field. Students should hear from a variety of guest speakers in an array of IT careers to better understand opportunities in the field. Through the orientation course, students should be prepared to document their own personalized career pathway that leads to a promising credential.

Skill Development Coursework

The skill development coursework for 10th, 11th, or 12th grade students center on introductory IT and computer hardware and software coursework. The Introduction to Computer Information Systems course provides students with technical introductions to IT topics ranging from applications and software to hardware to programming. Operating from a technical knowledge base across areas is critical for all students preparing for an IT career, both in the industry's current and future states. This course—also titled Fundamentals of Computer Information Systems, IT Fundamentals, or otherwise by community colleges—will expand beyond the use of computer applications, as introduced in an orientation course, to build students' understanding of the infrastructure underlying computer and information systems. Cross-disciplinary employability competencies such as problem solving, which is integral to programming and computer troubleshooting and support, will be woven throughout (see appendix A). The proposed key course competencies for this course are defined in section V. Introduction to Computer Information Systems is intended as a dual credit option equivalent to introductory computer information systems or technology coursework at the postsecondary level and to AP Computer Science Principles. Several

community colleges around the state grant equivalent credit for AP Computer Science Principles. Either course serves as a prelude to capstone coursework.

Additional recommended courses include basic programming courses in mobile applications or web development, such as the ISBE CTE website and interactive media development courses, or basic networking courses in computer hardware and software topics, such as the ISBE CTE computer operations and programming courses (non-dual credit). Students should select courses that supplement their introductory knowledge of IT with opportunities to apply that knowledge towards specific focus areas, and, ideally, an industry-recognized credential such as [CompTIA A+](#).

To be on track to earn the College and Career Pathway Endorsements, regional high school and community college partners should ensure students have earned three to six early college credit hours through the skill development courses. Additionally, students should continue progressing through the [work-based learning continuum](#). Classroom instruction should be coupled with continued employer site visits, an opportunity for students to participate in a job shadow experience at an employer site, and clubs or challenges related to their program area. Team-based challenges should be completed either as activities embedded within course curriculum or through a student/extracurricular organization. Students should be encouraged to engage in student or professional IT organizations, including Career and Technical Student Organizations, to continue to build familiarity with the profession and pathways towards various career options.

Capstone Coursework

At the capstone level, students can pursue advanced coursework in programming or networking; if schedules permit, students are highly encouraged to enroll in both.

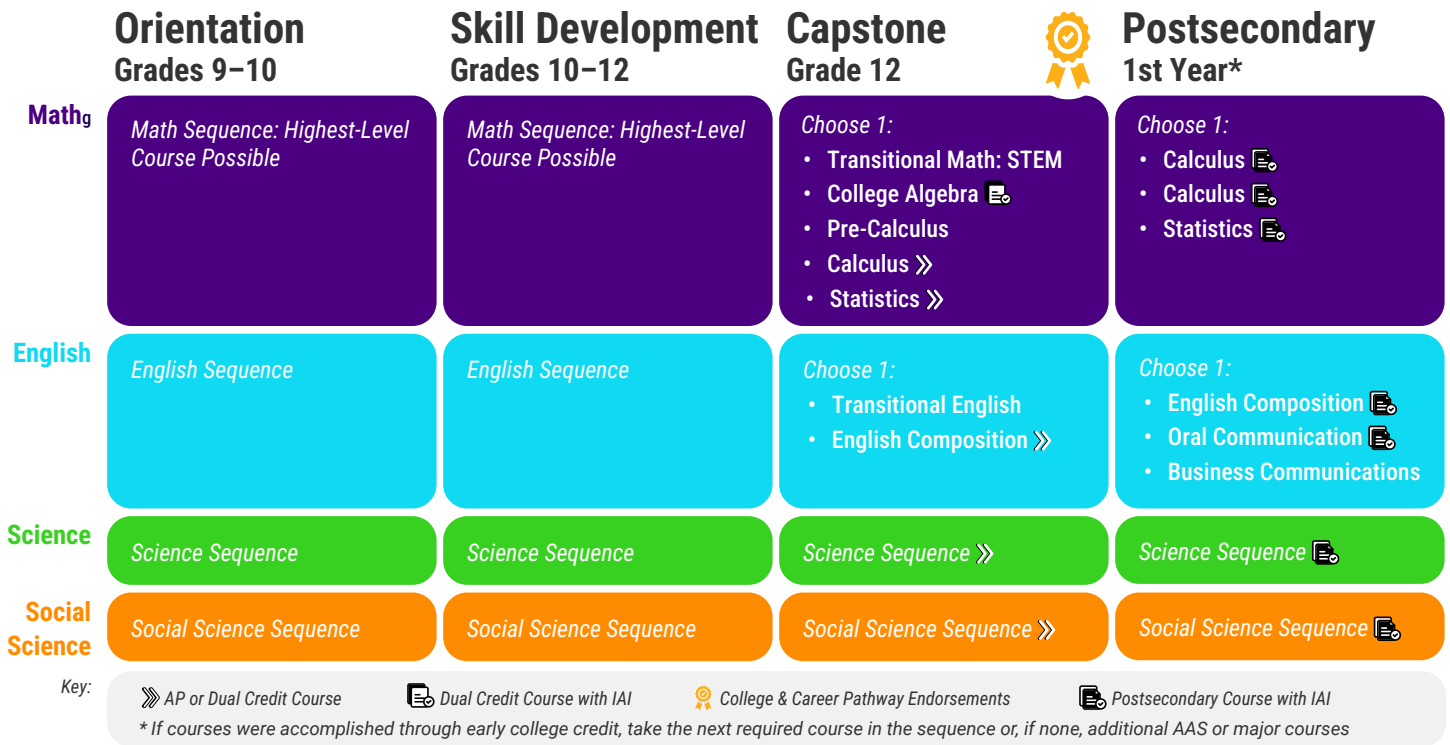
In the programming pathway, Computer Science I is an IAI-affiliated first course in a postsecondary computer science sequence. Keep in mind the IAI's strong recommendation that students enroll in both Computer Science I and Computer Science II through the same postsecondary institution and that they focus on the same programming language in both courses.⁵ The AP course equivalent is Computer Science A, which builds on AP Computer Science Principles taken at the skill development level. Both recommended programming courses expand on fundamental topics in computer science and programming and are considered equivalent in credit to an initial course for computer science majors.

The networking pathway continues with the dual-credit Introduction to Networking, which provides students with a focused introduction to networking concepts across devices and media; software; models, layers, and protocols; privacy, security, and ethics; virtualization and cloud computing; and others. Whereas skills development courses touch on networking—a topic relevant for all IT students—this course builds the broad conceptual knowledge necessary to ultimately earn industry-recognized networking certifications such as [CompTIA's Network+](#) or [Cisco's Certified Network Associate \(CCNA\)](#). Following the course, students should be prepared to take a certification exam in networking and advanced students could be positioned for more intermediate or cloud-focused certifications. Earning these or other credentials would serve as signals of job-ready skills that complement knowledge built in students' other coursework. Proposed course competencies for Introduction to Networking are defined in section V.

To be eligible for the College and Career Pathway Endorsements, all students should complete a career development experience of at least 60 hours in length and earn at least six or more early college credit hours, through a mix of both career-focused and general education coursework. Additionally, students should continue participation in clubs, professional organizations, or challenges related to their pathway.

⁵ Illinois Articulation Initiative. Computer Science/CS - Major Course Recommendations. ITransfer: Illinois Transfer Portal. Retrieved April 2024, from itransfer.org/courses/majors/cs.php

Diagram: General Education Instructional Sequence



High School General Education Courses

There are several critical considerations for general education coursework before graduating high school. The courses mentioned here are frequent requirements for many postsecondary promising credentials in information technology and enhance students' opportunities for postsecondary success in addition to the career-focused courses already delineated.

- In **science** and **social science**, students should complete upper-level courses as either AP or dual credit affiliated with an IAI course code if possible.
- In **math**, students should culminate their current course sequence, as appropriate, with one of the following: Transition to STEM, a transitional math course that guarantees placement into postsecondary College Algebra; dual credit College Algebra; Pre-Calculus; one or both courses in the AP Calculus sequence; and/or AP Statistics. Establishing a sound foundation in math and statistics helps ensure that students are prepared for the full extent of professional opportunities in IT.
- In **English**, students prepared for college-level coursework in their senior year should enroll in a dual credit English Composition course, if available. Students not prepared for college-level coursework should enroll in a transitional English course that guarantees placement into the partner community college's English Composition course.

First-Year Postsecondary Courses

The recommended first-year postsecondary courses extend the knowledge and skills recommended at the capstone level. The IAI-affiliated Computer Science I and Computer Science II courses prepare students for roles in programming and/or a guided transfer from community college to a computer science baccalaureate program. The Introduction to Web Development course serves as students' entry to web development at the postsecondary level.

Students not in a guided transfer program are recommended to follow their associate degree course sequence, with supplementary coursework aligned to a relevant IT certifications to support career goals.

In math, students are recommended to enroll in the most appropriate course, per placement or degree program requirement, of College Algebra, Calculus, or Statistics. For other general education course areas, students will take the required 100-level courses or, if already accomplished through early college credit, the next required course in the subject or, if none, additional courses in their major.

V. Strategic Dual Credit Courses: Competency Descriptions

EdSystems and ICCB convened a stakeholder Advisory Committee of secondary, postsecondary, and private sector representatives to vet the recommendations in this guide. A smaller working group further convened to identify key competencies for the targeted early college courses currently lacking statewide articulation. In IT, those courses are Introduction to Computer Information Systems and Introduction to Networking.

INTRODUCTION TO COMPUTER INFORMATION SYSTEMS

Key Competencies

Applications and Software	<ul style="list-style-type: none"> • Students can use their understanding of system software and software applications to explain the purposes and functions of operating systems, essential system utilities, general business software applications, and mobile and web-based applications. • Students can use their understanding of general software development to describe the life cycle of a software product from gathering requirements through deployment, maintenance, and next iteration.
Data and File Structures	<ul style="list-style-type: none"> • Students can use their understanding of common data and file structures to move, store, reference, access, and manipulate data or files necessary to create information.
Hardware	<ul style="list-style-type: none"> • Students can use their understanding of computer and peripheral hardware to explain the purposes and functions of the system unit and its components, input and output devices, and physical and virtual network devices and media.
Information Technology and Systems	<ul style="list-style-type: none"> • Students can use their understanding of fundamental IT concepts, systems, platforms, tools, and technology to understand the common roles of IT professionals. • Students can use their understanding of information systems to explain the purposes and functions of transactional, management, decision support, and other system types relevant to information technology.
Understanding Medical Records and Case Studies	<ul style="list-style-type: none"> • Students will use electronic resources and research methods to read medical writings and understand the medical information contained in them. • Students will analyze and interpret patient records, lab reports, diagnostic summaries, etc., and the information contained in them.
Networking and Cloud Computing	<ul style="list-style-type: none"> • Students will use electronic resources and research methods to read medical writings and understand the medical information contained in them. • Students will analyze and interpret patient records, lab reports, diagnostic summaries, etc., and the information contained in them.
Privacy, Security, and Ethics	<ul style="list-style-type: none"> • Students can use their understanding of fundamental privacy to identify and describe common and emerging privacy issues relevant to information technology and data. • Students can use their understanding of physical and virtual security controls to identify, describe, mitigate, and prevent basic threats to computers and data. • Students can use their understanding of fundamental ethics to identify and describe common and emerging ethical issues relevant to information technology, data, and artificial intelligence.
Programming	<ul style="list-style-type: none"> • Students can use their understanding of programming to code and debug basic programs via a graphical user interface and a command line interface.
Problem Solving and User Support	<ul style="list-style-type: none"> • Students can use their understanding of information technology and basic problem solving to identify a business problem; determine the problem's cause(s); and create, communicate, implement, and document a plan to resolve the problem. • Students can use their understanding of computers and communications to assist and support computer users in addressing common hardware and software issues.

INTRODUCTION TO NETWORKING

Key Competencies

Devices and Media	<ul style="list-style-type: none"> Students can use their understanding of networking infrastructure to explain the purposes, functions, and appropriate deployment of various network devices, media, and technology.
Software	<ul style="list-style-type: none"> Students can use their understanding of system software and software applications to explain the purposes and functions of a network operating system and common network utilities.
Models and Protocols	<ul style="list-style-type: none"> Students can use their understanding of the Open Systems Interconnect (OSI) model to identify and differentiate between OSI layers and their respective devices, protocols, and other components. Students can use their understanding of TCP/IP to subnet and address an IP network. Students can use their understanding of networking protocols to explain the purposes and functions of common ports.
Types and Topologies	<ul style="list-style-type: none"> Students can use their understanding of LAN and WAN to configure and monitor basic networks of each type. Students can use their understanding of physical and logical network topology to compare, contrast, and deploy bus, mesh, ring, and star topologies.
Security	<ul style="list-style-type: none"> Students can use their understanding of malware, firewall, IDS, and IPS to recognize and describe basic threats to networked computers. Students can use their understanding of physical and virtual security controls to secure basic local and wireless networks.
Privacy and Ethics	<ul style="list-style-type: none"> Students can use their understanding of fundamental privacy to identify and describe common and emerging privacy issues relevant to information technology and data. Students can use their understanding of fundamental ethics to identify and describe common and emerging ethical issues relevant to information technology and data.
Troubleshooting and Support	<ul style="list-style-type: none"> Students can use their understanding of troubleshooting to identify common network issues; determine an issue's cause(s); and create, communicate, implement, and document a plan to resolve the issue. Students can use their understanding of networking and communications to assist and support network users in addressing common network issues.
Virtualization and Cloud Computing	<ul style="list-style-type: none"> Students can use their understanding of networking and the Internet to describe the concepts of virtualization and cloud computing. Students can use their understanding of the features, benefits, and concepts of virtualization and cloud networking to differentiate among types of cloud services.

Appendices

A.1: Technical and Essential Employability Competencies for IT

The following technical and employability competencies for health sciences are from “[Recommended Technical and Essential Employability Competencies for College and Career Pathway Endorsements](#),” a document developed through an iterative process involving public-private steering committees established pursuant to the Postsecondary and Workforce Readiness Act in order to implement College and Career Pathway Endorsements.

Technical and Essential Employability Competencies for INFORMATION TECHNOLOGY	
Basic Principles of IT Concepts, Systems, Platforms, & Tools	Students can use their understanding of fundamental IT concepts, systems, platforms, tools, and technology to understand the common roles of IT professionals.
Security	Students can use their understanding of malware, firewall, IDS, and IPS to recognize and describe basic threats to networked computers.
Logic & Fundamentals of Computer Languages	Students can use their understanding of how computer languages communicate to build basic mobile and web applications.
Routing & Network Configuration	Students can use their understanding of common networking protocols to explain the purpose of routing, network configuration, and monitoring.
User & Customer Support	Students can use their understanding of the range of services used to provide assistance and technical support to help users implement and solve problems related to information technology.
Basic Principles of Hardware	Students can use their understanding of communication systems hardware to describe the purpose and function of fundamental end user devices, switches, routers, wireless access points, etc.
Risk Management & Information Assurance	Students can use their understanding of the standards and applications needed to protect the confidentiality, integrity, and availability of information and information systems.
Basic Principles of Software Development	Students can use their understanding of designing, writing, testing, and maintaining source code of computer programs to manage and maintain software.
Networks	Students can use their understanding of hardware and software to facilitate communication between people and computer systems.
Basics of Virtualization & Cloud Computing	Students can use their understanding of the features, benefits, and concepts of virtualization and cloud computing to differentiate among types of cloud services.

A.2: Cross-Sector Essential Employability and Entrepreneurial Competencies

The following cross-sector competencies are from “[Recommended Technical and Essential Employability Competencies for College and Career Pathway Endorsements](#),” a document developed through an iterative process involving public-private steering committees established pursuant to the Postsecondary and Workforce Readiness Act in order to implement College and Career Pathway Endorsements.

ESSENTIAL EMPLOYABILITY COMPETENCIES	
Teamwork & Conflict Resolution	Students can use their understanding of working cooperatively with others to complete work assignments and achieve mutual goals.
Communication	<p>Verbal: Students can use their understanding of English grammar and public speaking, listening, and responding, convey an idea, express information, and be understood by others.</p> <p>Written: Students can use their understanding of standard business English to ensure that written work is clear, direct, courteous, and grammatically correct.</p> <p>Digital: Students can use their understanding of email, keyboarding, word processing, and digital media to convey work that is clear, direct, courteous, and grammatically correct.</p>
Problem Solving	Students can use their critical thinking skills to generate and evaluate solutions as they relate to the needs of the team, customer, and company.
Decision Making	Students can use their understanding of problem solving to implement and communicate solutions.
Critical Thinking	Students can use their understanding of logic and reasoning to analyze and address problems.
Adaptability & Flexibility	Students can use their understanding of workplace change and variety to be open to new ideas and handle ambiguity.
Initiative & Self-Drive	Students can use their understanding of goal setting and personal impact to achieve professional goals and understand personal impact.
Reliability & Accountability	Students can use their understanding of commitment, time management, and follow through to ensure that a professional team functions properly and meets collective goals.
Cultural Competence	Students can use their understanding of diversity and inclusion to communicate and work effectively across a multitude of abilities, cultures, and backgrounds.
Planning & Organizing	Students can use their understanding of time management to plan effectively and accomplish assigned tasks.

ENTREPRENEURIAL COMPETENCIES

Principles of Entrepreneurship	Students can apply their understanding of the process and characteristics of business development and promotion in order to apply strategies of innovation to personal and professional business pursuits.
Innovation & Invention	Students can use their understanding of idea generation, design thinking, product and business development in order to introduce and process new and effective ideas.
Growth Mindset	Students can use their understanding of learning from challenges, set-backs, and failure in order to adapt strategies and continue efforts to achieve personal goals.

Source: "State of Illinois [Recommended Technical and Essential Employability Competencies for College and Career Pathway Endorsements](#)"

B: 2020 Advisory Committee Membership

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Director for Career & Technical Education
Illinois Community College Board

Bridget Altenburg

President & CEO
National Able Network

Jami Becker

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*Associate Professor & Program Coordinator
Moraine Valley Community College*

Lead EdSystems Staff

Charlie Rosemond

Data & Outcomes Manager

Jon Furr

Executive Director

Juan Jose Gonzalez

Pathways Director

Sarah Clark

Development and Communications Director

C: College and Career Pathway Endorsements Framework

The College and Career Pathway Endorsements system is a voluntary system for school districts to award endorsements on high school diplomas to graduates who have demonstrated readiness for college and careers. The following framework for the endorsement system is available as a [PDF download](#).



College and Career Pathway Endorsements Framework



INDIVIDUAL PLAN

Each student completing an endorsement must have an individualized plan, which includes college planning linked to early understanding of career goals, financial aid, resume, and personal statement.

PROFESSIONAL LEARNING

Awareness, exploration, and preparation activities that provide opportunities for students to interact with adults in their workplace and gain essential employability and technical competencies.

9th	10th	11th	12th
At least 2 career exploration activities or 1 intensive experience		60 cumulative hours of paid or for credit, supervised career development experience(s) with a professional skills assessment r	
At least 2 team-based challenges with adult mentoring			

CAREER-FOCUSED INSTRUCTIONAL SEQUENCE

2 years of secondary coursework or equivalent that include essential employability and technical competencies, at least 6 hours of early college credit, and articulation to a postsecondary credential with labor market value.

9th	10th	11th	12th
Orientation / Introduction Courses			
	Skill Development Courses		
			Capstone / Advanced Courses

ACADEMIC READINESS

Ready for non-remedial coursework in reading and math by high school graduation through criteria defined by the school district and local community college.

D: Illinois' Work-Based Learning Continuum

Illinois has a defined continuum of work-based learning opportunities, which spans from secondary to postsecondary. Components, defined in statute and the [Illinois Career Pathways Dictionary](#), include career awareness, career exploration, team-based challenges, career development experiences, youth or pre-apprenticeships, and apprenticeships.

Work-Based Learning & Host Engagement Continuums



Illinois' continuum represents the many forms of work-based learning that grow in intensity depending on the model. However, this continuum is not intended to convey a fixed or ideal progression. As individuals learn through their work-based learning experiences, they may return to less intensive models to develop different skills or explore additional interests. Individuals should be supported to engage in these activities iteratively as they explore the multiple entry and exit points of career pathways.

Providing high-quality work-based learning requires strong partnerships between educators and regional employers. As the intensity of students' experiences progress, so too does the role of employer partners serving as host sites.



Model Programs of Study in Information Technology

Recommended Courses

Orientation Grades 9–10

Skill Development Grades 10–12

Capstone Grade 12



Postsecondary 1st Year*

Career Focused Courses

- All
- Computer Information Systems, Programming, & Web Development
- Networking

Computer Applications for Business

Choose 1:

- Introduction to Computer Information Systems
- AP Computer Science Principles

Choose 1:

- Computer Science I
- Computer Science A

Computer Science I

Computer Science II

Mobile Applications or Web Development Courses

Intro to Networking

Intro to Web Development

Hardware or Operating System Courses

Continue Course Sequence

Work-Based Learning

Career Exploration (2)

Career Development Experience or Youth Apprenticeship

Team-Based Challenge (2); may be offered through *Career and Technical Student Organizations*

Math^g

Math Sequence: Highest-Level Course Possible

Math Sequence: Highest-Level Course Possible

Choose 1:

- Transitional Math: STEM
- College Algebra
- Pre-Calculus
- Calculus
- Statistics

Choose 1:

- Calculus
- Calculus
- Statistics

English

English Sequence

English Sequence

Choose 1:

- Transitional English
- English Composition

Choose 1:

- English Composition
- Oral Communication
- Business Communications

Science

Science Sequence

Science Sequence

Science Sequence

Science Sequence

Social Science

Social Science Sequence

Social Science Sequence

Social Science Sequence

Social Science Sequence

Key:

AP or Dual Credit Course

Dual Credit Course

Dual Credit Course with IAI

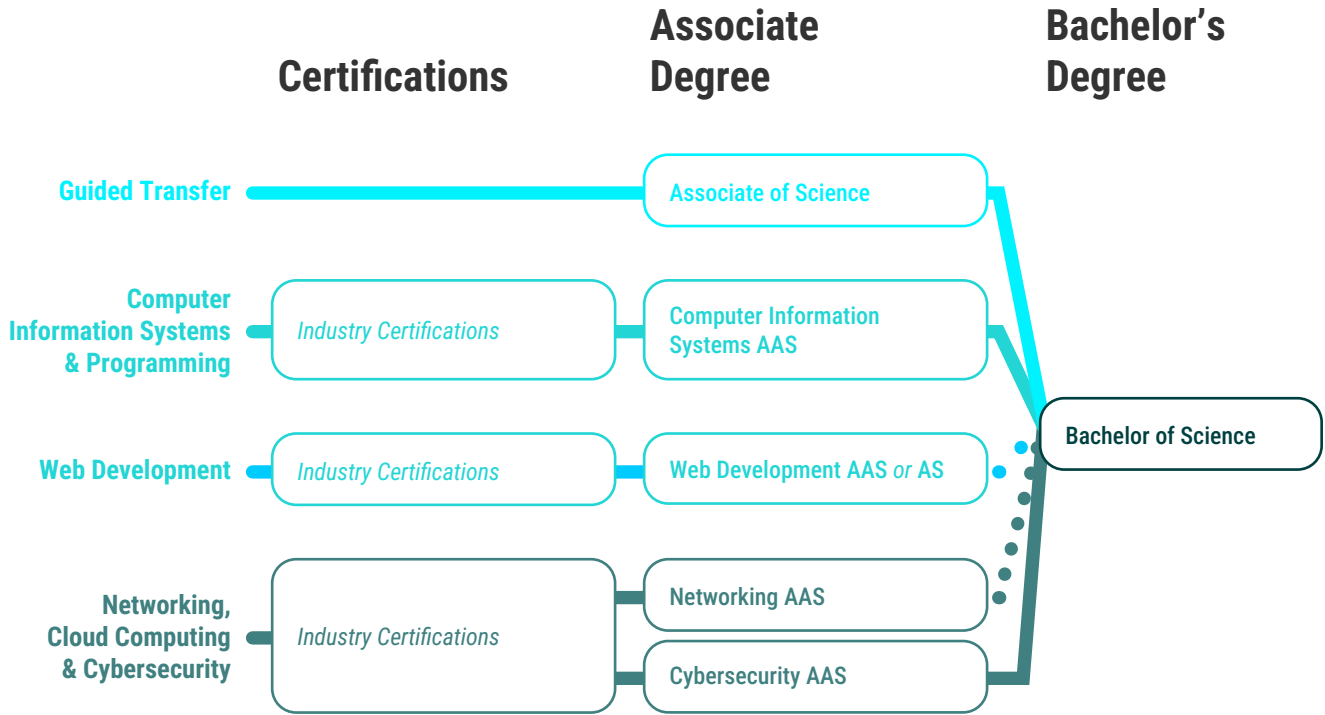
Course Prepares for Industry Credential

College & Career Pathway Endorsements

Postsecondary Course with IAI

* If courses were accomplished through early college credit, take the next required course in the sequence or, if none, additional AAS or major courses

Postsecondary Opportunities



..... Bachelor's degree is not required for employability

Selected Occupations, Wages, and Job Growth

Program	Typical Job(s)	Living Wage Potential*	Median Hourly Wage**	IL Growth: Change over 10 years ***	IL Annual Job Openings***	Typical Educational Requirements
Guided Transfer	Computer and Information Systems Managers	High	\$78.01	8.0%	1,828	Bachelor's Degree
	Software Developers or Software Quality Assurance Analysts and Testers	High	\$52.44	18.0%	6,256	
	Database Architects	High	\$66.32	5.6%	526	
Computer Information Systems & Programming	Computer User Support Specialists	Medium	\$27.93	4.1%	1,539	Some College
	Database Administrators	High	\$49.18	5.6%	526	Bachelor's Degree
	Computer Systems Analysts	High	\$49.45	4.2%	2,306	
Web Development	Web and Digital Interface Designers	Medium	\$35.94	7.3%	548	Bachelor's Degree
Networking, Cloud Computing, & Cybersecurity	Computer Network Support Specialists	Medium	\$33.95	3.4%	999	Associate Degree
	Network and Computer Systems Administrators	High	\$42.72	3.1%	804	Bachelor's Degree
	Information Security Analysts	High	\$54.18	25.3%	428	

* Living wage potential is based on MIT's Living Calculator (livingwage.mit.edu) for Illinois in 2024. Occupations with median salaries higher than the living wage for 1 adult + 1 child (\$39.63/hour) are considered as having a "high" living wage potential. Occupations with median salaries only higher than the living wage of 1 adult, no children (\$22.86/hour) are considered as having a "medium" living wage potential, and occupations with median salaries below the living wage of 1 adult, no children (less than \$22.86/hour) are considered as having a "low" living wage potential.

** Illinois Department of Employment Security (2022). Wage Information: Occupational Employment and Wage Statistics (Statewide). Retrieved April 2, 2024, from ides.illinois.gov/resources/labor-market-information/oews.html

*** Illinois Department of Employment Security. Employment Projections (Long-Term Occupational Projections 2020-2030). Retrieved April 2, 2024, from ides.illinois.gov/resources/labor-market-information/employment-projections.html