



Computational Thinking Part 1





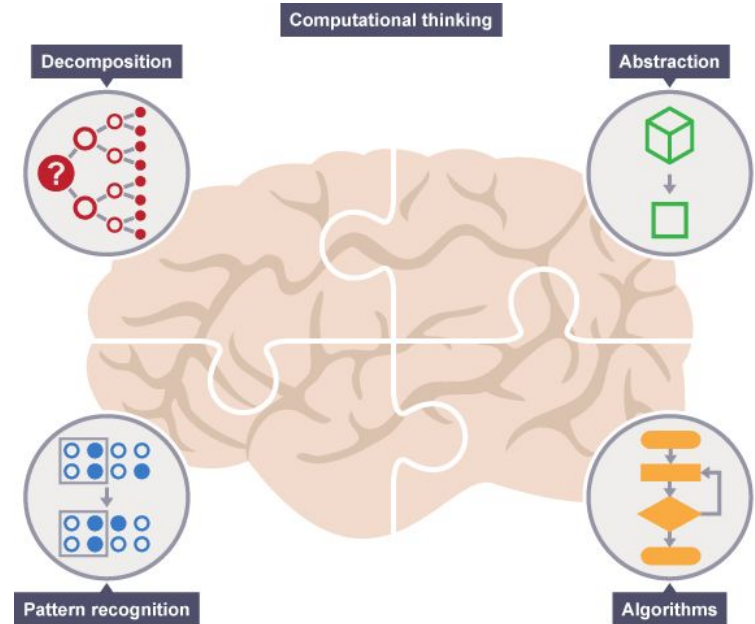
Real Industrial Application? APP-1

There are RF communicating devices on the field, Electricity and Water Meters. They are around 11000 pcs. Every collector receives signals without collision for about 800 pcs.

Today's Topics



- ▶ What is Computational Thinking?
- ▶ Decomposition
- ▶ Pattern Recognition
- ▶ Abstraction
- ▶ Algorithms



Were you able to finish pre-class work for Computational Thinking?



Students choose an option



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What is Computational Thinking?



Let's discuss!

Come with an explanation in 5 minutes.





What is Computational Thinking?



Computational thinking is:

- Logical thinking
- Critical thinking
- Problem solving

If a problem is too hard, what should you try to do?



Pear Deck



Students, write your response!

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Some Questions to Think About Before Starting

If you find similarities in lots of solutions to different problems what does that probably tell you?

If you have a problem that is just a little different from a problem that you have a solution for, what would you do?



What is Computational Thinking?



Computational thinking is:

- Organising data/information logically (Abstraction)
- Breaking problems into parts (Decomposition)
- Interpreting patterns and models (Pattern Recognition)
- Designing and implementing algorithms (Algorithms)

Challenge



Add all the numbers from 1 to 200

- ▶ Big problem?
- ▶ Did you try?
- ▶ A lot to do in your head?



Challenge

Calculate the Salary for an employee

Clarusway CT1

12345

Calculate the net payment for an employee

Daily Rate : 142

Day 1 : 0

Day 2 : 30

Bonus : 15

Taxes to subtract : 136

Calculate Net Salary

The Result is : 4731\$

What is programming?



Pear Deck



Students, write your response!

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What is Computational Thinking?



Computational Thinking is the must step between having a problem and having a solution to that problem.

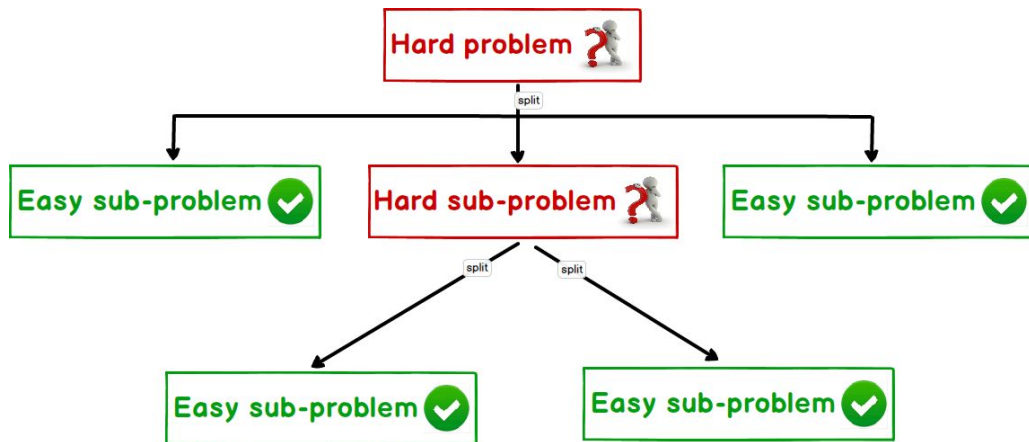
Computational Thinking aims to teach how to form a solution such that can be programmed into a computer.

**programming
= algorithms
+ coding**



Decomposition

It basically means breaking a problem into smaller pieces.



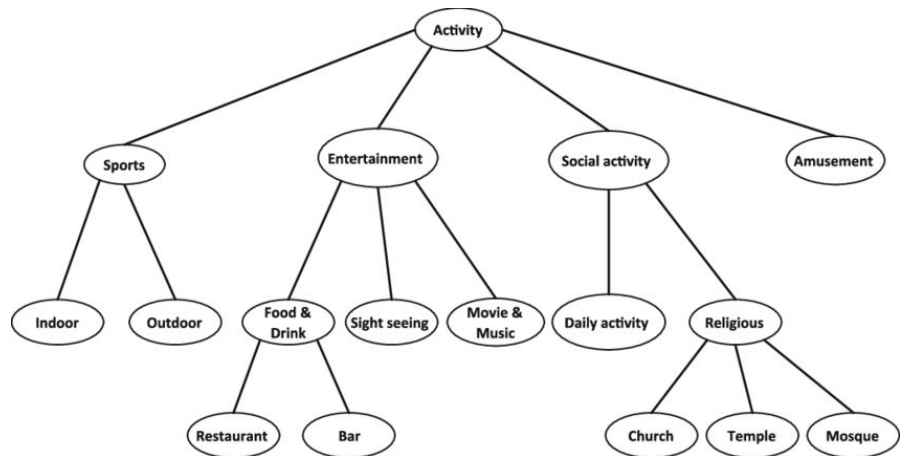
Let's think of some examples of decomposition!



Decomposition

We use **tree structures** to visualize decomposition

- ▶ Tree structures help us decompose problems into sub-problems.
- ▶ It consists of blocks connected by branches.
- ▶ Each block that is connected to its parent block which is above it, represents a sub problem of that block.





Making A Chocolate Cake

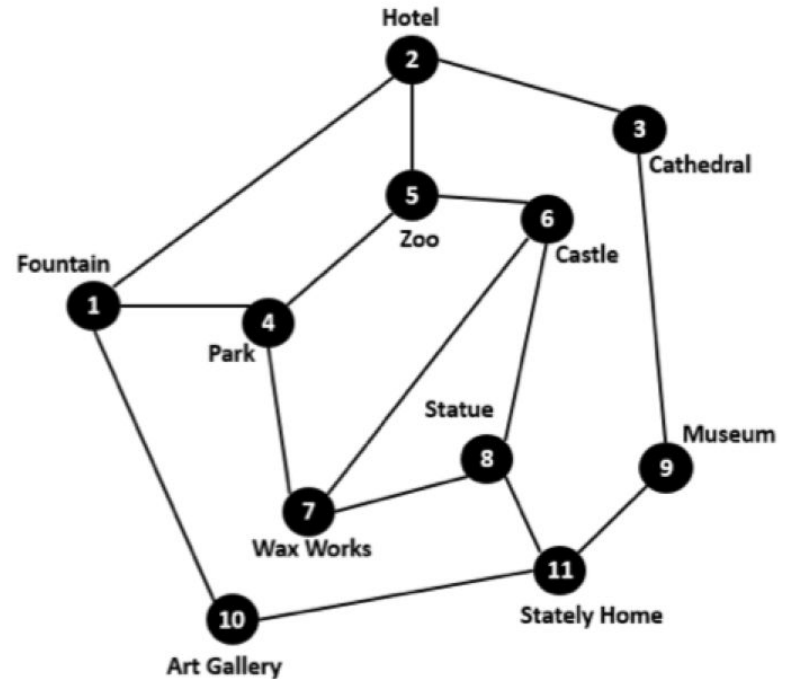




Decomposition Challenge



You are a tour guide. Tourists have booked a tour visiting all the city's attractions starting from the hotel they are staying in. This map shows where the attractions are and roads that connect them. You must work out a route that takes your tour group to **every** tourist site. The tourists will not be happy if they pass through the same place twice. They also want to end up back at their hotel that evening.

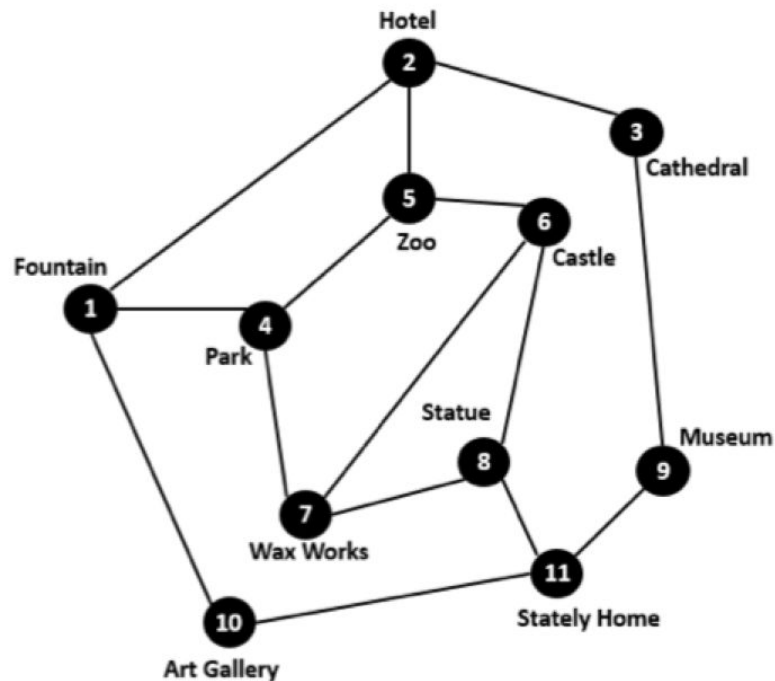


Students, write your response!



Decomposition Challenge

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2, 3, 9, 11, 10, 1, 4, 7, 8, 6, 5, 2



Preparing to Go to Work in the Morning



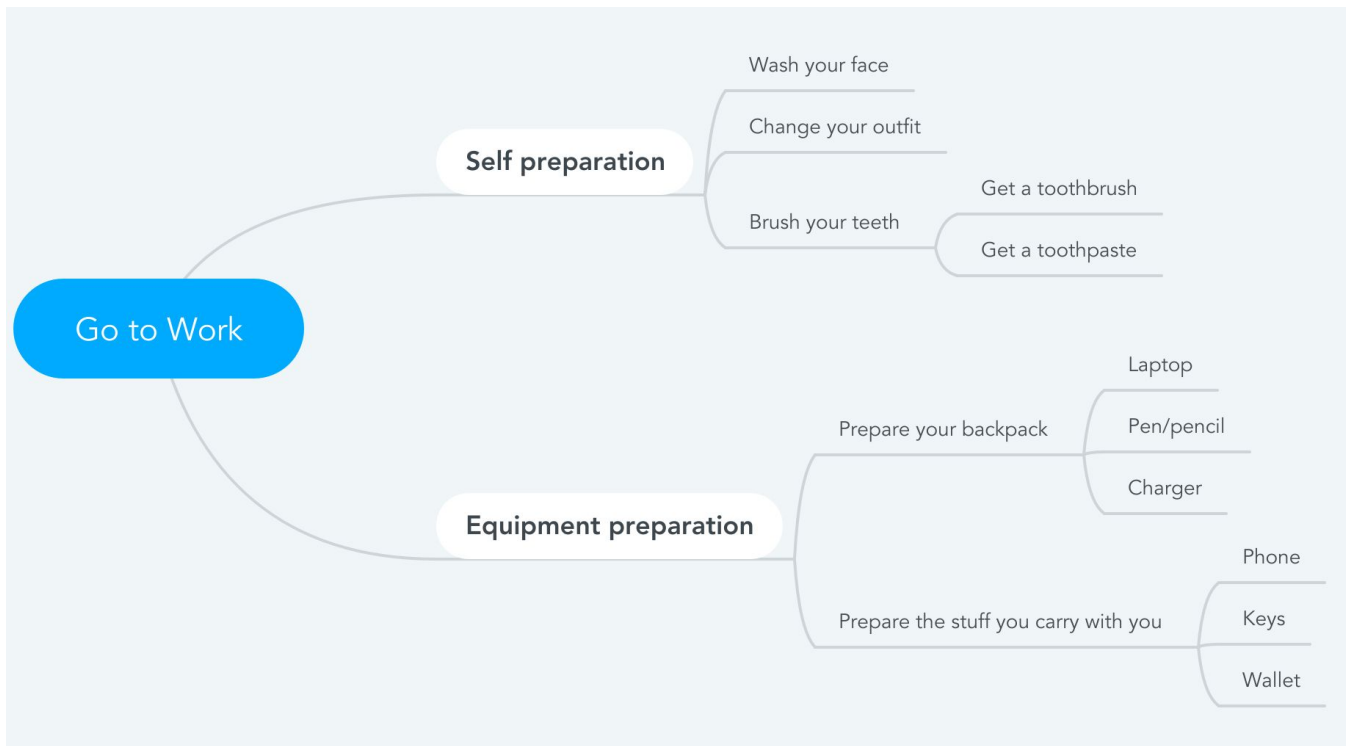
Go to Work



Students, draw anywhere on this slide!



Preparing to Go to Work in the Morning

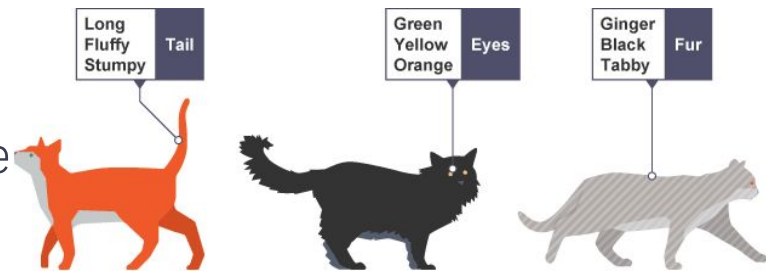




► Pattern Recognition

Pattern recognition is recognising patterns in different things (solutions) and being able to apply these patterns in the solutions of other similar problems.

Pattern recognition is good because we don't have to come up with a new solution each time we encounter the same problem. Instead, we apply the patterns that we have previously recognized.





Pattern Recognition Exercises



Look at the following number patterns and find the sequence.

1 2 5 10 17 ?





Pattern Recognition Exercises



Look at the following number patterns and find the sequence.

1 2 5 10 17 26

Add 1, 3, 5, 7, 9 etc. to previous number



Pattern Recognition Exercises



Look at the following number patterns and find the sequence.

123 117 108 99 ?





Pattern Recognition Exercises



Look at the following number patterns and find the sequence.

123 117 108 99 81

Subtract the sum of previous digits ($1 + 2 + 3 =$ and $123 - 6 = 117$)



Pattern Recognition Exercises



Look at the following number patterns and find the sequence.

849 352 768 493 527



Pattern Recognition Exercises



Look at the following number patterns and find the sequence.

849 352 768 493 527 684

The numbers are 84935276 repeated and then split into groups of 3 digits



Pattern Recognition Exercises



Look at the following number patterns and find the sequence.

12 48 163 26 412 ?





▶ Pattern Recognition Exercises

Look at the following number patterns and find the sequence.

12 48 163 26 412 8

The spaces are incorrectly added, when they are correct it is a simple $\times 2$ pattern



Pattern Recognition Exercises

Look at the following number patterns and find the sequence.



Students, write your response!

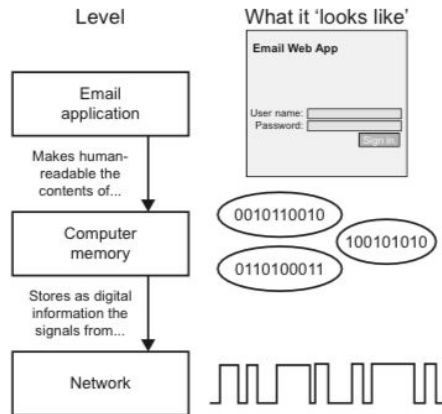
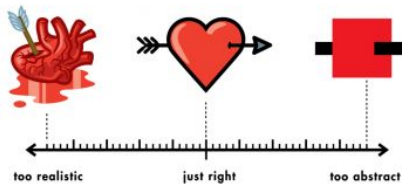


Abstraction

Abstraction is getting rid of the useless information that is not going to have any contribution to the solution.

Abstraction is the core concept of computer science and computational thinking. To be able to express a real world problem to a computer, the problem has to be abstract.

THE ABSTRACT-O-METER





Let's abstract stuff!

The key part of abstraction is ignoring the useless aspects of something and including the beneficial aspects. So, find out the useless aspects that are going to be ignored and the beneficial aspects that are going to be considered of the items below. Try going abstract as far as possible. (For example a house is nothing but a shelter for humans when you look abstractly)

Car



Pencil



House



Mobile phone



HINT: Think of what do these objects help solving and which aspects of them wouldn't prevent them from solving that particular problem.





Let's Abstract Stuff!

The abstractions should look something like this:

| Object | Include | Ignore |
|--------------|---------------------------------|----------------------------|
| Car | Engine, tires, rims, seat | Color, shape, trunk, radio |
| Pencil | color of the tip, grip | material, brand, type |
| Mobile phone | speaker, microphone,cellular | color, brand, camera |



4

Algorithm Design



Brief Explanation of Algorithm

- ▶ An algorithm is a sequence of clearly defined steps to describe a process.
- ▶ Algorithms are useful when we wish to explain someone else or a computer how to carry out steps.
- ▶ Algorithms are important for programming because a correct algorithm is the ultimate basis of any computer-based solution.

▶ Let's brew a coffee





Exact Instructions



Let's take attendance



- 1 stand up
- 2 assign yourself the number 1
- 3 until only one person remains standing
- 4 pair off with someone else standing
- 5 add your numbers together
- 6 assign yourself the new number
- 7 choose one member of the pair to sit
- 8 if you are chosen
- 9 sit down and do nothing else
- 10 if you are standing
- 11 report your number

▶ How computers sort?



6 4 5 2 1 3



Real Industrial Application? APP1

There are RF communicating devices on the field, Electricity and Watermeters. They are around 11000pcs. Every collector receives signals without collision for about 800pcs.



Real Industrial Application? APP-2

There is a small scale application where 1300 RF enabled water meters. Water Meters are installed in some cases inside the house, some cases out of it. You have around %97 coverage. Develop a mobile application to collect the readouts. Transfer the collected data to the server, integrate with their system with REST Json Service.



Real Industrial Application? APP-3

Create a complete solution for a smart card implementation.



THANKS!

Any questions?

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- ▶ volkan@clarusway.com

