Overview
This meeting, girls explore computational thinking by creating suncatchers using string and beads. Girls will learn how this process is like creating an algorithm with patterns, variables, and functions (pieces of code that you want to use over and over again).

Notes for Volunteers:

Use The Talking Points (But Make Them Your Own): In each session, you’ll find suggested talking points under the heading “SAY.” Some volunteers, especially new ones, find it helpful to follow the script. Others use the talking points as a guide and deliver the information in their own words. Either way is just fine.

Be Prepared (It’s What Girl Scouts Do!): Each meeting includes a “Prepare Ahead” section that includes a materials list and what kind of set-up is required. Read it in advance so you have enough time to gather supplies and enlist help, if needed.

Use Girl Scouts’ Three Processes: Girl-led, learning by doing, cooperative learning — these three processes are the key to making sure girls have fun in Girl Scouts and keep coming back.

“Learning by doing” and “cooperative learning” are built into this Journey, thanks to the hands-on activities and tips. You’ll also find specific “keep it girl-led” tips in the meeting plans. They’ll help you create an experience where girls know they can make choices and have their voices heard.

Solve Big Problems Step By Step: On this Journey, girls will do hands-on activities to learn how computer programmers think through problems. They’ll learn to follow and create algorithms, break big problems down into smaller ones, and persist when faced with challenges.

You can help girls think this way! Encourage them to keep trying when their first few approaches to solving a problem don’t work. Tell them that they can solve any problem if they break it down in smaller ones. And remind them that they can use those skills in their daily lives as well.

Leave Time For The Closing Ceremony: If girls are having fun doing an activity, you may be tempted to skip the Closing Ceremony so they can keep going — but the Closing Ceremony is absolutely key to their learning. Here’s why:

When girls leave a meeting, they’ll remember how much fun it was to plant a seed, make a suncatcher or play a game of “Programmer Says.” However, they may not realize that they just learned how algorithms work — unless you tell them. When you do that, you turn a hands-on activity into a minds-on activity. During the Closing
Ceremony, you can connect the dots for girls by:

- Pointing out how they acted as programmers. (For example: They used an algorithm to plant a seed or they created an algorithm to teach a skill to others. They struggled a bit with a challenging activity — but they persisted. Now they know that they can solve hard problems if they keep trying. They worked together to solve problems.)
- Reminding girls that they are *already* programmers — and that it’s fun to solve problems using programming.
- Letting them know that they have what it takes to continue exploring STEM.

These simple messages can boost girls’ confidence and interest in STEM — and end the meeting on an upbeat note!

**Tell Your Troop Story:** As a Girl Scout leader, you’re designing experiences that girls will remember their whole lives. Try to capture those memories with photos or videos. Girls love remembering all they did — and it’s a great way for parents to see how Girl Scouting helps their girls.

And please share your photos and videos with GSUSA by emailing them to STEM@girlscouts.org (with photo releases if at all possible!).

**Prepare Ahead (Roughly 100+ minutes)**

1. Watch three videos (16 minutes)

**CS Fundamentals Unplugged: Functional Suncatchers demo video** (8:11)
code.org/girlscouts/FunctionalSuncatchers/DemoVideo

This video provides a demo of Activity 3: Functional Suncatchers and tips for facilitating the activity.

(Note to Volunteers: This video was filmed in a classroom setting. Of course, Girl Scout troop meetings are not like school. Your girls won’t sit at desks, and you may need to shorten your set-up.)

Listen for the main points you want to make with girls:

- *How is a program used to replicate a task?*
- *How do functions help us to simplify programs?*
How do you use variables within functions and programs? What is their purpose?

Course 3 - Functional Suncatchers overview video (6:38)
code.org/girlscouts/FunctionalSuncatchers/OverviewVideo

This video gives you an overview of Activity 3: Functional Suncatchers and tips for facilitating the activity. It highlights how the activity relates to patterns, functions, and variables in programs.

Unplugged – Functional Suncatchers activity video (1:01)
https://www.youtube.com/watch?v=d1MdyeXy0v0

The video introduces girls to the "Functional Suncatchers" activity and how the concepts of functions and variables can be used in programming. This video may be shown to the girls prior to starting Activity 3: Functional Suncatchers. This is optional. You may not have the wi-fi connection or the time to show the video.

2. Review vocabulary (2 minutes)

This meeting includes the following vocabulary:

- **Algorithm** — a list of steps that allow you to complete a task
- **Program** — instructions (or an algorithm) that can be understood and followed by a machine
- **Function** — a piece of code that you can easily call over and over again
- **Variable** — a placeholder for a piece of information that can change
- **Decompose** — to break a hard problem up into smaller, easier ones
- **Pattern** — a theme that is repeated many times
- **Abstraction** — removing details from a solution so that it can work for many problems
- **Computational Thinking** — the thought processes involved in formulating a problem and expressing its solution(s) in such a way that a computer—human or machine—can effectively carry out.

See the Multi-Level Think Like a Programmer Journey Glossary for more vocabulary and examples.

3. Read through this guide and its Meeting Aids (15 minutes)
Think Like a Programmer pt. 2

This will help you get familiar with the flow of the meeting.

Read the following handouts (found in the Meeting Aids section):

Multi-Level Think Like a Programmer Journey Materials List: Each meeting has its own materials list, but you can use this handout if you like to do all your supply shopping at one time. It includes all materials needed for the entire Journey.

Multi-Level Think Like a Programmer Journey Glossary: This is a list of words that girls may not know and how to define them.

Think, Pair, Share: These facilitation tips will help you to make sure that every girl’s voice is heard during brainstorming activities.

Take Action Guide: This handout explains the difference between Take Action and Community Service. It also includes tips to make a project sustainable and Take Action project ideas that you and your troop can use as inspiration.

Benefits of a Multi-Level Troop: This handout highlights the benefits of running a multi-level troop and offers practical advice and insight into working with multi-level girls.

4. Gather materials (60 minutes)

Gather materials using the Materials List for this meeting. If your meeting location doesn’t have a flag, bring a small one that girls can take turns holding or hang in the room.

Get Help from Your Family and Friends Network

Your Friends and Family Network can include:
- Girls’ parents, aunts, uncles, older siblings, etc.
- Other volunteers who have offered to help with the meeting

Ask your Network to help:
- Make snacks
- Bring art supplies (beads, spacers, etc.) for Activity 3: Functional Suncatchers.

Award Connection

Girls will earn two awards:
Think Like a Programmer pt. 2

- Think Like a Programmer award
- Take Action award

Girls will earn both awards following the completion of the Take Action project and Journey in Think Like a Programmer PT. 6.

(Note to Volunteers: You can buy these awards from your council shop or on the Girl Scouts’ website.)

Meeting Length
90 minutes
- The times given for each activity will be different depending on how many girls are in your troop.
- There is no snack time scheduled in these meetings, but there are 15 minutes of “wiggle room” built in for snacks or activities that run long.
- Give girls 10- and 5-minute warnings before they need to wrap up the last activity so you’ll have time for the Closing Ceremony.

This meeting, girls explore computational thinking by creating suncatchers using string and beads. Girls will learn how this process is like creating an algorithm with patterns, variables, and functions (pieces of code that you want to use over and over again).

Materials List

Activity 1: As Girls Arrive: Paper Programming
- Worksheet: Graph Paper Programming (one for each girl or group)
- Worksheet: Debugging (one for each girl or group)
- Paper
- Pencils

Activity 2: Opening Ceremony
- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Activity 3: Functional Suncatchers
Activity 4: Closing Ceremony: Brainstorming Our Take Action Project

- List of girls’ Take Action ideas from Think Like a Programmer PT. 1
- Optional: Take Action Guide handout

Awards
Girls do not receive any awards in this meeting.

Detailed Activity Plan

Activity 1: As Girls Arrive: Paper Programming

Time Allotment
10 Minutes

Materials
- Worksheet: Graph Paper Programming (one for each girl or group)
- Worksheet: Debugging (one for each girl or group)
- Paper
- Pencils

One foot of string, thread, or fishing line per girl
- 2-4 beads per girl
- 2-4 other accessories (buttons, hoops, spacers) per girl
- One special bead, prism, button, or girl-made sun charm per girl
- Pens, Pencils, & Scissors
- **Functional Suncatchers Skills Sheet** (one for each group)
- Create a suncatcher to use as an example for the activity
- Prepare a program and two skills with blank steps on a large paper or blackboard for the girls to help you fill in during Part 1. (Sample can be found on the **Functional Suncatchers Skills Sheet**.)
- Optional: Computer/tablet or other device with ability to show girls the **Unplugged – Functional Suncatchers** video
- Optional: **Worksheet: Functional Suncatchers** (one for each girl)

An “assessment worksheet” sounds a lot like school, but girls will probably see this as a fun puzzle page. If there’s time, girls could do the activities in the meeting or you could give each girl a copy to take home. Perhaps they’d like to show their families what they learned about programs, debugging, functions, and variables by doing the worksheet together.
Think Like a Programmer pt. 2

**Steps**
Welcome girls, and have them practice some more paper programming to refresh themselves on creating algorithms and programs.

Girls can first practice writing programs with the **Worksheet: Graph Paper Programming** handout, then practice debugging with the **Worksheet: Relay Debugging** handout if there’s extra time.

**Multi-Level Tip:** Encourage older girls to work with a younger partner as a team to come up with solutions together. Praise them when you hear them collaborating.

You can also ask an assistant or parent to help the Daisies while the Brownies and Juniors pair up.

Either option works! The first option gives older girls a chance to teach younger girls and practice leadership skills, in addition to learning about computer science. The second option gives Daisies more specialized attention and allows the older girls to team up and learn at roughly the same level.

**SAY:**
Today, you’re going to learn more about how to think like a programmer. Last time, you created programs on paper. Let’s practice a bit more!

Remember, programmers test their programs over and over again to make sure they work for everyone. They debug any problems so the programs can run every time.

Have fun playing with this! It will give you a chance to start thinking like programmers and get ready for what we’re going to do today.

Permission for use of Code.org activities is provided by Code.org, a non-profit dedicated to giving every student in every school the opportunity to learn computer science. See [www.code.org](http://www.code.org).

**Activity 2: Opening Ceremony: Use Computational Thinking Every Day**

**Time Allotment**
Think Like a Programmer pt. 2

15 Minutes

**Materials**
- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

**Steps**
Recite the Pledge of Allegiance and the Promise and Law.

Conduct any troop business.

Review the paper programming activities from Think Like a Programmer PT. 1.

**SAY:**
*What was your favorite part about the paper programming activities?*

**Girls may say:** We used arrows to give directions on where to color in the grid, I liked debugging, I liked the relay race, etc.

Remind girls that in "Graph Paper Programming," we guided our teammates using arrows as symbols to represent different instructions (or directions). In Relay Programming, girls worked as a team to write and debug a program.

Go over the following definitions.

- **Algorithm** — a list of steps that allow you to complete a task. For example, a recipe is an algorithm.
- **Program** — instructions (or an algorithm) that can be understood and followed by a machine
- **Debugging** — finding and fixing problems in your algorithm or program

Explain decomposition to girls.

**SAY:**
*When you create paper programs, you break the problem of not knowing how to make the image down into something much simpler by creating a list of directions to recreate the image. Often, big problems are just lots of little problems stuck together.*

You "decomposed" the activity into smaller tasks, letting each step seem a little easier on its own. This is called decomposition.

**Can you think of any other time in life you might have “decomposed” a problem?**
Girls might say: I had a school project I made a plan for, I made a recipe, etc.

You decompose big problems into smaller ones every day!

Today, we are going to use decomposition and create an algorithm that can teach others how to make a suncatcher.

Activity 3: Functional Suncatchers

Time Allotment
40 Minutes

Materials
- One foot of string, thread, or fishing line per girl
- 2-4 beads per girl
- 2-4 other accessories (buttons, hoops, spacers) per girl
- One special bead, prism, button, or girl-made sun charm per girl
- Pens, Pencils, & Scissors
- Functional Suncatchers Skills Sheet (one for each group)
- Create a suncatcher to use as an example for the activity
- Prepare a program and two skills with blank steps on a large paper or blackboard for the girls to help you fill in during Part 1. (Sample can be found on the Functional Suncatchers Skills Sheet.)
- Optional: Computer/tablet or other device with ability to show girls the Unplugged – Functional Suncatchers video
- Optional: Worksheet: Functional Suncatchers (one for each girl)

An “assessment worksheet” sounds a lot like school, but girls will probably see this as a fun puzzle page. If there’s time, girls could do the activities in the meeting or you could give each girl a copy to take home. Perhaps they’d like to show their families what they learned about programs, debugging, functions, and variables by doing the worksheet together.

Steps

Set Up. (5 minutes)

Show your suncatcher to girls, and explain how you made it.
SAY:
What do you all think about my suncatcher?

Girls may say: Your suncatcher is pretty, I like the beads, I like the charms.

You will be making a very similar, but slightly different suncatcher today!

If I wanted to tell you how I made my suncatcher, how could I do that?

Girls may say: Write down the steps, tell me how, take a picture, etc.

I could create an algorithm to tell you exactly how I made my suncatcher.

Explain variables to girls and that they will be using them to make their own suncatchers.

SAY:
The materials may be different for each of your suncatchers, but the steps to make them will be pretty much the same.

[Pointing to a bead] For example, my suncatcher has beads like this. Yours may be a different color or even a different shape, but it is still called a "bead".

[Pointing to a spacer] This is what my space looks like. Yours may be a different size, different texture, or maybe a different material altogether, but it will still be called a “spacer”.

[Pointing to a special charm] Finally, we will all have a “special charm”. Yours might be a large bead, a handmade ornament, or even a random item from the room, but we all will call it a “special charm.”

The differences between the types of beads, spacers, or charms are examples of variables. Can anyone tell me what a variable is?

Girls may say: Things that change, etc.

A variable is a placeholder for a piece of information that can change.

Optional: Show the Unplugged – Functional Suncatchers video here.

Learn about Functions. (10 minutes)
Show girls the sample suncatcher, and explain how they will create their suncatchers.

SAY:
Let me tell you how I made this suncatcher.
(Note to Volunteers: Your explanation may be different, depending on how you made your suncatcher.)

Example SAY: First, I put a bead on the string, then I tied a knot. I put another bead on a string, and tied another knot. Then, I put a spacer on the string and tied another knot. After that, I did it all again. I put a bead on the string, then I tied a knot. I put another bead on a string, and tied another knot. Then, I put a spacer on the string and tied another knot. Finally, I put on the special charm, and tied one last knot.

That's a lot of steps, right? I'll give you a sing-songy way to remember the order.

(Note to Volunteers: It helps to have a bit of a rhythm with the words as you go through.)

Example:
"Bead, knot, bead, knot, spacer, knot.
Bead, knot, bead, knot, spacer, knot.
Special charm, final knot."

Give each girl a Functional Suncatchers Skills Sheet and markers, pens, or pencils.

SAY:
To help, I will also write down the steps to create this program, so that everyone has the directions in front of them to make their own suncatchers.

Use the paper or chart you prepared on the board with the Program and two Skill set (as seen in the Functional Suncatchers Skills Sheet), and begin to write the steps in the "Program" area as the girls shout out instructions. Write one instruction per line.

As the girls give instructions and you write them on the paper/board, girls should also copy the instructions on to their Functional Suncatchers Skills Sheet.

Example:
PROGRAM
1. Bead
2. Knot
3. Bead
4. Knot
5. Spacer
6. Knot
By now, the girls should be noticing an issue (there are more instructions than lines). If they don’t, ASK:

- How many instructions do we have left to go through?
- How many lines do we have left?
- What should we do?

**Girls may say:** There aren’t enough lines to make the suncatcher, we could add more lines, etc.

Point out that there are two “extra” sections on the Skills Sheet.

**SAY:**
There are two “extra” sections on the Skills Sheet. You can use these to combine steps so that you can write one name to call them all in the Program section.

*How do you think we can combine steps? (Answer: Look for patterns!)*

A pattern is a theme that is repeated many times.

Sometimes, when a problem has lots of little pieces, you will notice that the pieces have something in common. If they don’t, then they may at least have some similarities to some pieces of another problem that has been solved before. If you can spot these patterns, understanding your pieces gets much easier.

*What sort of patterns do you see?*

**Girls might say:** Bead knot bead, etc.

You can use these patterns to create a function that can be called to repeat the pattern over and over! Then you had enough space on your list for all the steps.

*For example, everything that you put into the top section, can be used all at once by using “Skill 1” in the Program instructions; this is a function.*

A function is a piece of code that you can easily use over and over again to help simplify programs.

Challenge the girls to fill out their **Functional Suncatchers Skills Sheet** in a way that makes sense and allows them to fit the entire sequence under the “Program” list in some way.

**Multi-Level Tip:** Encourage older girls to work with a younger partner as a team to come up with solutions together. Praise them when you hear them collaborating. Let
them know that programmers work in teams and need to get along with people of all different experiences and backgrounds.

You can also ask an assistant or parent to help the Daisies while the Brownies and Juniors pair up. If Daisies have trouble with the activity, you can instead have them complete Activity 3: Happy Maps in Think Like a Programmer PT. 1 of the Daisy Think Like a Programmer Journey.

Either option works! The first option gives older girls a chance to teach younger girls and practice leadership skills, in addition to learning about computer science. The second option gives Daisies more specialized attention and allows the older girls to team up and learn at roughly the same level.

Give girls about five minutes to complete their sheet (more for younger girls).

While you circulate the room, if you see that a girl’s program is incorrect, encourage her to ‘debug’ and correct it.

**SAY:**

*How could you repeat the sequence a thousand times or more?*

*How many different ways did we fill out the same sheet to make the same suncatcher?*

**Build Functional Suncatchers. (15 minutes)**

Hand out supplies to the girls. Give each girl:

- One foot of string, thread, or fishing line,
- 2-4 beads,
- 2-4 other accessories (buttons, hoops, spacers), and
- One special bead, prism, button, or girl-made sun charm.

Point out that different people may have different supplies, and they may all be different than the ones you used for the sample suncatcher.

**SAY:**

*If we have different supplies, should that stop us from sharing the program (instructions) to create the suncatcher? Why or why not? Does anyone remember what we call these differences?*

**Girls may say:** No because even if you use different beads, you will still make a suncatcher, the suncatcher will still work, it’s okay for everyone’s suncatcher to look different, etc.
Right! Every suncatcher will be a little different, which is part of the fun!

Do you remember what we call these kinds of differences? (Answer: Variables.)

A variable is a placeholder for a piece of information that can change. We can treat the words (Bead, Spacer, Knot, etc.) as placeholders or variables for whatever items we are using that fit those descriptions.

Let the girls make their suncatchers, using the program and functions they made.

Reflect on Computational Thinking. (10 minutes)

Have girls form a Friendship Circle to share their suncatchers.

SAY:
You did a great job creating programs to make your suncatchers today.

What are the steps you took to make your suncatcher?

Girls may say: We looked at the sample, we used variables and functions, we decomposed, we wrote down the steps, we created an algorithm.

First, you decomposed the project into smaller steps to create your program.

What did you do next?

Girls might say: We wrote the steps down but didn’t have enough space, etc.

You realized that the list didn’t have enough spaces for all of the steps!

How did you solve that problem? (Answer: We looked for patterns and created a function!)

You found patterns that repeated and were able to create functions so that all of the steps fit into our program.

Now, each of you has a beautiful suncatcher that was made that same way, but each of your suncatchers is unique and different. How can this be? (Answer: We used variables!)

Variables let your suncatcher algorithm be used by many more people.
Once I told you, or defined, the variables (bead, space, special charm), you were able to “abstract out” or ignore the details that make things different and use the general framework to find a solution that works for more than one problem.

Abstraction is removing details from a solution so that it can work for many problems.

You used abstraction so everyone can make suncatchers no matter what supplies they have!

And then you had a complete algorithm! You found an answer to the problem of how to make a suncatcher and wrote it up in a way that allows it to be processed step by step, so that the results are easy to achieve over and over again.

It sounds like you used the steps of computational thinking, just like programmers!

Hold a short wrap up discussion with girls on the activity.

**SAY:**
*(Note to Volunteers: If you don’t have enough time to ask all these questions, just ask the ones in bold type.)*

**Which one of these definitions did we learn a word for today? What word did we learn?**

- “To pull on something suddenly”
- “A piece of code that you can easily call over and over again”
- “Someone who creates something that no one else has ever made”

**What items did you use for the suncatchers that could have been "variable" from person to person?**

**How important do you think it was to have groups of skills that we could call for making the suncatcher?**

**What if we had done each set of steps to make a suncatcher 100 times instead of only twice?**

**Can you think of anything else that we could group together once and call easily over and over again?**
Activity 4: Closing Ceremony: Brainstorming Our Take Action Project

Time Allotment
10 Minutes

Materials
- List of girls’ Take Action ideas from Think Like a Programmer PT. 1
- Optional: Take Action Guide handout

Steps
Have girls form a Friendship Circle, and briefly reflect on the last activity.

SAY:
Today, you used decomposition, abstraction, patterns, and algorithms to help solve a problem.

Each of these steps or tools are part of a method called Computational Thinking. Computational thinking uses these four steps to help solve lots of different kinds of problems.

Many people believe that computational thinking is all about getting solutions ready to run on a machine. That’s true, but it also helps make light work of difficult problems. Computer scientists often find that they’re in charge of programming solutions to things that people have only ever dreamt of—things that have never been created before.

Have girls brainstorm Take Action projects.

SAY:
Last meeting you talked about how Girl Scouts do Take Action projects to help make the world a better place.

What programmers do is a lot like a Take Action project. Can you say why? (Answer: Programmers spot problems and break them down to create programs that solve them. They work together to test, debug, and create solutions that work for everyone.)

What’s a problem in your community that you’ve noticed?
Let's make a list of Take Action project ideas.

Write down girls' ideas.

(Note to Volunteers: Check out the Take Action Guide handout in the Meeting Aids if girls need help with ideas. Bring the list of ideas girls come up with to the next meeting.)

End the meeting with a Friendship Squeeze.
Benefits of a Multi-Level Troop

Leading a multi-level troop can be lots of fun, but also challenging!

Picture this: The troop meeting is in full swing. You notice that the Brownies and Juniors are absorbed in an activity, but the Daisies are distracted. Or the Juniors are ready to take on a more complex project, but the younger girls can’t move at the same pace or don’t get the concept. Or you see that the Daisies are having tons of fun doing an activity that completely bores the Brownies and Juniors.

How do you manage it all?

This Think Like an Engineer Journey was developed with the multi-level troop in mind. You’ll find “multi-level notes” throughout to help you navigate the challenges of leading groups of K – 5 girls.

Multi-level troops are naturally set up to create a more girl-led environment.

- Older girls have a unique opportunity to lead. They can serve as role models for younger girls, creating an enhanced leadership experience for all involved. They can explain more advanced concepts, which gives younger girls a powerful near-peer experience.
- Younger girls have aspiration built right into their experience. As they interact with the older girls, they learn what’s possible for them.

Multi-level troops offer all girls a diversity of perspective.

When they do an activity together:

- Older girls approach it with confidence and skill, based on their experience.
- Younger girls bring a sense of wonder and imagination that makes the
Tips for Working with Girls at Different Levels

Follow these tips and insights to help make your multi-level troop experience fun, not challenging:

• Check out the STEM Glossary in Meeting Aids, and share definitions with all girls.
• Offer younger girls more concrete guidance to help them express their thoughts and come up with ideas.
• Older girls will have more nuanced understandings of interpersonal interactions and how Girl Scouts can take action, as well as more in-depth knowledge about the subject matter. They will bring up more complex concepts, which won’t be familiar to younger girls. This is a great opportunity to ask older girls to share their knowledge with younger girls. Ask questions like, “Can you give us an example of that?” or “Can you describe that for everyone in the group?”
• Sometimes Daisies will outperform Brownies or you may have Juniors who perform at Brownie level. That’s all OK, just customize your activities based on your experience with your troop.
• Younger girls will need more adult supervision, and it’s natural that older girls will help them, too. But make sure to treat older girls like troop members, not as mini-Troop Leaders.
• Help older girls feel welcomed and valued by giving them leadership opportunities, such as guiding a discussion or acting as a scribe. Juniors may want to earn their Junior Aide award by mentoring the younger girls.
• Give older girls more responsibility in troop decision-making. While all girls should be involved in decision-making at some level, older girls will be able to offer good insights about how to make things work better for them. When older girls make a suggestion that can reasonably be implemented, try it out and acknowledge their contribution.
• Encourage all girls to help hand out supplies and snacks.
Sometimes you want to do certain instructions over and over again. That’s where functions come in handy! Group all repeated instructions into one place, give them a simple name, then you can call that entire group at the same time just by using the name you gave it.

What if you want to do something over and over, but don’t know what supplies you’ll be working with ahead of time? This is the perfect place for variables! Variables are just placeholder words that you can put into your program so that you know where your *actual* supplies are supposed to go, once you know what they are.

**Directions:**

1) Take a program that contains several sets of identical instructions.
2) Move one or more of the sets of identical instructions into the “Skills” areas of the Skills Sheet.
3) Rewrite the original program, using the skill names instead of actually writing out the group of instructions that the skills describe.

**New Words!**

**Function**

Say it with me: *Func-shun*

*A piece of code that you can easily call over and over again*

**Variable**

Say it with me: *Vayr-ee-ah-buhl*

*A placeholder for a piece of information that can change*
Name: ______________________  Date: __________

Functional Instructions
Skills Sheet

SKILL 1
1) ______________________
2) ______________________
3) ______________________
4) ______________________
5) ______________________
6) ______________________

SKILL 2
1) ______________________
2) ______________________
3) ______________________
4) ______________________
5) ______________________
6) ______________________

PROGRAM
1) ______________________
2) ______________________
3) ______________________
4) ______________________
5) ______________________
6) ______________________
The Girl Scout Promise

On my honor, I will try:

To serve God and my country,
To help people at all times,
And to live by the Girl Scout Law.

The Girl Scout Law

I will do my best to be
honest and fair,
friendly and helpful,
considerate and caring,
courageous and strong, and
responsible for what I say and do,
and to
respect myself and others,
respect authority,
use resources wisely,
make the world a better place, and
be a sister to every Girl Scout.
Think Like a Programmer Journey: Take Action Guide

What’s the difference between a community service project and a Take Action project?

Community Service makes the world better by addressing a problem “right now.” For example, collecting cans of food for a food pantry feeds people “right now.” Gathering toys for a homeless family shelter makes kids happy “right now.” Providing clothing and toiletries to people after a fire or flood helps them “right now.” These acts of kindness are important ways to help people — right now.

Take Action encourages girls to develop a project that is sustainable. That means that the problem continues to be addressed, even after the project is over. Sustainability simply means coming up with a solution that lasts.

For example, girls might want to do something about trash in a local park. If they go to the park and pick up trash, they’ve solved the problem for today — but there will be more trash to pick up tomorrow.

Instead, girls could explore why there’s so much trash. Here’s what they might discover:

1. There aren’t enough trash cans in the park.
2. The trash cans are hard to find.
3. People have to walk out of their way to throw away trash because of where the cans are placed.
4. People don’t realize the importance of putting trash in the trash cans.

Here’s how girls might address these issues:

• **Issues 1 – 3**: Make a presentation to the city council to report on their findings and suggest adding more trash cans or moving them to more visible or convenient positions.

• **Issue 4**: Create a public awareness campaign that encourages people to use the trash cans instead of littering.

• **Variation**: Older girls may want to design interactive garbage cans that make tossing your trash fun. Do an online search for “the fun theory” or “the world’s deepest bin” to see this in action.
What are the steps of a Take Action project?

Girls team up to:

- Identify a problem
- Come up with a sustainable solution
- Develop a team plan
- Put the plan into action
- Reflect on what they learned

Keep It Girl-Led: Girls should actively participate in each step in order for this to be girl-led. Younger girls will need more guidance, but they can and should decide as a team what problem they want to address.

How do girls make their project sustainable?

Here are three ways to create sustainable change:

1. Make your solution permanent.
2. Educate and inspire others to be part of the change.
3. Change a rule, regulation or law.

How can I help girls come up with Take Action Ideas?

Next are some specific examples you can use to help girls understand what sustainable Take Action projects look like.

Keep It Girl-Led: These examples are intended to give a sense of what a Take Action project could look like. Please do not choose a project from this list for girls to do! Instead, guide them to brainstorm ideas, get feedback, and come up with a plan. Girls will learn key leadership skills, such as decision-making, compromise, conflict resolution, and teamwork, when their Take Action project is girl-led.
Computer Science/STEM Take Action Ideas

**Issue:** Some girls think computer science is hard or boring or just for boys.

- **Solution:** Educate and inspire others. Create a girls’ coding club that meets at lunchtime or recess. Teach other girls how to play with tangrams or learn algorithms by making functional suncatchers.

**Issue:** Some kids think computer science is too hard to understand.

- **Solution:** Educate and inspire others. Make a video to explain algorithms, using fun examples like baking a cake, planting a flower or giving directions. Show it to your class at school or to a group of friends.

**Issue:** More kids need to know that how computer programmers can help others and make the world a better place

- **Solution:** Educate and inspire others. Do some research about people who used code to help others, and then create a video or slideshow to show at your school.

**Issue:** Not everyone knows about women who changed the world using their knowledge of computer science.

- **Solution:** Educate and inspire others. Research the “hidden figures” in your community. They might be women who have helped shape history, like those portrayed in the movie Hidden Figures. Or you might want to profile computer science teachers who have made a difference by mentoring and encouraging girls. You could create a display about their accomplishments for a library or community center or make a video about them and show it at school.

**Issue:** More people need to know how exciting and fun STEM can be.

- **Solution 1:** Educate and inspire others. Create a list of great books, movies and documentaries that focus on STEM. Make copies for teachers to hand out or make posters for the school library.
- **Solution 2:** Educate and inspire others. Create a short play based on one of the books and perform it for your class or school.
Other Ideas for Take Action

**Issue:** More kids need to know that engineering is a fun, creative way to help others.

- **Solution 1: Educate and inspire others.** For show-and-tell, explain what you’ve learned about how engineers help others, then lead a design challenge activity with your class.

- **Solution 2: Make it permanent.** Partner with a teacher or principal to create an “engineering space” at school where kids can make prototypes and share ideas for new inventions. Put out a call for donations of recyclable materials or cheap prototyping supplies (cardboard boxes, tape, string, paper towel tubes, etc.) to stock the space.

**Issue:** It’s hard for new students to meet people and make friends at school.

- **Solution: Make it permanent.** Design and build “buddy benches.” Partner with the school to have the benches installed on the playground so kids who want to make new friends can find each other.

**Issue:** Parents often run their engines outside the school as they wait to pick up or drop off their children, which pollutes the air.

- **Solution: Change a rule, regulation or law.** Make a presentation to the school board or administrators about why this is a problem and suggest a new rule that makes the pick-up/drop-off area a “no idling” zone.

**Issue:** We could conserve water if more people collected rain water and used it to water plants.

- **Solution 1: Make it permanent.** Make rain collection devices for family or friends that can be installed in their yards. Give them a list of different ways to use rain water and how they’re helping the Earth.

- **Solution 2: Educate and inspire others.** Create a handout, video tutorial, or show-and-tell presentation about how to make a rain collection device, how to use rain water and how that helps the Earth.

**Issue:** The local park doesn’t have a swing for children with disabilities.

- **Solution: Make it permanent.** Make a presentation to the city council explaining the problem and offering to use troop money from the cookie sale to help pay for the swing.

- **Extra Inspiration:** Do an online search for “How One Brownie Troop Became Social Entrepreneurs.”
Issue: There's no sidewalk along a street near the elementary school, which makes it dangerous for children to walk home.

- **Solution: Make it permanent.** Make a presentation to the city council about the problem and suggest that they build a sidewalk. (Note: Even if the council doesn't vote to create a sidewalk, the girls have earned their Take Action award because they came up with a sustainable solution and took action through their presentation.)
- **Extra Inspiration:** Do an online search for “Girl Scout Brownies Convince City Hall to Build Sidewalk.”

Issue: There have been several accidents at a busy intersection that doesn’t have a stoplight.

- **Solution: Make it permanent.** Research the number of accidents and make a presentation to the city council, asking that they have a stoplight installed.

Issue: The local shelter is having a hard time getting rescue animals adopted.

- **Solution: Educate and inspire others.** Use your photography skills to create pet portraits for the shelter’s web site. Use your writing skills to craft heart-warming bios for each portrait.

**Need more ideas?**

Check out [Girls Changing the World](https://www.girlscouts.org) on the GSUSA web site. Girls post their Take Action and Bronze/Silver/Gold Award projects on this site. You can search by project topic or grade level. (And after the troop has done their project, please post it so they can inspire other girls!)
33 Ways to Take Action!

Make your solution permanent.
1. Make and install something outside (benches, bird houses, dog run, ropes course, sensory trail for children with disabilities, Little Library, etc.)
2. Plant something (butterfly garden, tree, wind chime garden, etc.)
3. Make something inside (Maker Space, reading room, etc.)
4. Create a collection (children's books, children's hospital or family shelter, oral histories for town museum, etc.)
5. Advocate for building a permanent community improvement (sidewalk, bridge, park, streetlights, stoplight, etc.)

Educate and inspire others to be part of the change.
6. Do a show-and-tell
7. Create a poster campaign
8. Perform a skit
9. Make a “how to” handout
10. Draw a comic
11. Give a speech
12. Write and perform a song
13. Make an animated movie
14. Make a live-action movie
15. Make a presentation
16. Create a workshop (perhaps in partnership with a local business or organization) to teach a skill such as coding, camping, canoeing, robotics, sewing, car care, healthy eating, gardening, home repair, budgeting, etc.
17. Create a workshop to teach others about healthy living (exercise, nutrition, mental health, etc.)
18. Create a social media campaign
19. Make video tutorials to teach a skill
20. Organize an email campaign
21. Organize a petition
22. Organize an event (concert, play, poetry slam, art exhibit, sporting event, field day) to raise awareness about an issue
23. Make a “playbook” to help others follow your lead (how to mentor robotics teams, organize a workshop or event, advocate to city council, create an online petition, change a law, etc.)
24. Make an app that helps people take action on an issue
25. Create a web site
26. Write an op-ed or letter to the editor of a newspaper or magazine
27. Start a blog

Change a rule, regulation or law.
28. Make a presentation to your school principal
29. Make a presentation to your school board
30. Make a presentation to your city council
31. Speak up at your representative’s town hall meeting
32. Create an online petition
33. Advocate for a law with your state government
Think Like a Programmer Journey
Glossary for Girls

Girls may not know some of the words used on this Journey. Here are definitions you can share with them:

**Computational thinking** is the thought process involved in solving a problem and expressing its solution(s) in a way that a computer—human or machine—can effectively carry it out.

An **algorithm** is a list of steps that you can follow to finish a task. A recipe is an example of an algorithm; it tells you how to cook a dish by following step-by-step instructions.

A **program** is an algorithm that has been coded into something that can be run by a machine.

**Debugging** is finding and fixing problems in your algorithm or program.

A **function** is a piece of code that you can easily call over and over again.

A **variable** is a placeholder for a piece of information that can change.

**Decomposition** is when you break a hard problem up into smaller, easier ones.

A **pattern** is a theme that is repeated many times.

**Abstraction** is removing the details from a solution so that it can work for many problems.

**Innovation** is a new or improved idea, device, product, etc.

A **prototype** is a sketch of an idea or model for something new. It’s the original drawing from which something real might be built or created.

**Inventors** are people who make up new things and products.
Think Like a Programmer Journey: Materials List

Think Like a Programmer 1

Activity 1: As Girls Arrive: Morse Code Messages
• Morse Code handout
• Paper
• Markers or crayons

Activity 2: Opening Ceremony: All About Solving Problems
• Flag
• Optional: Poster Board with the Girl Scout Promise and Law

Activity 3: Paper Programming
• Paper Programming Example Sheet
• Four-by-Four Activity Worksheet (at least one for each pair of girls)
• Blank paper or index cards for programs
• Relay Programming Activity Packet (one for each group)
• Extra sheets of 4x4 paper grids and blank paper to use as practice. These are also provided as part of the Relay Programming Activity Packet.
• Markers, pens, or pencils
• Optional: Computer/tablet or other device with ability to show girls the Unplugged – Graph Paper Programming and Unplugged – Relay Programming videos

Activity 4: Closing Ceremony: Making the World a Better Place
• Optional: Take Action Guide

Think Like a Programmer 2

Activity 1: As Girls Arrive: Paper Programming
• Worksheet: Graph Paper Programming (one for each girl or group)
• Worksheet: Relay Programming (one for each girl or group)
• Paper
• Pencils

Activity 2: Opening Ceremony: Use Computational Thinking Everyday
• Flag
• Optional: Poster Board with the Girl Scout Promise and Law

Activity 3: Functional Suncatchers
• One foot of string, thread, or fishing line per girl
• 2-4 beads per girl
• 2-4 other accessories (buttons, hoops, spacers) per girl
• One special bead, prism, button, or girl-made sun charm per girl
• Pens, Pencils, & Scissors
• Functional Suncatchers Skills Sheet (one for each group)
• Create a suncatcher to use as an example for the activity
• Prepare a program and two skills with blank steps on a large paper or blackboard for the girls to help you fill in during Part 1. (Sample can be found on the Functional Suncatchers Skills Sheet.)
• Optional: Computer/tablet or other device with ability to show girls the Unplugged – Functional Suncatchers video
Think Like a Programmer Journey: Materials List

**Think Like a Programmer 2 (continued)**

**Activity 3: Functional Suncatchers (continued)**
- Optional: Worksheet: Functional Suncatchers (one for each girl)
  An “assessment worksheet” sounds a lot like school, but girls will probably see this as a fun puzzle page. If there’s time, girls could do the activities in the meeting or you could give each girl a copy to take home. Perhaps they’d like to show their families what they learned about programs, debugging, functions, and variables by doing the worksheet together.

**Activity 4: Closing Ceremony: Brainstorming Our Take Action Project**
- List of the girls’ Take Action ideas from Think Like a Programmer 1
- Optional: Take Action Guide

**Think Like a Programmer 3**

**Activity 1: As Girls Arrive: Walk the Line**
- Prepare masking tape trails made of right angles (one for each group of 3-4 girls). See Sample Trails for Walk the Line for ideas.
- Blindfold (one for each group of 3-4 girls)
- Masking Tape

**Activity 2: Opening Ceremony: Reviewing Our Take Action Ideas**
- Flag
- List of Take Action ideas from last meeting
- Index Cards (or a whiteboard and marker)
- Pens
- Tape
- Optional: Poster Board with the Girl Scout Promise and Law

**Activity 3: Personal Innovations**
- Post-its or slips of paper and tape (at least one for each girl)
- Markers, pens, or pencils
- Poster paper for sharing innovations (one for each girl)
- Personal Innovations Activity Guide (one for each girl)
- Markers, pens, or pencils
- Tape to hang posters

**Activity 4: Closing Ceremony: Time to Decide on Take Action!**
- The girls’ Take Action ideas on index cards.
- Optional: Computer/tablet or other device with ability to show girls the Computer Science is Changing Everything video
Think Like a Programmer Journey: Materials List

Think Like a Programmer 4

Activity 1: As Girls Arrive: Innovate Your Take Action!
- Paper
- Pencils, crayons and markers

Activity 2: Opening Ceremony: Programming Power!
- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Activity 3: Designing Our Take Action Project
- Large pieces of paper or poster boards
- Markers
- Post-It notes
- Pens/pencils

Think Like a Programmer 5

Activity 1: As Girls Arrive: Our Recipe for Success
- Poster board or large paper
- Paper
- Colored markers

Activity 2: Opening Ceremony: Why is Our Project Important?
- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Activity 3: Creating Our Take Action Project
- Any materials the girls need for their Take Action project

Think Like a Programmer 6

Activity 1: As Girls Arrive: Get Ready to Celebrate!
- Girl Scout Promise and Law poster(s)
- Any items the girls want to display (such as photos or videos from their Take Action project)
- Photos and videos from the Journey meetings
- Music system
- Decorations
- Snacks

Activity 2: Opening Ceremony: Welcome!
- Flag
- Optional: Poster Board with the Girl Scout Promise and Law
Think Like a Programmer Journey: Materials List

Think Like a Programmer 6 (continued)

Activity 3: Awards Ceremony and Celebration
- Think Like a Programmer award
- Take Action award

(Note to Volunteers: You can buy these awards from your council shop or on the Girl Scouts’ website.)

Activity 4: Girl Survey
- If girls are taking the survey online: Laptop/tablet
- If girls are filling out the survey on paper: Copies of Girl Survey (pdf available in Meeting Aids) and pen or pencil
Brainstorming Tips: Think, Pair, Share

How to Run a Think, Pair, Share Activity:

Tell girls that they’re going to brainstorm answers to your question using “Think, Pair, Share.”

Lead girls through the basic steps by telling them they will:

1. **Break into small groups.**

2. **Listen to the question or prompt.**

3. **Think about their answers.**
   - Girls may want to write their answers down.
   - Twenty seconds should be enough time, since girls will need to sit quietly.

4. **Pair with other girls.**
   - Girls talk with one to three other girls (depending on group size), making sure everyone has a chance to share their answers. If there's time, it's OK for girls to ask questions about each other’s answers.
   - For pairs, 20 seconds should be enough time. If your troop enjoys discussion, consider extending this to 1 to 2 minutes.

5. **Share with the group.**
   - Girls share their answers with the larger group.
   - This can be completed in 20 – 30 seconds, but will run longer based on group size and how the group sharing is done.

There are two ways to set up group sharing:

- **Strongly Recommended:** One girl shares the best/most interesting/summary answer for the group. This approach is great if you're running short on time. It also helps develop conflict resolution and compromise skills.

- **Optional:** Each girl shares her partner’s answer. This helps girls develop active listening skills, but will run longer because all girls are sharing.
Sometimes when you are coding in groups, someone will make an error that will affect everyone.

Somebody has already written programs for the images below, but each one has a mistake! Figure out what the programs are *supposed* to look like, and circle the error in each one. Then, draw the correct symbol in the box beneath.

Each program should use the symbols below to draw the image to its left.

<table>
<thead>
<tr>
<th>Move One Square Right</th>
<th>Move One Square Left</th>
<th>Move One Square Up</th>
<th>Move One Square Down</th>
<th>Fill-In Square with Color</th>
</tr>
</thead>
</table>

### Start Here

![Image 1]

```plaintext
→ → ↓ ↓ → → → → ↑ ↑
```

### Start Here

![Image 2]

```plaintext
→ → → → ↓ ↓ ↓ ↓
```

### Start Here

![Image 3]

```plaintext
↓ ↓ ↑ ↑ → → → →
```

### Start Here

![Image 4]

```plaintext
→ → → → ↓ ↓ → →
```
Below, you will find three sets of skills, and a program that calls them.

Use the New Program and the skills that go with it to figure out what the steps of the Original Program were. Fill out the steps of the Original Program appropriately.

<table>
<thead>
<tr>
<th>ORIGINAL PROGRAM</th>
<th>NEW PROGRAM</th>
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</thead>
<tbody>
<tr>
<td>1) ____________</td>
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</tr>
</tbody>
</table>

**SKILL 1**

| 1) banana     | 1) cat     |
| 2) face       | 2) ____________ |
| 3) smells     | 3) ____________ |
| 4) ____________ | 4) ____________ |
| 5) ____________ | 5) ____________ |

**SKILL 2**

| 1) ____________ | 1) ____________ |
| 2) ____________ | 2) ____________ |
| 3) ____________ | 3) ____________ |
| 4) ____________ | 4) ____________ |
| 5) ____________ | 5) ____________ |

**SKILL 3**

| 1) one        | 1) ____________ |
| 2) stinky     | 2) ____________ |
| 3) ____________ | 3) ____________ |
| 4) ____________ | 4) ____________ |
| 5) ____________ | 5) ____________ |

**NEW PROGRAM**

| 1) ____________ | 1) ____________ |
| 2) ____________ | 2) ____________ |
| 3) ____________ | 3) ____________ |
| 4) ____________ | 4) ____________ |
| 5) ____________ | 5) ____________ |
You have just learned how to create algorithms and programs from drawings, and how to draw an image from a program that someone gives to you. During the lesson, you worked with other people to complete your activities. Now you can use the drawings and programs below to practice by yourself.

Use the symbols below to write a program that would draw each image.

- Move One Square Forward
- Move One Square Backward
- Move One Square Up
- Move One Square Down
- Fill-In Square with Color

Now, read the program below and draw the image that it describes.