

COMPUTER SCIENCE

In this session, Explorers will begin with an overview of the computer science discipline, and they will then conduct a short, fun investigation that is related computer science.

CATEGORY

- Engineering
- Computer Science

OBJECTIVES

By the end of this session, participants will be able to:

- Define computer science.
- Describe what computer scientists do.
- Demonstrate a key computer science and coding concept.

SUPPLIES

- Computer with Internet access
- See Activity 3 for suggested activities, and prepare supplies as needed.

RESOURCES

Reminder: Any time you use an outside source, be sure you review the content in advance and follow the content owner's or website's permission requirements and guidelines.

The following are suggested resources that Advisors may find helpful in planning this session:

- Suggested website: United States Bureau of Labor Statistics Occupational Outlook Handbook, <http://www.bls.gov/ooh/architecture-and-engineering/home.htm>
- Suggested website: Code.org, a non-profit dedicated to computer science education, www.code.org
- Suggested website: Computer Science Field Guide (created by the University of Canterbury, New Zealand), <http://www.csfieldguide.org.nz/en/index.html>

ADVISOR NOTE: Text in italics should be read aloud to participants. As you engage your post in activities each week, please include comments, discussions, and feedback to the group relating to **Character, Leadership, and Ethics**. These are important attributes that make a difference in the success of youth in the workplace and in life.

ACTIVITY 1

Introduction: What Do Computer Scientists Do?

According to [Dictionary.com](https://www.dictionary.com), computer science is the science that deals with the theory and methods of processing information in digital computers, the design of computer hardware and software, and the applications of computers.

A computer scientist specializes in the theory of computation and the design of computational systems.

Discuss with Explorers information about the field of computer science and what they could expect if they choose it as a career.

(All remaining information for Activity 1 and Activity 2 is from the Bureau of Labor Statistics Occupational Outlook Handbook for Computer and Information Research Scientist. Source: <http://www.bls.gov/ooh/computer-and-information-technology/computer-and-information-research-scientists.htm>)

Computer scientists invent and design new approaches to computing technology and find innovative uses for existing technology. They study and solve complex problems in computing for business, science, medicine, and other fields.

Duties

Computer and information research scientists typically do the following:

- Explore fundamental issues in computing and develop theories and models to address those issues.
- Help scientists and engineers solve complex computing problems.
- Invent new computing languages, tools, and methods to improve the way in which people work with computers.
- Develop and improve the software systems that form the basis of the modern computing experience.
- Design experiments to test the operation of these software systems.
- Analyze the results of their experiments.
- Computer scientists create and improve computer software and hardware.

Creating and improving software involves working with algorithms, which are sets of instructions that tell a computer what to do. Some computer tasks are very difficult and require complex algorithms. Computer scientists try to simplify these algorithms to make computer systems as efficient as possible. The algorithms allow advancements in many types of technology, such as machine learning systems and cloud computing.

Computer scientists design new computer architecture that improves the performance and efficiency of computer hardware. Their work often leads to technological advancements and efficiencies, such as better networking technology, faster computing speeds, and improved information security. In general, computer scientists work at a more theoretical level than do other computer professionals.

Work Environment

The industries that employed the most computer scientists were as follows:

- Federal government, excluding postal service **28%**
- Computer systems design and related services **18%**
- Information **14%**
- Research and development in the physical, engineering, and life sciences **12%**
- Colleges, universities, and professional schools; state, local, and private **11%**

ACTIVITY 2

How to Become a Computer Scientist

Most computer and information research scientists need a Ph.D. in computer science or a related field, such as computer engineering. A Ph.D. usually requires 4 to 5 years of study after earning a bachelor's degree, typically in a computer-related field, such as computer science or information systems. During their first 2 years in a Ph.D. program, students take a variety of computer science classes. They then choose a specialty and spend the remaining years in the program doing research within that specialty.

Computer scientists who work in a specialized field may need knowledge of that field. For example, those working on biomedical applications may have to take some biology classes.

Other computing fields, such as computer programming, might require a bachelor's degree or an associate's degree in computer science. 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.

Important Qualities

- Analytical Skills: Computer scientists must be organized in their thinking and analyze the results of their research to formulate conclusions.
- Communication Skills: Computer scientists must communicate well with programmers and managers and be able to clearly explain their conclusions to people with no technical background. They often present their research at conferences.
- Critical-Thinking Skills: Computer scientists work on many complex problems.
- Detail Oriented: Computer scientists must pay close attention to their work, because a small programming error can cause an entire project to fail.

- Ingenuity: Computer scientists must continually come up with innovative ways to solve problems, particularly when their ideas do not initially work as intended.
- Logical Thinking: Computer algorithms rely on logic. Computer scientists must have a talent for reasoning.
- Math Skills: Computer scientists must have knowledge of advanced math and other technical topics that are critical in computing.

PAY

The median annual wage for computer scientist was \$77,550 in May 2014. 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 \$44,140, and the highest 10 percent earned more than \$127,640.

ACTIVITY 3

Hands-on Computer Science

It is recommended that Advisors visit the website Code.org to find fun and educational computer science activities. The following page includes a number of activities that Advisors might choose to try with their posts: [Teacher-Led Hour of Code Lesson Plans](#).

Another option for Advisors is to prepare and follow the activity suggested in [this video](#) supporting the BSA Programming merit badge. The activity focuses on embedded programming using the Arduino board, which can be purchased [here](#).

Be sure to review and test out the plans for all activities in advance in order to purchase and/or prepare materials, anticipate challenges, and develop questions.

ADVISOR NOTE

Some sample questions are below. They are designed to help the participants apply what they have learned to their own interests. You are welcome to use these questions or develop your own questions that relate to your post or specific focus area.

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| Focusing Questions | <ul style="list-style-type: none"> ▪ <i>What was the purpose of these activities? Why did we do them?</i> ▪ <i>What part of today's session did you enjoy most?</i> ▪ <i>What is something new that you learned about computer science?</i> |
| Analysis Questions | <ul style="list-style-type: none"> ▪ <i>What computer science skills were used in each activity?</i> ▪ <i>How did you overcome challenges while you worked on the hands-on activity?</i> |

- Generalization Questions
- *What parts of the computer science field would you like to learn more about?*
 - *What subjects in school do you believe you will need for this type of computer science?*

ADVISOR AND OFFICER REVIEW

After the meeting, address the following:

- Identify what was successful from the meeting.
- Identify what needed improvement.

Schedule an officer and Advisor planning meeting to prepare for next the post meeting or activity.