

Summer Externship 2017 - Collaborative Programming

Objectives (CSTA K-12 Computer Science Standards)

Student will be able to (3A-A-2-1) design and develop a software artifact working in a team. (3A-A-2-2) Demonstrate how diverse collaborating impacts the design and development of software products (e.g., discussing real-world examples of products that have been improved through having a diverse design team or reflecting on their own team's development experience). (3A-I-1-27) Demonstrate how computing enables new forms of experience, expression, communication, and collaborating. (3B-A-2-1) Use version control systems, integrated development environments (IDEs), and collaborating tools and practices (code documentation) in a group software project.

CTE Standards that will be covered

A8.1 Develop the purpose and scope of a project.

A8.2 Acquire, use, and manage necessary internal and external resources when supporting various organizational systems.

A8.3 Use various tools to manage projects involving the development of information and communication systems.

A8.5 Design, develop, implement, and monitor a project by creating and integrating technologies.

C1.1 Identify the phases of the systems development life cycle, including analysis, design, programming, testing, implementation, maintenance, and improvement.

C1.3 Identify and describe how specifications and requirements are developed for new and existing software applications.

C1.4 Work as a member of, and within the scope and boundaries of, a development project team.

C1.5 Track development project milestones using the concept of versions.

Student learning outcomes

Students will be able to collaboratively write programs in which the individual pieces come together for a larger purpose.

Unit name

Collaborative Programming

Timing of activities

Day 1: Group collaboration to determine their app idea

Day 2: Divide the programming tasks into equal parts for each group member. Determine required input/output for each part, including variables and any other necessary components for compatibility

Day 3-5: Individual programming

Day 6-8: Combining code and debugging

Class discussion questions

1. Why is it more efficient to program individually or collaboratively?
2. What are the requirements for collaborative programming?
3. What are the compatibility requirements for collaborative programming?
4. What challenges need to be overcome?
5. How will the debugging process be different for a collaborative project?
6. How can time be used most effectively?

How you will assess student learning

Students will complete both individual and collaborative programming projects.

Resources/ instructional materials required

- [Pair programming](#)
- [3 best practices for pair programming](#)

Video links

- [Pair Programming](#)
- [Mob Programming](#)
- [Working at Microsoft](#)

Link to industry/job information

- [CS Teachers](#)
- [Computer Programmers](#)
- [Computer and Information Research Scientists](#)

Collaborative Programming Assignment

Directions

Work with your partners to create a socially useful app that uses some combination of graphics, animation, simulation, location awareness, data persistence, and/or texting. As you develop your project keep track of significant errors and challenges that you encountered and how you solved or debugged them. After completing the project, you should complete an individual write up.

Please review the rubric that follows for grading guidelines.

Requirements

Below is an overview of the process you should follow for creating your app:

1. With your partners, brainstorm a project idea, develop drawing(s) of the User Interface and a rough storyboard of how your app will function.
2. Meet with your teacher to discuss the feasibility of the app and if necessary make any changes to your plan.
3. Present a short (2-3 minute) elevator pitch of your project idea to the class. The pitch could follow this template:
 - ***[name of app] is a [kind of thing it is] for [the people who would use it] that, unlike [similar apps] is able to [the major distinguishing feature of your app].***
4. Other students should provide feedback: Is the app presented socially useful why or why not? What is a strength of the proposed app? What suggestions do you have to improve the app?
5. Consider the feedback provided and make adjustments if warranted. Work collaboratively to develop, test, and debug your app, making sure that it meets the following coding specifications.
 - *Documentation of Code:* For this assignment, a well documented app means having well named components, variables, and procedures. Where appropriate, your code should contain comments that explains the various parts of your code.
 - *Data:* For this assignment, your app should make appropriate use of variables. If data persistence is necessary for your app, you should make use of a TinyDb and/or a TinyWebDb.
 - *Algorithms:* For this assignment, your app should make appropriate use of sequence, selection, and repetition control structures.
 - *Abstraction:* For this assignment, your app should make appropriate use of one or more programmer defined procedures to handle certain subtasks. Also, your procedures should use parameters where appropriate.

- *Feature Specifications:* For this assignment your app should make appropriate use of some combination of graphics, animation, simulation, location awareness, data persistence, and/or texting.
6. Divide individual parts of the project amongst the group, determining necessary compatibility requirements.
 7. After individually programming your part, come back together with the group to combine everyone's part and to debug.
 8. Create a one-page write up of your project.
 9. Create a 1 minute video presentation by providing a demo of your working app.
 10. Present your video to the class for class feedback.

CONTENT AREA & WEIGHTING	PERFORMANCE QUALITY		
	LOW	MEDIUM	HIGH
<p>1: Developing a Program with a Purpose Submission Requirement: 1: 2a LO: 5.1.1; OR 5.1.2; 5.4.1 Weighted: 20%</p>	<p>The video demonstrates the running of at least one feature of the program. OR The written response or video narration summarizes what the video illustrates, without clearly identifying the program's purpose.</p>	<p>The video demonstrates the running of at least one feature of the program. AND The written response or video narration summarizes what the video illustrates, without clearly identifying the program's purpose.</p>	<p>The video demonstrates the running of at least one feature of the program that illustrates the program's intended purpose as described in the written response or the video narration.</p>
<p>2: Developing a Program with a Purpose Submission Requirement: 2b LO: 5.1.1; OR 5.1.2 Weighted: 20%</p>	<p>The response identifies the steps in the development of the program in at least one point. AND The response must identify at least one point in the development of the program that was completed independently.</p>	<p>The response describes a difficulty and an opportunity encountered (or two difficulties or two opportunities) at two points in the development of the program. AND The response must identify at least one point in the development of the program that was completed independently.</p>	<p>The response describes a difficulty and an opportunity encountered (or two difficulties or two opportunities) at two points in the development of the program. AND The response describes how each of the difficulties and/or opportunities were resolved and incorporated as part of an incremental and iterative development process. AND The response must identify at least one point in the development of the program that was completed independently.</p>
<p>3: Applying Algorithms Submission Requirement: 3c LO: 4.1.1; 4.1.2; 5.2.1; 5.5.1 Weighted: 30%</p>	<p>The selected algorithm is a commonly used algorithm and integrates mathematical and/or logical concepts. AND The response provides a general description of the algorithm OR a correct line-by-line summary of the algorithm. *If needed, more than one area of the program code can be selected as part of the response to describe the algorithm.</p>	<p>The selected algorithm integrates two or more commonly used or new algorithms and integrates mathematical and/or logical concepts to create a new algorithm. AND The response identifies the algorithm's purpose in the program and accurately describes with specificity how the algorithm achieves this purpose. *If needed, more than one area of the program code can be selected as part of the response to describe the algorithm.</p>	<p>The selected algorithm integrates two or more commonly used or new algorithms, and integrates mathematical and/or logical concepts to create a new algorithm. AND The response identifies the algorithm's purpose in the program and accurately describes with specificity how the algorithm achieves this purpose. AND The response accurately describes how two of the algorithms function independently as well as in combination to create a new algorithm. *If needed, more than one area of the program code can be selected as part of the response to describe the algorithm.</p>
<p>4: Applying Abstraction Submission Requirement: 2d LO: 2.2.1; 5.3.1 Weighted: 30%</p>	<p>The selected abstraction includes mathematical and/or logical concepts and serves to manage complexity of the program. AND The response indicates that an abstraction was developed and provides a general description or summary of the purpose the abstraction. *If needed, more than one area of the program code can be selected as part of the response to describe the abstraction.</p>	<p>The selected abstraction integrates mathematical and/or logical concepts and serves to manage complexity of the program. AND The response indicates that an abstraction was developed and provides an accurate description with specificity of the purpose of the abstraction. *When necessary, the response should include descriptions of a list(s) or procedure(s), and explains any use of parameters and return values in the abstraction. *If needed, more than one area of the program code can be selected as part of the response to describe the abstraction.</p>	<p>The selected abstraction integrates mathematical and/or logical concepts and serves to manage complexity of the program. AND The response indicates that an abstraction was developed and provides an accurate description with specificity of the purpose of the abstraction. AND The response explains how the abstraction manages complexity of the program due to the inclusion of the abstraction in the program or explains how the program would function without the abstraction. *When necessary, the response should include descriptions of a list(s) or procedure(s), and explains any use of parameters and return values in the abstraction. *If needed, more than one area of the program code can be selected as part of the response to describe the abstraction.</p>



Benefits and perks

A culture of wellness and balance

Benefits play an important role in your choice of an employer. That's why we work hard to make sure our benefits reflect the changing needs and wants of our people, and it's why we provide many industry-leading benefits to our employees who rely on them. Our goal is to empower you with the resources, incentives, and flexibility you need to enjoy success on the job and to live a healthy, balanced life.

Learn more about our [benefit offerings for employees in the U.S.](#) If you are seeking employment with Microsoft outside of the US, please consult with your local recruiter for more detail on the benefits offered in your country of employment.

Career development

At Microsoft, you'll have an amazing range of opportunities. You might become an expert in a particular field or build proficiencies across many areas. You might be an individual contributor or become a manager. Because we have so many kinds of jobs in so many different places, you can stay in one building, city, or country, or you can cross borders—in person, or virtually.

Your career and professional development is a partnership between you and your manager, reinforced by our numerous career resources. And as much as we're here to support you, we believe your career is an individual adventure. You drive your career development plan while your manager assists and coaches you, and we provide a framework with the tools and resources you need to succeed.

One thing is certain, you'll never stand still at Microsoft.

Our philosophy: an individual adventure

Defined roles. Each of our jobs has clear requirements for success but lots of room to push boundaries and grow. Managers provide ongoing support, but ultimately you are empowered to shape your personal experience and chart your own career path. You can go deep in an area of expertise, or move across functions or businesses to experience a breadth of opportunity.

Career path options. You don't have to be a manager to move up. Both individual contributor and management careers progress all the way through senior levels—we highly value both.

Movement between job families. We define desired results and consistently apply them for all job families available across our teams. This makes it easy for you to learn about each job family and identify and develop.

Our career guide

A clear way to manage your career. Our career guide is a tool that describes careers across the company and provides visibility to those opportunities to help you manage your career. The career guide helps you understand the skills and capabilities that contribute to success in today's environment, and provides a

variety of ways to develop both in role and for your future career. As part of your development, you'll have the option to engage in some 2,000 training programs taught by instructors from leading educational institutions and offered online, virtually, or in classrooms around the globe. You can't beat the level of investment we place on career development.

Mentoring & networking

Connections to help us grow. At Microsoft we share knowledge, experiences, and resources to help each other achieve our career goals and grow both professionally and personally.

Mentoring allows you to learn from the experiences of professionals within and outside of your own area of expertise, and to build a network to help find opportunities that can promote your development. Mentoring is a great way to make a big company feel smaller—and its opportunities more accessible—to each of us.

Employee resource groups, networks and social groups allow people with common interests or backgrounds to connect with each other. Do you love pets, vegetarian cooking, or the environment? Do you share a cultural background or special need with other employees? Chances are you'll find a network of people with similar interests and/or needs at Microsoft, and you can connect with them as you develop your career and lifestyle. Being a part of the Microsoft community is a rich, fulfilling experience.

Diversity and inclusion

The heart of our business. Microsoft has always been about recognizing the value that different life experiences and viewpoints bring to our business. We seek out people from diverse backgrounds and encourage them to take risks and approach challenges unconventionally.

[Learn about diversity and inclusion at Microsoft](#)

[See our open roles in disability hiring](#)

Corporate citizenship

Global reach. Local impact. Microsoft has a responsibility, based on our mission and values, to promote social and economic opportunity in the communities where we work, live, and do business. That's why we collaborate with governments and community organizations to address societal needs. Our commitment to enabling societal change and upholding the highest standards of business conduct are a part of what make us proud about working at Microsoft. With the support of our employees and in alliance with our many partners, we will continue to make positive and lasting contributions to society.

Labor Market Analysis: Computer Programmers

Summary



Programmers spend most of their time writing and testing computer code.

Quick Facts: Computer Programmers	
2016 Median Pay	\$79,840 per year \$38.39 per hour
Typical Entry-Level Education	Bachelor's degree
Work Experience in a Related Occupation	None
On-the-job Training	None
Number of Jobs, 2014	328,600
Job Outlook, 2014-24	-8% (Decline)

What Computer Programmers Do



Computer programmers write programs in a variety of computer languages, such as C++ and Java. Computer programmers write and test code that allows computer applications and software programs to function properly. They turn the program designs created by software developers and engineers into instructions that a computer can follow. In addition, programmers test newly created applications and programs to ensure that they produce the expected results. If they do not work correctly, computer programmers check the code for mistakes and fix them.

Duties

Computer programmers typically do the following:

- Write programs in a variety of computer languages, such as C++ and Java
- Update and expand existing programs
- Test programs for errors and fix the faulty lines of computer code responsible
- Create and test code in an integrated development environment (IDE)
- Use code libraries, which are collections of independent lines of code, to simplify the writing

Programmers work closely with software developers, and in some businesses their duties overlap. When such overlap occurs, programmers can do work that is typical of developers, such as designing the program. Program

design entails planning the software initially, creating models and flowcharts detailing how the code is to be written, writing and debugging code, and designing an application or systems interface. Programmers often use an IDE, which allows them to create, edit, and test code.

A program's purpose determines the complexity of its computer code. For example, a weather application for a mobile device will require less programming than a social-networking application. Simpler programs can be written in less time. Complex programs, such as computer operating systems, can take a year or more to complete.

Software-as-a-service (SaaS), which consists of applications provided through the Internet, is a growing field. Although programmers typically need to rewrite their programs to work on different system platforms, such as Windows or OS X, applications created with SaaS work on all platforms. Accordingly, programmers writing SaaS applications may not have to rewrite as much code as other programmers do and can instead spend more time writing new programs.

Work Environment



Most programmers work independently in offices.

Computer programmers held about 328,600 jobs in 2014. The largest employers of computer programmers were as follows:

- Computer systems design and related services

- Software publishers
- Finance and insurance
- Manufacturing
- Administrative and support services

Programmers normally work alone, but sometimes work with other computer specialists on large projects. Because writing code can be done anywhere, many programmers telecommute.

Work Schedules

Most computer programmers work full time.

How to Become a Computer Programmer About this section



Most programmers have a degree in computer science or a related field. Most computer programmers have a bachelor's degree in computer science or a related subject; however, some employers hire workers with an associate's degree. Most programmers specialize in a few programming languages.

Education

Most computer programmers have a bachelor's degree; however, some employers hire workers who have an associate's degree. Most programmers get a degree in computer science or a related subject. Programmers who work in specific fields, such as healthcare or accounting, may take classes in that field to supplement their degree

in computer programming. In addition, employers value experience, which many students gain through internships.

Most programmers learn a few computer languages while in school. However, a computer science degree gives students the skills needed to learn new computer languages easily. During their classes, students receive hands-on experience writing code, testing programs, fixing errors, and doing many other tasks that they will perform on the job.

To keep up with changing technology, computer programmers may take continuing education and professional development seminars to learn new programming languages or about upgrades to programming languages they already know.

Licenses, Certifications, and Registrations

Programmers can become certified in specific programming languages or for vendor-specific programming products. Some companies require their computer programmers to be certified in the products they use.

Other Experience

Many students gain experience in computer programming by completing an internship at a software company while in college.

Advancement

Programmers who have general business experience may become computer systems analysts. With experience, some programmers may become software developers. They may also be promoted to managerial positions. For more information, see the profiles on [computer systems analysts](#), [software developers](#), and [computer and information systems managers](#).

Important Qualities

Analytical skills. Computer programmers must understand complex instructions in order to create computer code.

Concentration. Programmers must be able to work at a computer, writing lines of code for long periods.

Detail oriented. Computer programmers must closely examine the code they write because a small mistake can affect the entire computer program.

Troubleshooting skills. An important part of a programmer's job is to check the code for errors and fix any they find.

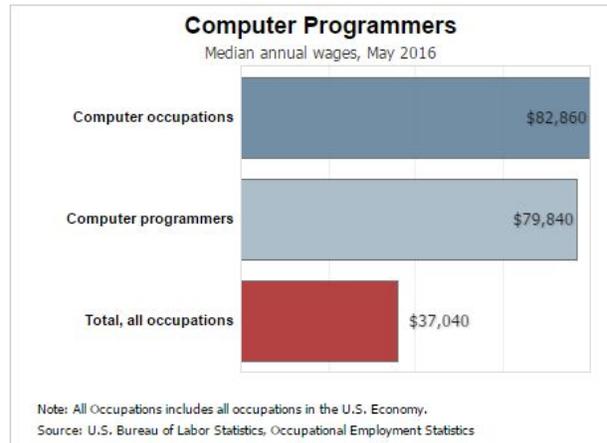
Pay

The median annual wage for computer programmers was \$79,840 in May 2016. The median wage is the wage at which half the workers in an occupation earned more than that amount and half earned less. The lowest 10 percent earned less than \$45,570, and the highest 10 percent earned more than \$130,360.

In May 2016, the median annual wages for computer programmers in the top industries in which they worked were as follows:

Software publishers	\$93,380
Finance and insurance	87,930
Administrative and support services	81,920
Manufacturing	79,870
Computer systems design and related services	79,030

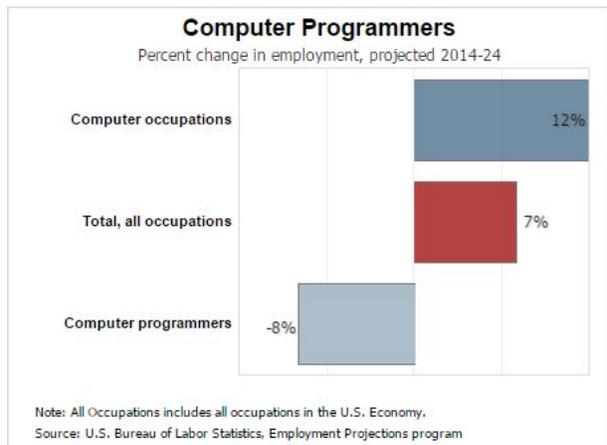
Most computer programmers work full time.



Job Outlook

Employment of computer programmers is projected to decline 8 percent from 2014 to 2024. Computer programming can be done from anywhere in the world, so companies sometimes hire programmers in countries where wages are lower. This ongoing trend is projected to limit growth for computer programmers in the United States. However, the high costs associated with managing projects given to overseas programmers sometimes offsets the savings from the lower wages, causing some companies to bring back or keep programming jobs in the United States.

Many computer programmers work in the computer system design and related services industry, which is expected to grow as a result of increasing demand for new computer software. The software publishers industry is also expected to grow as the use of software offered over the Internet increases. This new use of software over the Internet should lower costs for firms and allow users more customization. In addition, new applications will have to be developed for mobile technology and the healthcare industry. An increase in computer systems that are built into electronics and other noncomputer products should result in some job growth for computer programmers and software developers.



Job Prospects

Job prospects will be best for programmers who have a bachelor's degree or higher and knowledge of a variety of programming languages. Keeping up to date with the newest programming tools will also improve job prospects.