Programming

Merit Badge Workbook

This workbook can help you but you still need to read the merit badge pamphlet.

This Workbook can help you organize your thoughts as you prepare to meet with your merit badge counselor.
You still must satisfy your counselor that you can demonstrate each skill and have learned the information.
You should use the work space provided for each requirement to keep track of which requirements have been completed,
and to make notes for discussing the item with your counselor, not for providing full and complete answers.
If a requirement says that you must take an action using words such as "discuss", "show",
"tell", "explain", "demonstrate", "identify", etc, that is what you must do.

Merit Badge Counselors may not require the use of this or any similar workbooks.

No one may add or subtract from the official requirements found in Scouts BSA Requirements (Pub. 33216).
The requirements were last issued or revised in 2013 • This workbook was updated in March 2019.

Scout's Name: Abboud Alomari Unit: 61

Counselor's Name: Jim Cover Counselor's Phone No.: _____

http://www.USScouts.Org • http://www.MeritBadge.Org

Please submit errors, omissions, comments or suggestions about this **workbook** to: **Workbooks@USScouts.Org**
Comments or suggestions for changes to the **requirements** for the **merit badge** should be sent to: **Merit.Badge@Scouting.Org**

The Programming merit badge website, http://www.boyslife.org/programming, provides information and resources that may assist you in completing the following requirements.

1. **Safety.** - Do the following:

   a. Show your counselor your current, up-to-date Cyber Chip.

   Earn the Cyber Chip

   Earning the Cyber Chip can help you learn how to stay safe while you are online and using social networks or the latest electronic gadgets. Topics include cell phone use, texting, blogging, gaming, cyberbullying, and identity theft. Find out more about the Cyber Chip at www.scouting.org/cyberchip.

   Note: A workbook for the Boy Scout Cyber Chip is attached at the end of this workbook.

   b. Discuss first aid and prevention for potential injuries, such as eyestrain and repetitive stress injuries, that could occur during programming activities.

Eyestrain	For prevention of eyestrain, people should use the "20-20-20" method. What you do is every 20 minutes, you look at something 20 feet away for 20 seconds. First aid for eyestrain is to stop using the computer and take a break, and then increase the resolution and decrease the brightness because if the computer is too bright it might be too hard on your eyes and it will make work harder too, as work errors become more frequent. For example, you could mistype something from how fatigued your eyes are.
Repetitive Stress Injuries	Repetitive Stress Inuries, also known as RSI's are when too much pressure (stress) is being put on your hand, or any affected area. To prevent it, if yiu start feeling a bit sore, take a 15-minute break and take a walk away from the screen. You can stretch out your sore area and make it better. Treating RSI's is complicated. First, apply a cold ice pack to help with the pain and swelling. Then, wrap the area with an elastic bandage firmly, but not too tight. Then, rest it and apply heat. Seek medical attention if pain persists.

Other	Carpal Tunnel Syndrome is when swelling inside a "tunnel" formed by the bone. If it is not treated, you could end up paralyzing your hand and bot be able to use it anymore. To treat early stages of it, wrap an elastic bandage around your hand and wrist and visit a doctor for further help.
	Tendonitis is when the muscles and/or tendons that control your arms are ripped severly, and can end in severe pain and loss of control in your arm(s). For treatment of it, apply an ice pack and wrap an elastic bandage around it. Apply heat after 24 hours to help with pain and comfort it, and help with healing. Then seek medical attention immediately.

2. **History.** - Do the following:
   a. Give a brief history of programming, including at least three milestones related to the advancement or development of programming.

Programming started out as binary code, as 0's and 1's, meaning "off" and "on". All modern programming languages depend on binary code to run their tasks, and the motherboard of the computer depends on it. Binary code is the base of everything.

Next came assembly language. Instead of just 0's and 1's, they had expressionsthat were a bit more readable by humans. This made programming easier and took it to a new level.

Finally came "Next-Generation" programming languages. These programming languages far beyond advanced and portable, unlike binary and assembly language. The languages could run on more processors and on different operating systems (OS's). These languages were then used for specific things as managing digital databases, for businesses, etc.

These languages started to become popular and were taught in schools and universities .

   b. Discuss with your counselor the history of programming and the evolution of programming languages.

3. **General knowledge**. - Do the following:
   a. Create a list of 10 popular programming languages in use today and describe which industry or industries they are primarily used in and why.

	Language	Industry	Why is it used?
1.	Python	All!	It is used for its ease and flexibility across OS's.
2.	HTML/CSS/JS	Internet/Web	It is used in the World Wide Web for web pages
3.	Swift/Obj-C	Mobile Devices	It is used in iOS/MacOS to make applications.
4.	C++ /C	OS Development	It is used for compilers and operating systems
5.	Java	Mobile Devices	It is used for Android and cross-platform coding.
6.	Shell Script	Security	It is used for OS control and performing actions.
7.	C#	Mobile Devices	It is used for Microsoft Windows application development.
8.	Lua	Mobile Devices	It is used for game development.
9.	R	Internet/Web	It is used mainly for data mining and other various things.
10.	Matlab	Engineering	It is used for technical computing and for its simplicity.

   b. Describe three different programmed devices you rely on every day.

1.	Apple MacBook Pro MacOSX 10.14.4	For this device, I use it for work and development. I also use it for printing things out and watching informational videos. I also play a bit of video games on it too. I also use it for checking my email.
2.	Netgear Router	I use it for internet access when I use a internet-depending device, like a computer of an iPhone. It is what electronics we have at home depend on to access the World Wide Web.
3.	Google Home	I use it for asking questions when I don't have access to the computer. It is very useful, as it can play music, tell jokes, do mathematics, and do other various things. It is fun to play around with it when we don't have anything to do.

4. **Intellectual property.** - Do the following:
   a. Explain the four types of intellectual property used to protect computer programs.

The four types of intellectual property are: Copyright Protections, Patents, Trademarks, and Trade Secrets. Copyright Protections are for protecting certain parts of your work when you release it online, so someone can't copy what you did or something similar. Patents are when you propose an idea to the government so they can protect it for you. You have to apply for it, and it is usually a lengthy process. Trademarks are when you put the "trademark" symbol (™) after a product name, or in a program that they have created. Programmers use this to stop people from using their product name or something similar. Finally, Trade Secrets are when the programmer trusts people with a secret (e.g. the source code) and makes them sign a contract not t reveal the trade secret. But, any developer can make a program similar to that as long he doesn't have inappropriate access to the source code.

b. Describe the difference between licensing and owning software.

When you license a software, they developers give you a pass to access the source code or what they allowed you to access, and they may not let you release your own version of it. But they will tell you in the terms and conditions of the license. It is like renting something. You will have restrictions, but you can use it under those conditions. There are a few types to license software: Freeware, Shareware, Demo, Oper Source. Freeware is free, but that doesn't mean you own the software. There might be restrictions to what you can do, and restrictions to who can use it.

When you own software, you have the right to use it as much as you want to use it. There is no restriction to anything.

c. Describe the differences between freeware, open source, and commercial software, and why it is important to respect the terms of use of each.

Shareware is when a developer releases a program and expects you to make a donation or pay a fee for using it to help the developer.
Demo software, also known as trial software, is when the software will work with a time limit or limited features. This is useful for testing software out before you buy it. After you pay the fee, the developer will remove the restrictions.
Open Source is when the developer doesn't just release the code, but releases the executable program. It is free, but it may come with some limitations or restrictions.

When you own software, you have the right to use it as much as you want to use it. There is no restriction to anything.
You should respect the terms because if you don't you might be charged because there are copyright laws that can arrest you if you don't follow them.

5. Projects. - Do the following:

a. With your counselor's approval, choose a sample program. Modify the code or add a function or subroutine to it. Debug and demonstrate the modified program to your counselor..

The Programming merit badge website, http://www.boyslife.org/programming, has a number of sample programs that you could use for requirement 5a. However, you have the option of finding a program on your own. It's a good idea to seek your merit badge counselor's guidance.

Language	Python
Environment	Atom Editor Atom.io
Industry	Business
Program:	(Program in GitHub)

Modify the code or add a function or subprogram to it.

Modification:

- I changed the messages to have different advice for extreme temperatures.
- I changed the trigger temperatures (hot or cold) to something different.
- I added another temperature trigger check for very extreme temperatures.
- I collected the person's name before the loop starts (store in a variable) and add this to the output messages.
- I changed the whole program into a currency converter. Input amount in US dollars and convert to Euros.

Debug and demonstrate the modified program

Debugging performed

I printed out the user's outputs after it was converted. Also, if any errors were rasied, it would automatically print it out.

Demonstrate the program

b. With your counselor's approval, choose a second programming language and development environment, different from those used for requirement 5a and in a different industry from 5a. Then write, debug, and demonstrate a functioning program to your counselor, using that language and environment.

Language	C/C++
Environment	Atom Atom.io
Industry	Entertainment
Program	(Program in GitHub)
Debugging performed	It printed the amount of guesses left the user had. When it was wrong, it told the user it is wrong. When it was right, it told the user it is right.

Demonstrate the program

c. With your counselor's approval, choose a third programming language and development environment, different from those used for requirements 5a and 5b and in a different industry from 5a or 5b. Then write, debug, and demonstrate a functioning program to your counselor, using that language and environment.

Language	HTML/CSS/JS
Environment	Atom Atom.io
Industry	Internet
Program	(Program in GitHub)
Debugging performed	It printed out the outputs from the user clicks into the JS console.

Demonstrate the program

d. Explain how the programs you wrote for requirements 5a, 5b, and 5c process inputs, how they make decisions based on those inputs, and how they provide outputs based on the decision making.

5a. processed inputs by inputting the temperature (or money) that the user wanted to convert, and made the decision to convert it. Then the answer gets outputted after the conversion is made unless there is an error. 5b. processed inputs by inputting the number that the user guessed. Then, if it was right, the program made the decision of informing the user that they are correct. Otherwise, they would tell the user that they are incorrect. 5c. processed inputs by inputting the two numbers that the user wanted to perform operations with. Then after that, when the user gave input by pressing a button to perform an operation, the program converted it based on the button that they pressed and outputted the answer.

6. Careers. - Find out about three career opportunities that require knowledge in programming.

1.	C programmer in IBM.
2.	R programmer in Covance.
3.	Software developer at Stanford Univeristy

Pick one and find out the education, training, and experience required.

Career	C programmer in IBM
Education	You need a bachelors degree in computer science or any other technical degree.
Training	Experience in C and experience in networking and kernel level/file-system programming.
Experience	You need 5 years of experience in professional software development.

Discuss this with your counselor and explain why this career might be of interest to you.

When working on merit badges, Scouts and Scouters should be aware of some vital information in the current edition of the *Guide to Advancement* (BSA publication 33088).Important excerpts from that publication can be downloaded from http://usscouts.org/advance/docs/GTA-Excerpts-meritbadges.pdf.
You can download a complete copy of the *Guide to Advancement* from http://www.scouting.org/filestore/pdf/33088.pdf.