



Computational Thinking?

Session-1



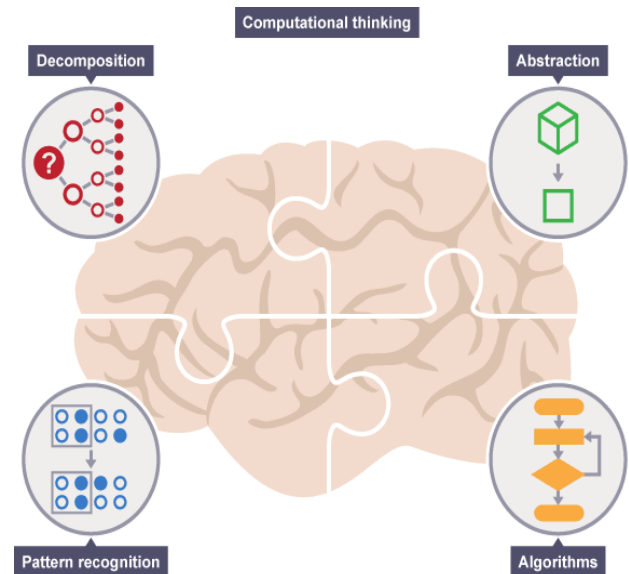
Were you able to finish pre-class work for Computational Thinking?



Today's Topics



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



What is Computational Thinking?



Let's try to predict and discuss!





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!

Pear Deck Interactive Slide
Do not remove this bar

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)

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**



Architects or Bricklayers?



Programming is like bricklaying. You don't have to have an in depth knowledge and thinking to be able to build a wall.

Programming with computational thinking is the architecture.

Architects or Bricklayers



Four pillars of Computational Thinking

- ▶ Decomposition
- ▶ Pattern Recognition
- ▶ Abstraction
- ▶ Algorithm Design



1

Decomposition



Decomposition



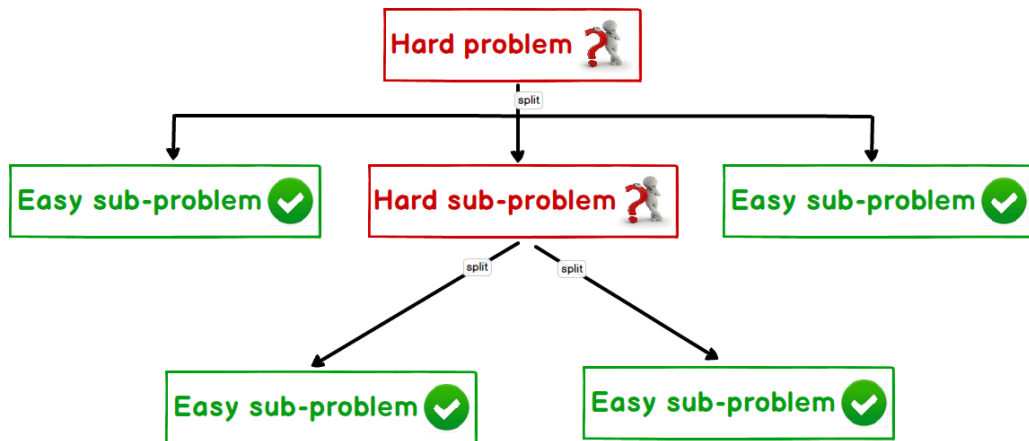
Let's discuss and try to predict what does decomposition mean in computational thinking!





Decomposition

It basically means breaking a problem into smaller pieces.



Let's think of some examples of decomposition!

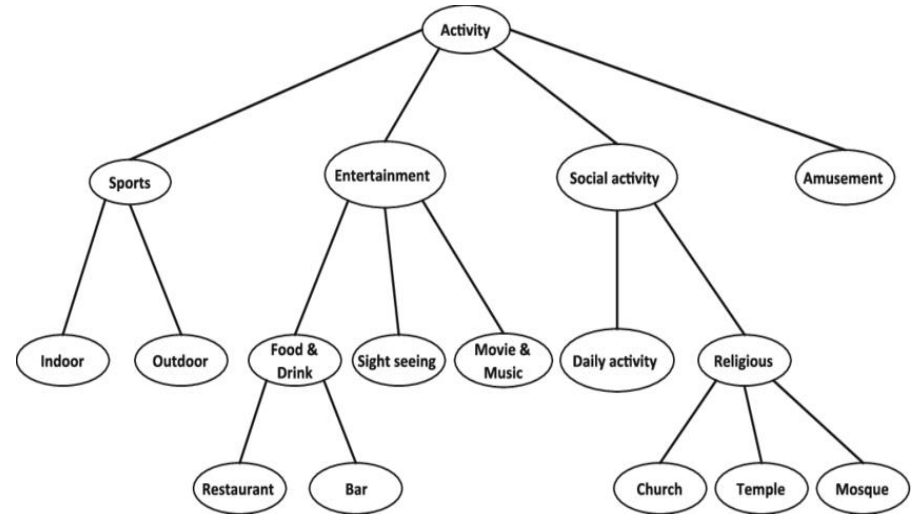


Decomposition



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.





Decomposition

Try to break these problems into as much sub problems as possible and represent them with tree structures:

Making a chocolate cake

Parking a car

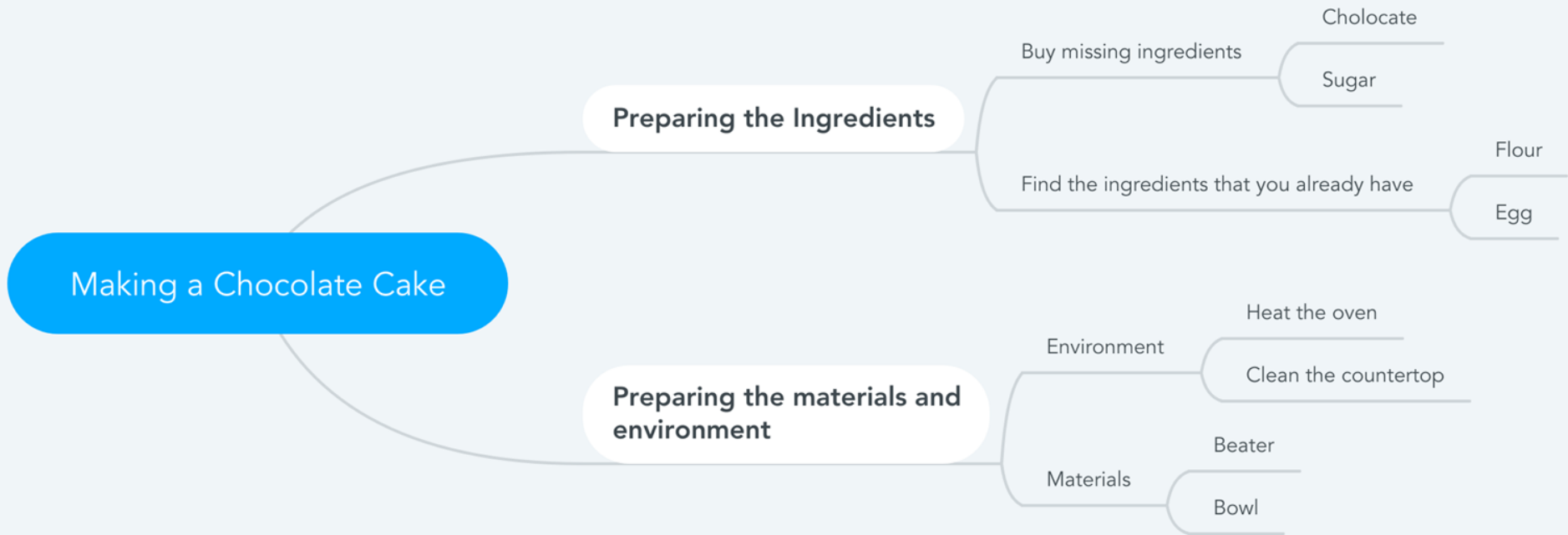
Preparing to go to work in the morning

Preparing vocation plan

Become IT guy

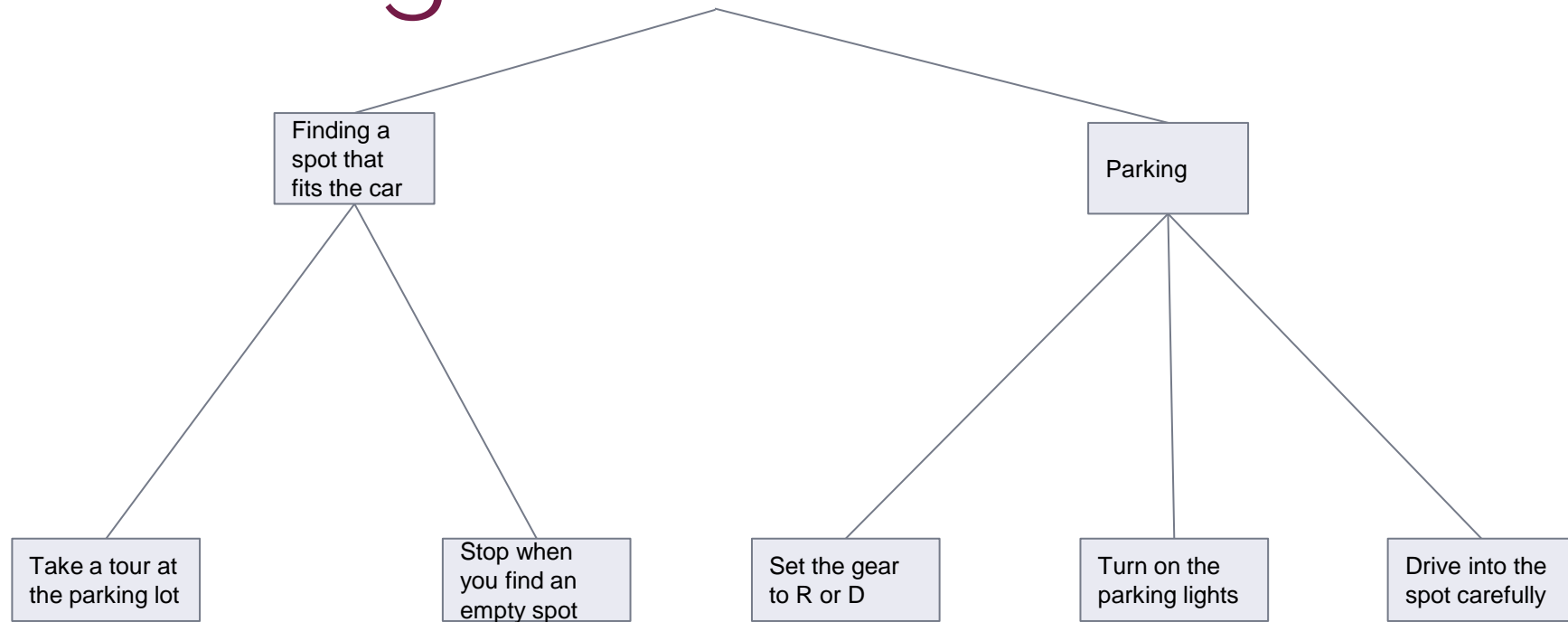


Making A Chocolate Cake

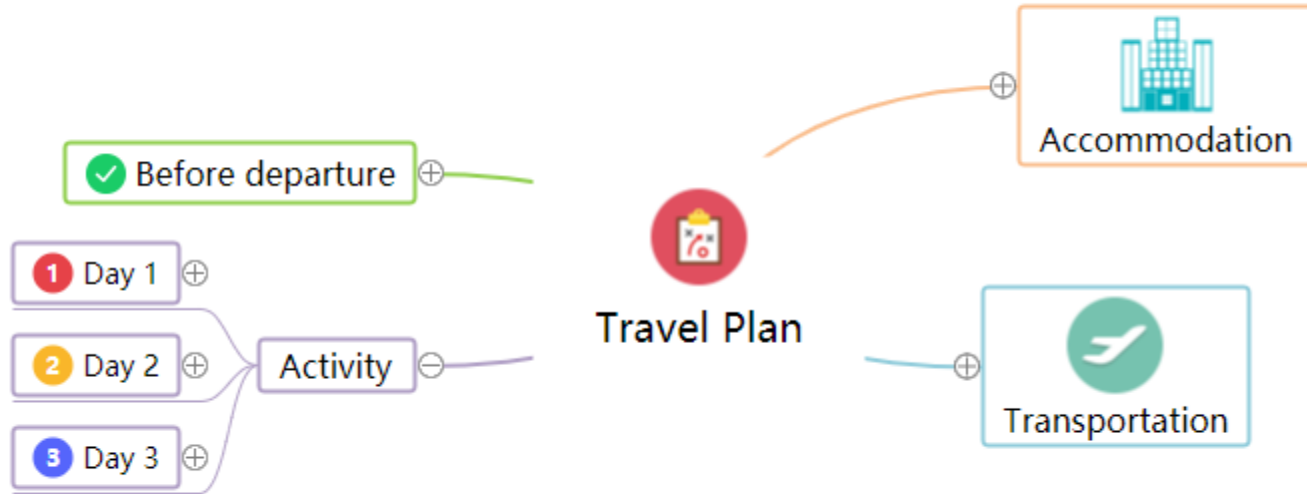




Parking a Car

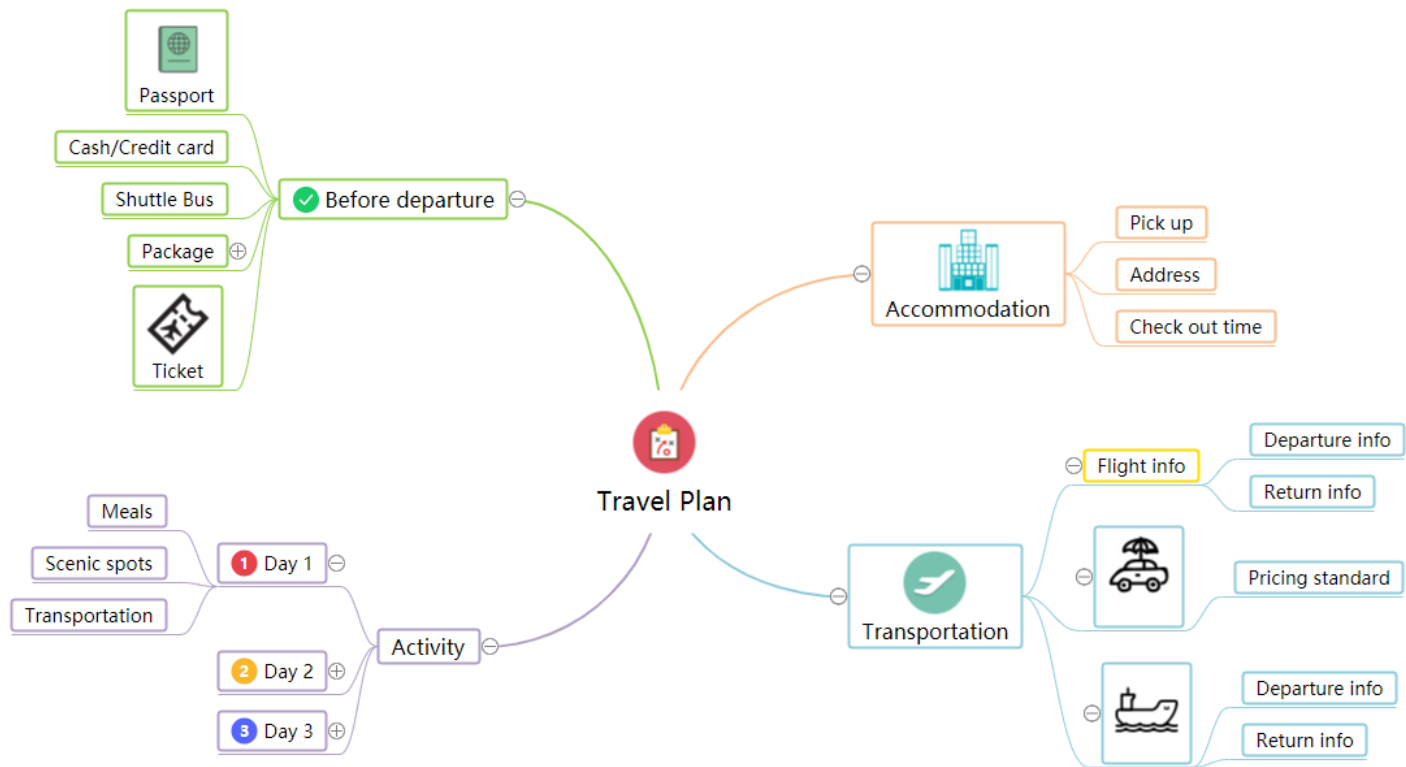


Preparing Vacation Plan





Preparing Vacation Plan



Preparing to Go to Work in the Morning

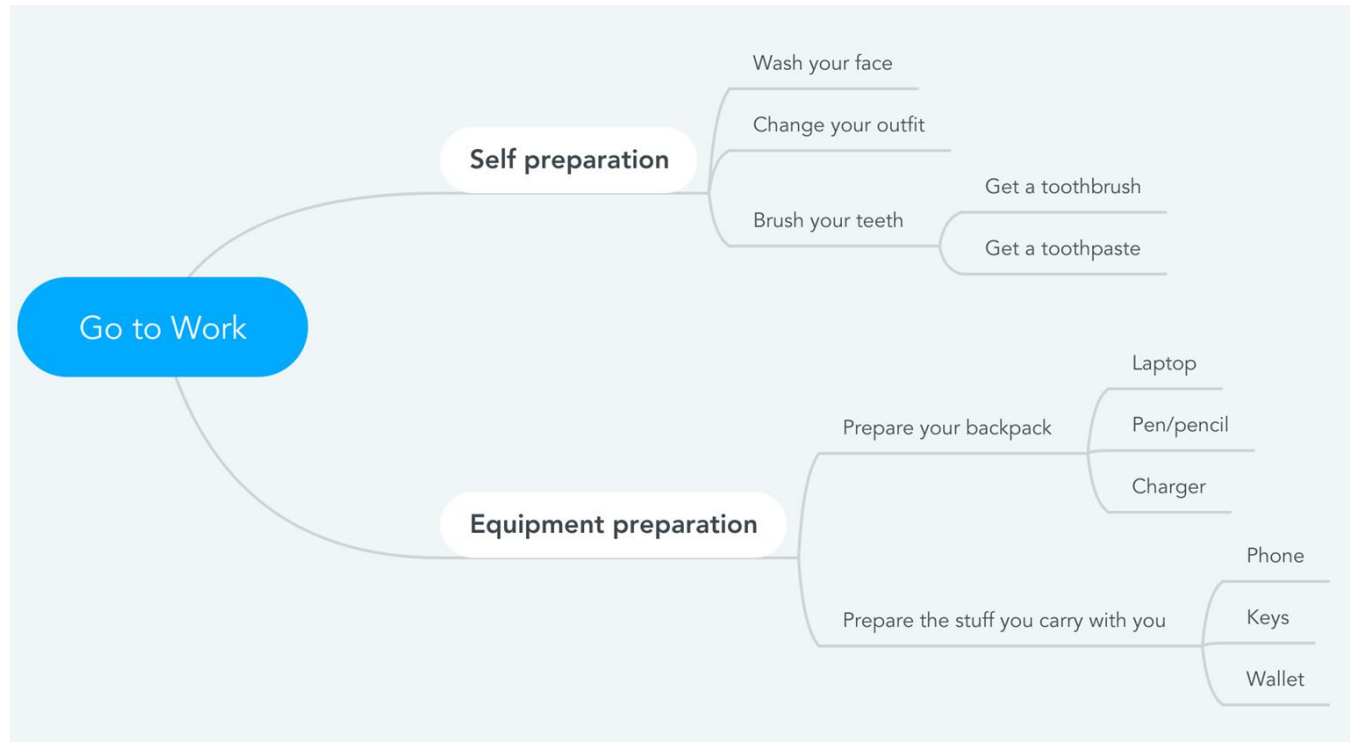


Go to Work

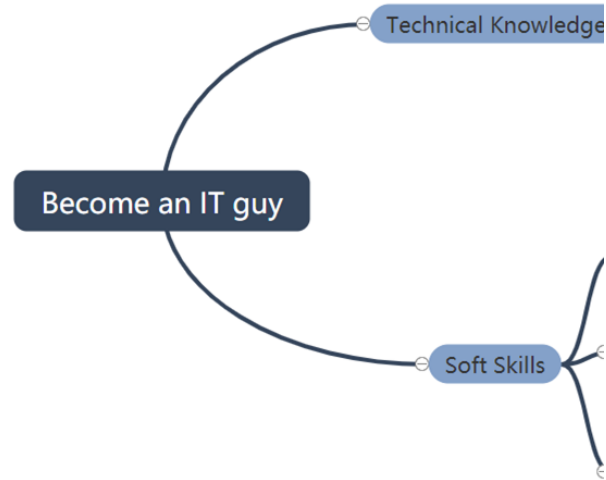


Students, draw anywhere on this slide!

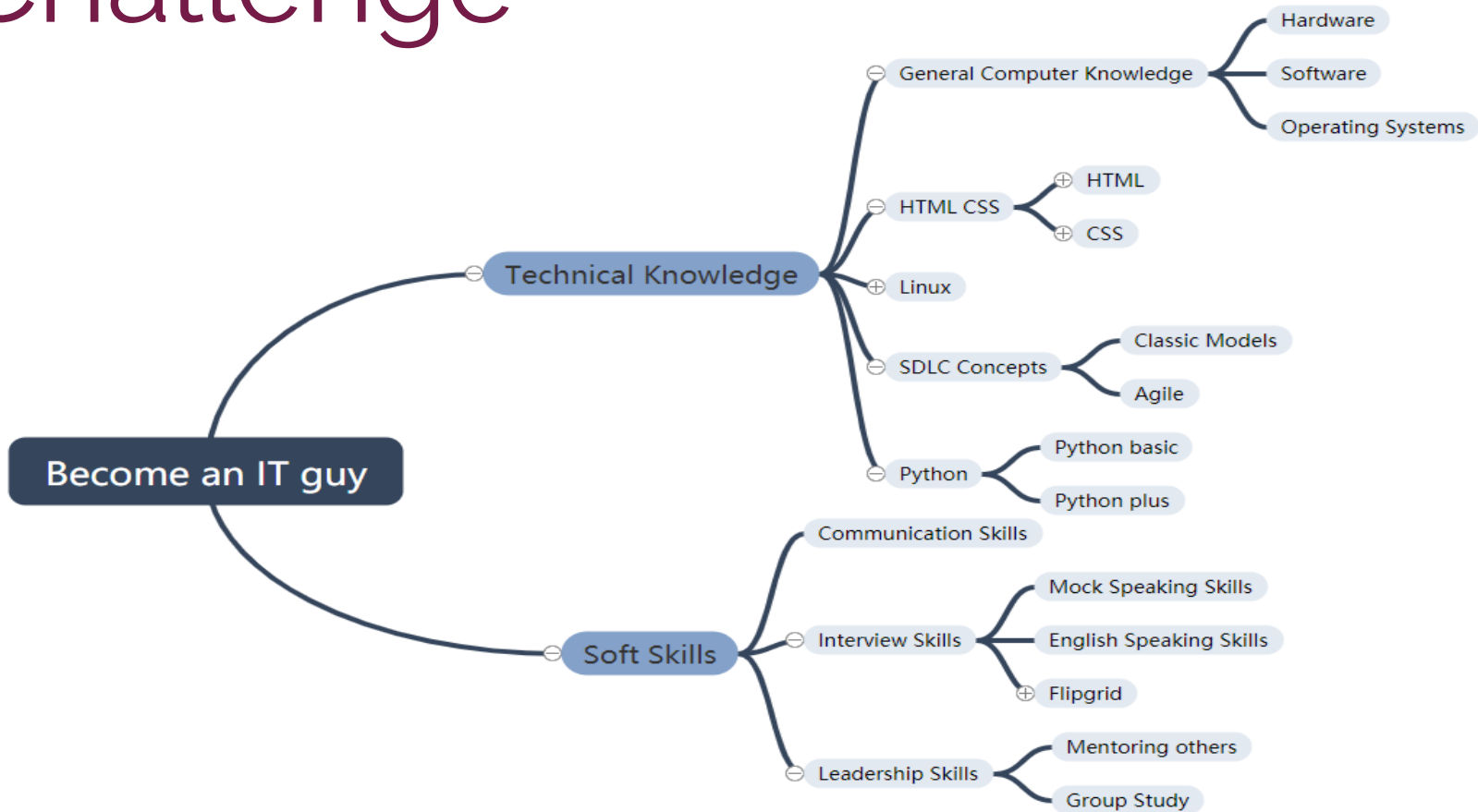
Preparing to Go to Work in the Morning



Let's decompose what you're doing right now?

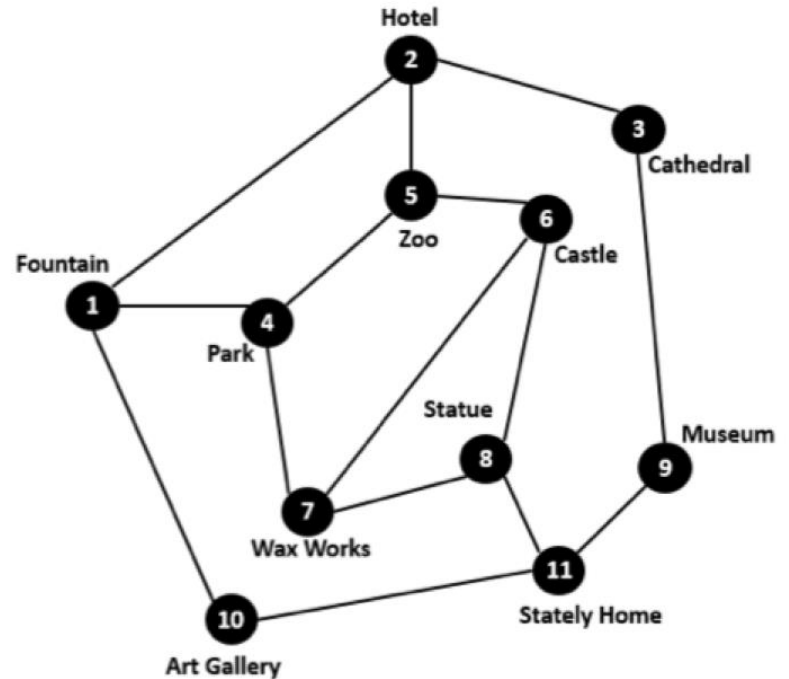


Challenge



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.

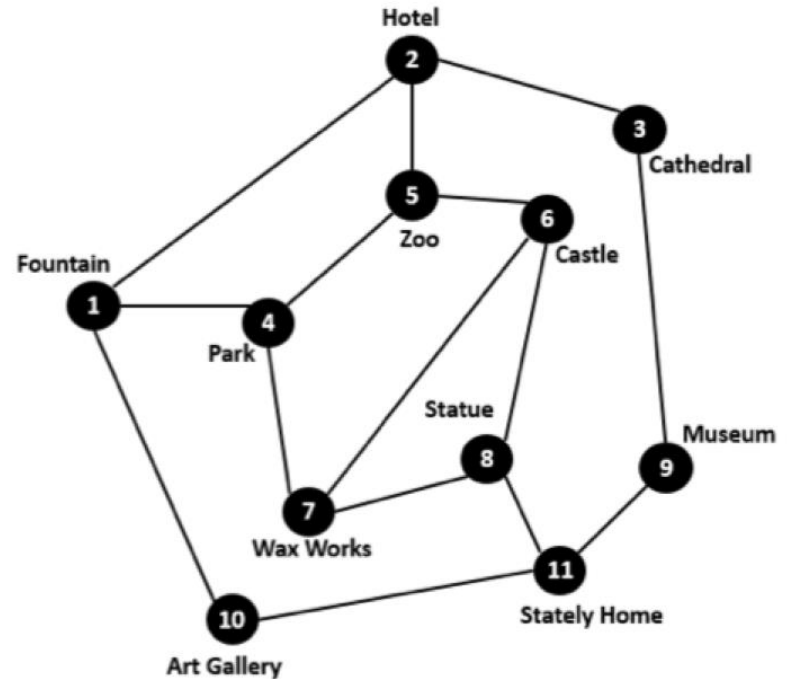


Students, write your response!

Decomposition Challenge

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.

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



Students, write your response!



2

Pattern Recognition



Some Questions to Think About Before Starting

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

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Pattern Recognition



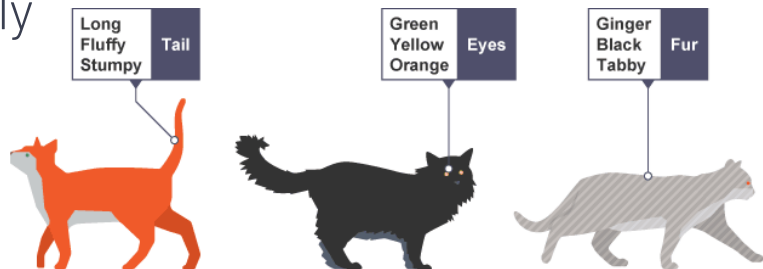
Let's discuss and try to predict what does pattern recognition mean in computational thinking!





► 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.

Challenge

add all the numbers from 1 to 200

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



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.

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.

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.

1	*
2	***
3	*****
4	*****
5	*****





Finding The Rules of the Game

Can you find the rules for this game? If so, how did you find the rules?





Finding the Rules of the Game

To find the rules we found a pattern that is repeated in both of the user experiences:

Phrases like “I guess a number in between 0 and 10”, “someone tried to guess it and sayed...” and “I said ...” are repeated. So we can use these phrases to be able to play the game. Except, we change the parts like the numbers that we guess and statements about the number that is guessed saying whether it is above or below the number that the player thought of.



3

Abstraction

► Abstraction



Let's discuss and try to predict what does abstraction mean in computational thinking!



Students, write your response!

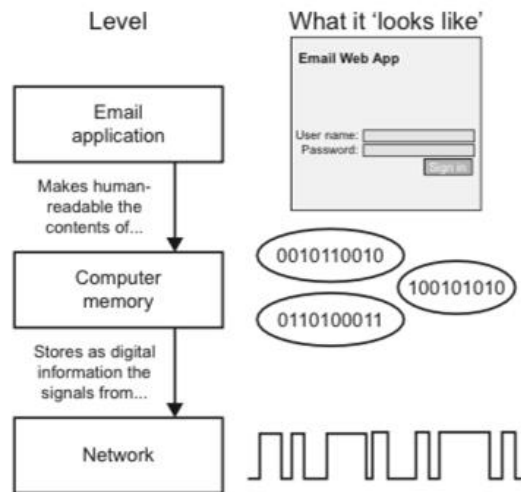
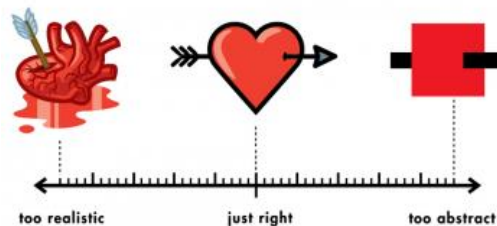


Abstraction

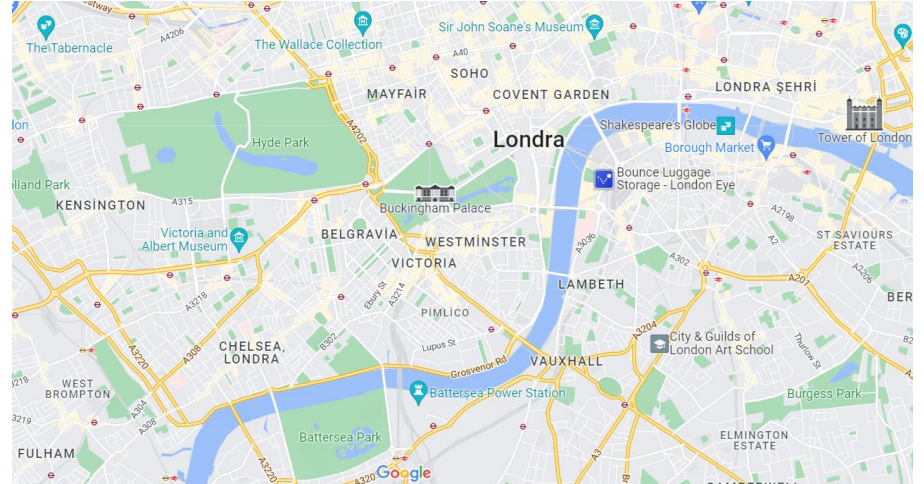
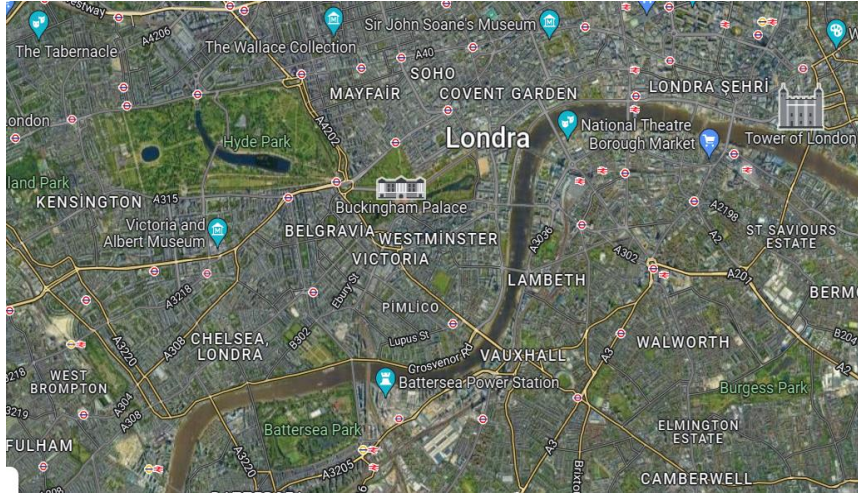
Abstraction is getting rid of the useless information that is not going to have any contribution to the solution.

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



Abstraction





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.



Students, write your response!

REINVENT YOURSELF

Pear Deck Interactive Slide

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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



Let's Abstract Stuff!



Finally, try to describe the objects that you have abstracted, ignoring the parts that you think should be ignored, and including the parts that you think should be included.



▶ Recap Time

What are some examples of abstraction that we encounter in our daily lives?

Do you think that you already abstract stuff?
Can you give any examples?

Why do you think abstraction is important for computer science?





4

Algorithm

Algorithm

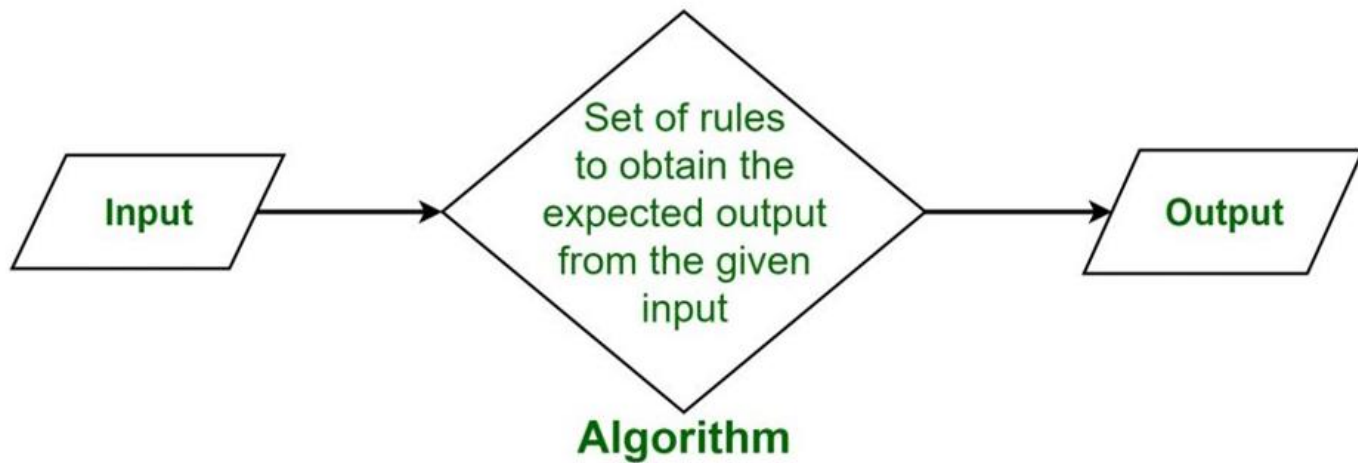


Let's discuss and try to predict what does algorithm design mean in computational thinking!



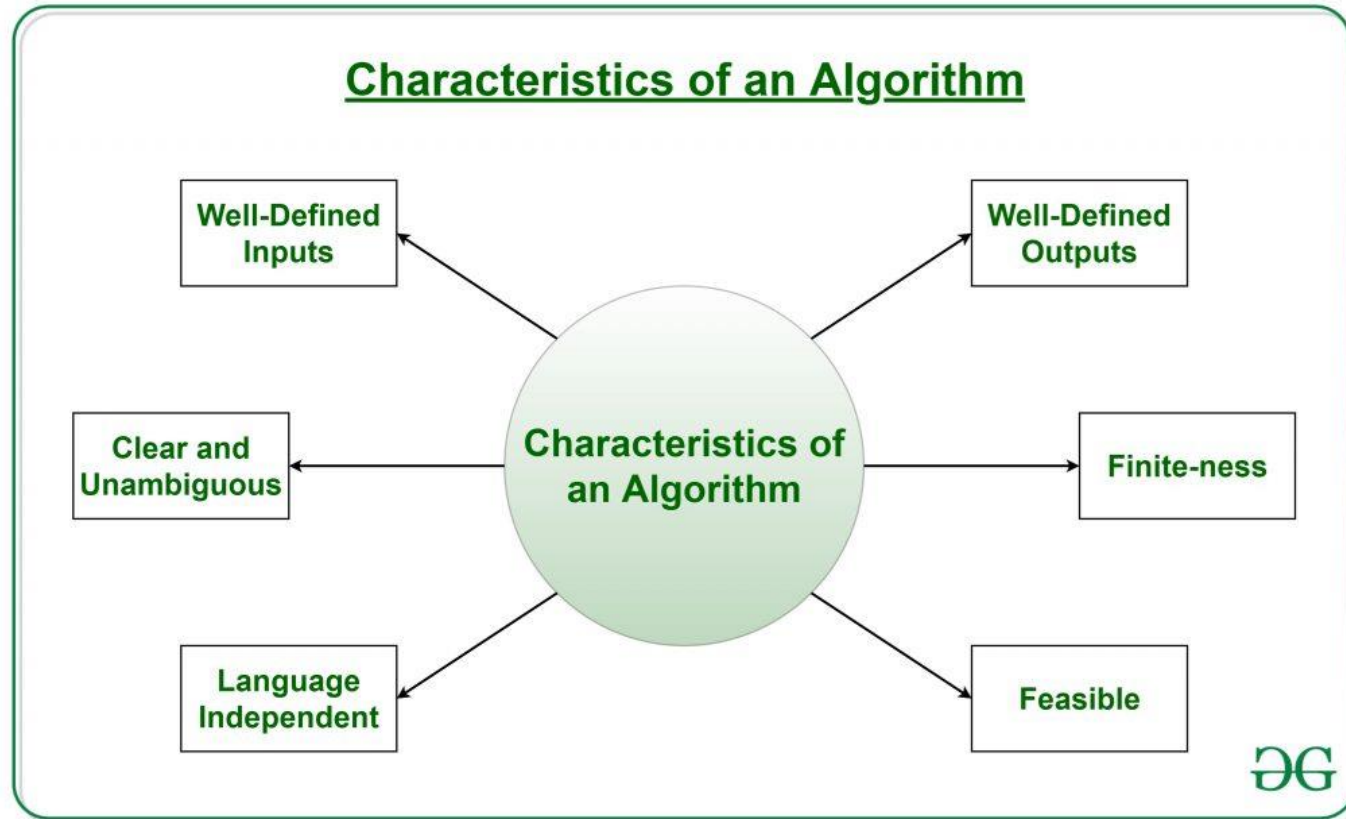


What is Algorithm





What is Algorithm





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.

What is Computational Thinking?





Exact Instructions



Let's brew a coffee



?





Let's brew coffee

- ▶ Prepare ingredients
- ▶ Make coffee
- ▶ Prepare serving
- ▶ Enjoy





► Let's brew a coffee

- START
- Fetch a tea cup
- Boil some water
- Place a tea bag into the cup
- Pour on boiling water
- Stir tea bag
- Remove tea bag
- END



THANKS!

Any questions?

