Getting Started with CT Handout 4 - The What & Why of Computational Thinking

What is computational thinking?
Computational thinking (CT) refers to thought processes used to formulate problems and their solutions (Wing 2006 (https://www.cs.cmu.edu/~15110-s13/Wing06-ct.pdf)). These include breaking down problems into smaller parts, looking for patterns, identifying principles that generate these patterns, and developing instructions that computers — machines and people — can understand. It is an approach to critical thinking that can be used to solve problems across all disciplines (Google's Exploring Computational Thinking (https://edu.google.com/resources/programs/exploring-computational-thinking/), nd).

Along with leaders in education and industry, the Libraries Ready to Code initiative considers CT to be a critical literacy for all ages of learners. While there is no one single list of the specific concepts, practices, and dispositions included in CT, we recommend this leadership guide - https://c.ymcdn.com/sites/www.csteachers.org/resource/resmgr/471.11CTLeadershiptToolkit-S.pdf) by the Computer Science Teachers Association (https://www.csteachers.org/) as one source for more information on what CT is, why it is important, and how it is used.

Why should libraries do computational thinking?
Claudia Haines, Homer (AK) Public Library, was asked to answer questions about libraries and computational thinking. Here's what she had to say:

Children's librarians may not teach preschoolers to read and write; however, supporting young people's growing literacies is a fundamental part of the work library staff do with young children and their families. Facilitating literacy development doesn't stop after preschool. Library staff continue to engage with youth of all ages to support a range of literacies from text-based literacies, to media literacy, to financial literacy, and more. In fact, library staff integrate a variety of essential literacies into the activities and resources they provide. Library programs are often fun and informal, with learning at the heart of the work.

When libraries host "build a robot" activities, "design a website" programs, or enable youth to create a video game, young people gain computational thinking (CT) literacies. CT involves identifying problems, breaking apart or decomposing the problem into smaller parts, finding patterns, and designing solutions. Teaching CT literacies often involves computers, but it isn't limited to coding and computer programming.

When kids tinker, create, design, build, code, and make, they engage in CT. For example:

- In storytimes, children take part in CT when they find patterns, identify and predict sequences, understand directionality, interpret and create symbols, explore cause and effect, discover spatial awareness, and think critically. All of these support acquisition of both reading and writing literacies and computational thinking literacies.
- Library activities in which children, teens, or families cook together are filled with opportunities to practice CT. When youth or families are challenged to make their own recipe for salsa and guacamole, they start by breaking apart the items “salsa” and “guacamole” into their base ingredients--e.g. salsa almost always contains tomatoes and onions, and guacamole always contains avocado. In that way, they are finding patterns in the recipe and abstracting ideas to

craft their own variations of the original. The step-by- step recipes they create are similar in flow to the algorithms a computer follows.

- Clicking “blocks” of code together in a programming app to build an algorithm that makes a robot dance provides a visual, hands-on activity that demonstrates identifying a problem (how to make a robot dance), breaking it into smaller parts (making the robot move left), finding patterns (moving left and right more than once makes the robot appear to dance), and designing a solution using automation (creating a loop to make the code repeat).
- Taking apart an old computer or alarm clock provides an opportunity for children and teens to see what makes the tools they use every day work and how parts fit together. When fixing one of these tools, youth get to problem-solve in a very practical way.
- Designing and building a block tower that is the tallest and can withstand a simulated “earthquake” provides a creative play opportunity in which they model solutions to a real- life problem. Ultimately, when youth practice CT they find new ways to communicate their ideas, express themselves, and practice problem-solving. Library staff can embed CT in addition to traditional literacy in their work with children and teens, empowering them with the literacies they need to be lifelong learners and to succeed in college and career.

How can I best facilitate CT opportunities for youth in my library?

Libraries across the U.S. in rural, small, tribal, suburban, and urban communities are already integrating CT activities into their work with youth and families. Activities range from drop-in events to multi-week series. The Libraries Ready to Code Collection was developed to help others learn how and feel confident to bring CT to their communities.