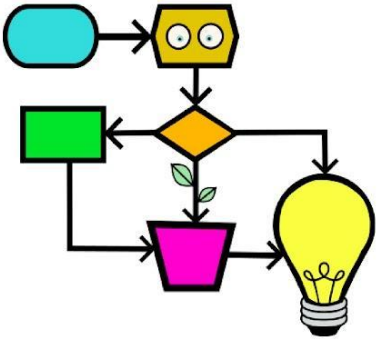
CTprimED

CT foundations - Introduction to Pattern recognition



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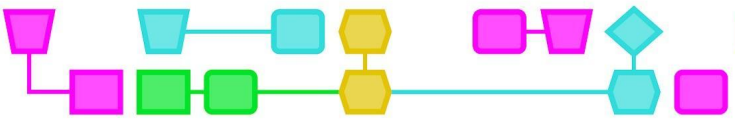


Summary
Pattern recognition helps you to find similarities between problems and systems and apply previous solutions to solve new problems. In this lesson, students will use pattern recognition to divide cards into different categories. As an additional task, there is the possibility of writing an algorithm so a computer can also arrive at the same categories.

Target group: 6-12 years old

Duration: 25 minutes - extra assignment 25 min

Learning goals: By the end of this lesson, students will be able to:

- Identify patterns in a set (or data set)
- Understand how patterns are visible in daily life
- Use previous solutions to solve a new problem

Online/offline: offline.

Computational Thinking:

- General skills: creativity, working together, decision making
- CT foundations: Pattern Recognition, Abstraction, Algorithms
- CT concepts**:** sorting, classify

Materials:

- Photo card set (Appendix 2)
- Timer on a smartboard or phone.
- Small boxes - at least four for each group of 3-4 students
- Worksheet for extra assignment

Tip: laminate the cards to make them durable.

Preparation:
The cards (Appendix 1) should be printed and cut out in advance. Divide the class into groups of 3-4 students and ensure that each has their own surface (table, etc.) on which they can place the cards. At the start of the lesson, give each group a set of cards.

General introduction to the four CT foundation lessons

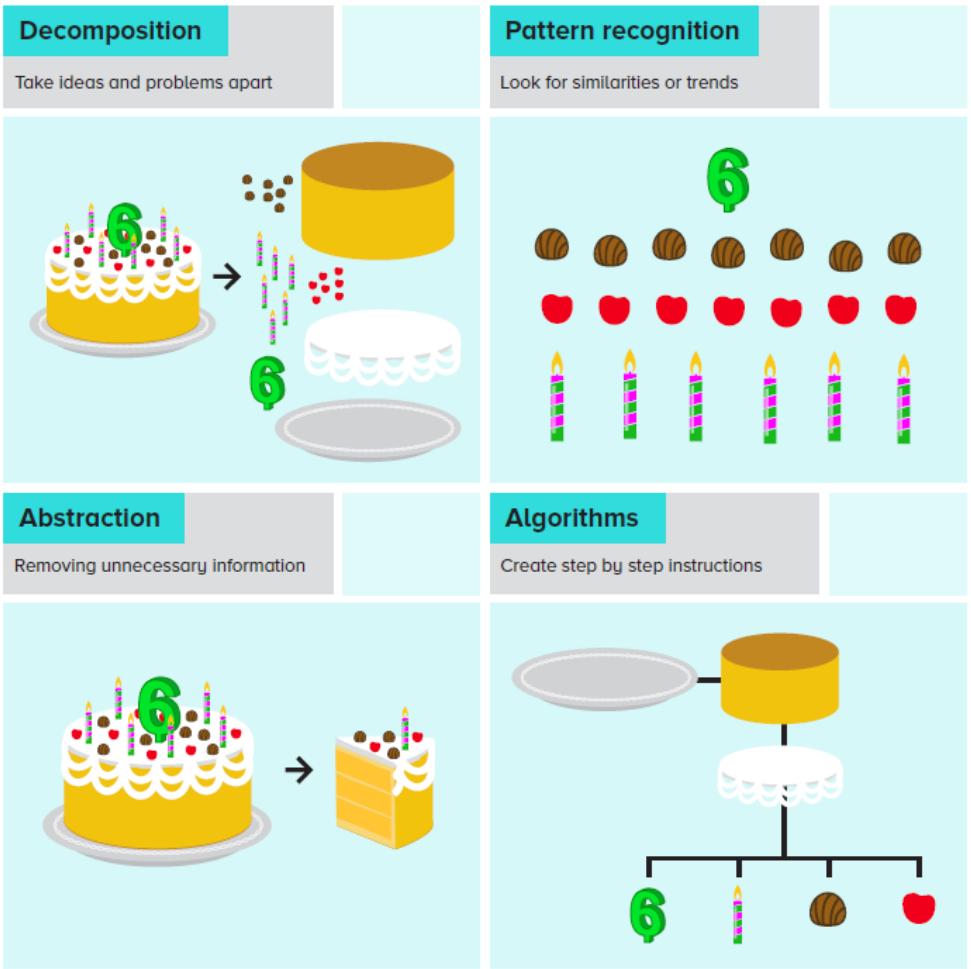
Ask the students:

- What do you know about how computers and telephones work?
- Can they think for themselves? (Why or why not?)
- Who controls what a computer does?

Explain to the students that they are going to work on Computational Thinking. Simply put, this involves learning how to get a computer to solve a problem for you. It is not merely programming, but also, for example, learning how to break down a problem into pieces, or recognizing patterns so you can better solve a problem. There are four main foundations of CT:

- Decomposition⟶ dividing a problem into small pieces.
- Pattern recognition ⟶ looking for similarities or patterns within those small pieces that can help yo
- u solve the problem.
- Abstraction ⟶ distinguishing between the main and secondary issues. What is really important to solve the problem?
- Algorithms ⟶ coming up with step-by-step instructions to solve the problem.

In this lesson you will be introduced to pattern recognition.



Lesson description - pattern recognition

Task 1 - Sorting (10 min):
Hand out the cards and instruct the students to sort the cards in three minutes. If necessary, explain what the word 'sort' means. Give no further explanation and let the students decide which categories they want to sort the cards into.

Set the timer for three minutes. After the three minutes are up, discuss what the students did:

- What categories did they choose? (The groups probably all created different categories.)
- How did they determine the categories?
- What did they find difficult?

> Merriam-Webster: sort to put in a certain place or rank according to kind, class, or nature.

Continue with task 2.

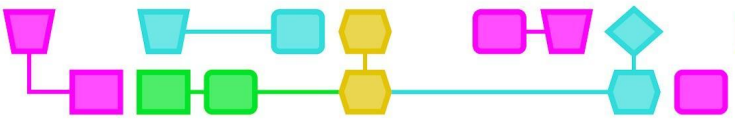
Task 2 - Make a number of categories (10 min):
For this task, the students have to divide the same set of cards into **four** categories. It is up to the students which four categories they decide to sort the cards into. Ordinarily, students will have difficulty sorting the cards into four categories, because they have to merge the categories they used in the previous task. For example, if they had the categories 'objects, animals, humans, food, shapes, and colours,' then they now have to figure out how to merge these categories into four categories.

Set the timer for three minutes. After the three minutes are up, discuss what the students did:

- What categories did they choose?
    - they will all have different categories, so there is no right or wrong
- How did you determine the categories?
- How did this activity compare to the previous one?

Explain that while sorting, they were looking for patterns: they looked at which things were roughly the same and which were not. They scanned the cards with their eyes and saw for example that there were food and animals. In making the categories, they were thus striving to look for patterns: what similarities and what differences are there? And based on this, they then decided very quickly what should be in which category.

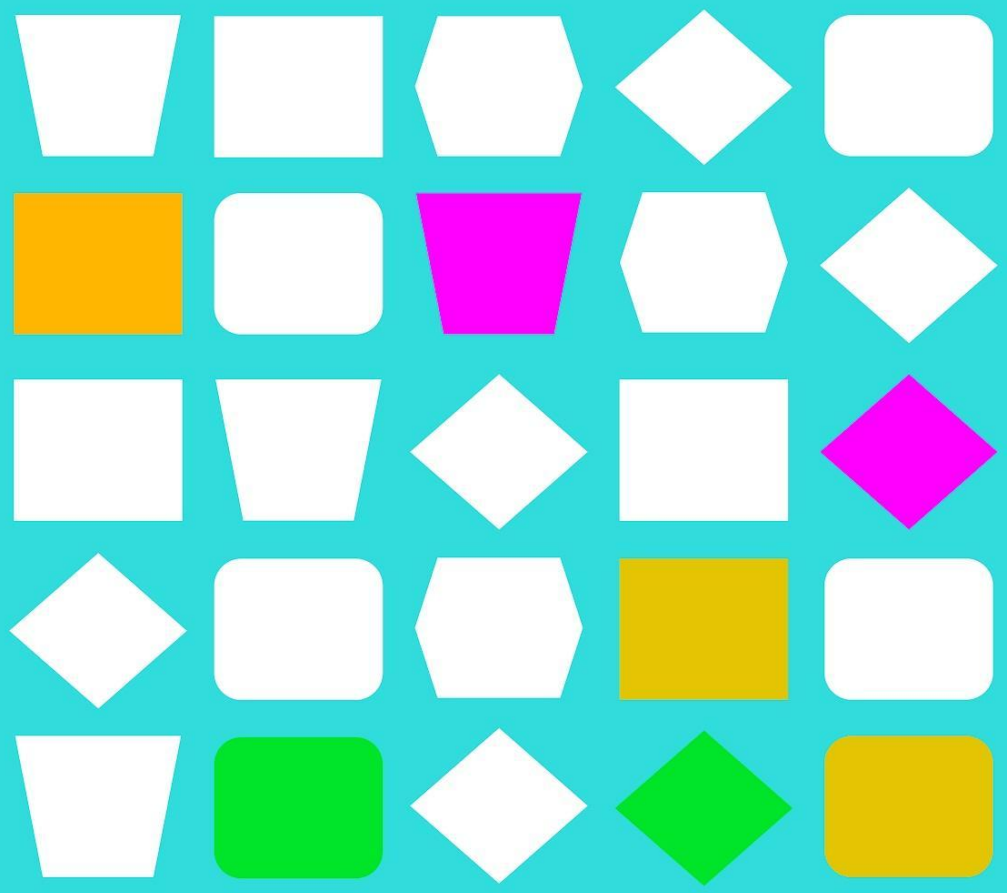
> **Tip**: A lot of games use pattern recognition. Think of Minecraft, where you need certain "recipes" (patterns) to build tools, or in Roblox, where you learn how different games work by recognizing the patterns.



Conclusion (5 min):
All these cards together can also be referred to as data. Computers often work with a lot of data. In order to tell the computer how to handle all this data, it is vitally important to recognize the patterns in the data. When designing an app about food, for example, the computer does not need to think about specific items, but rather about the characteristics they all have as a category (i.e., type, processed, weight, colour, packaging and more). In this way the data structure is modeled, and it can be filled with actual specific data. The data structure model is highly specific, because when designing an app for use in a supermarket, for example, the above points are not of interest. We are then more interested in price, discounts, quality, etc. Patterns are therefore very specific in use, which can make it hard to determine which exact pattern you are looking for in the data.

Pattern recognition is also very important in daily life. For example, students can solve calculus problems faster if they know what the patterns are. Think of solving six times five if they already know what five times five is. They can also recognize animals more easily because they know what pattern it belongs to (does it have legs, fur, whiskers, etc.?). Patterns thus make life just that little bit easier.

Tip: You can use students' answers to explain the concept of abstraction. Abstraction is when you can ignore the specific details and see the important big picture. That what you do when you "scan" these cards, for example, determine the categories. You not going to look at the details of each thing, but which things roughly fit together. If you need to solve a problem, can also at the big picture, rather than every detail. You find that you can then come up with a solution faster.



Appendices

Appendix 1: additional activity - sorting algorithm for animal cards (25 min)

Conditions and rules (5 min):
Use a set of animal cards and explain to the students that they can also use a computer to sort the cards (the data) for them. In this assignment they will create an algorithm for a computer that sorts the cards.

To make the instructions as clear as possible for the computer, you can use conditions. This is an if-then rule that states that something must happen before the other thing happens. An example of a condition for sorting could be: 'if it has legs, it is an animal and it must go in the first bin' or 'if it has feathers, it must go in the second bin.'

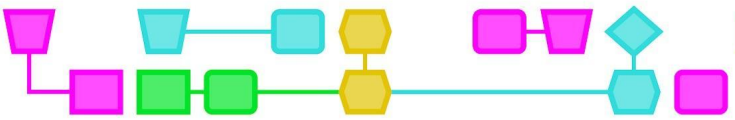
Algorithms (25 min):
The students use the worksheet, sorting cards (both in the appendix) and four bins, in order to write an algorithm for a computer to sort the cards into categories. They create four (or more) categories and try to come up with conditions to write a program that sorts the cards into these categories.

After the students have written the sorting program, let them exchange the programs and try out the sorting algorithm from another group. Discuss how the algorithm worked and whether the instructions were clear enough?

The students probably did not write a perfect sorting algorithm, as it is very difficult to accurately explain the conditions. For example, students can have the condition 'if it has feathers, it is a bird, and it must go in the first bin labelled 'birds''. However, if they also have a bin labelled 'farm animals,' then it is unclear where exactly a chicken would go. A computer cannot think for itself at all, which is why sorting algorithms are very difficult to write, even if you are only sorting animal cards.

Closing (5 min):
Explain to the students that they have made if-then rules (=condition) to write an algorithm that a computer can use to sort the animal cards. By creating conditions, the computer can decide which item belongs in which bin. Since a computer cannot think for itself at all, sorting algorithms require precision and a lot of explaining, which is why they are usually very difficult to write.

Explain that they themselves also perform algorithms in their everyday lives! Think about brushing your teeth or doing a dance. These are all step-by-step instructions that they follow in order to make a particular task easier or smoother.



Sort the cards - Algorithm

Sort the animal cards into four categories.

Our categories are:

-
-
-
-

The rules for the computer are:

- If…… …….. → Then……
- If…… …….. → Then……
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Appendix 2: Printable cards

Colophon

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