Unit 6.2: We are computational thinkers

5 words to remember

abstraction: a process that helps simplify things by identifying what is important and what detail can be hidden or ignored

binary search: a search algorithm that repeatedly halves the sorted list of data to find the target

decomposition: breaking a problem down into smaller parts, for example using a divide-and-conquer approach

greedy algorithm: an algorithm that works on a 'biggest first' basis, applying divide-and-conquer to reduce the problem

sorting algorithm: instructions used for putting data (information) in order, for example the selection, bubble and quick-sort algorithms

People: Dr Jeannette Wing

Dr Jeannette Wing (born 1956) is an American professor of computer science. She strongly believes that computational thinking, especially algorithmic instructions, should be used to tackle and solve all types of problems.

Key takeaways

- Computational thinking is a set of skills that helps solve problems in efficient ways. These skills can help us to sort and search for information (data).
- Computational thinking can be seen in everyday life where computers and machines are programmed to solve problems and complete tasks in the most efficient way.
- Google Maps uses graph algorithms to calculate the shortest distance from point A (starting location) to point B (destination).
- **Decomposition** is a common computational-thinking approach where a problem is broken down into smaller, more manageable parts. The greedy algorithm is an example of repeated decomposition.
- In a 'guess my number' game, we could use different search algorithms to identify which approach works best for the game, for example random, linear or binary searches.
- Computational thinking does not always involve computers, for example we can use efficient problem-solving to sort playing cards or different weights by using sorting algorithms.

Knowledge check: Google Maps

Maps are an example of **abstraction**, where choices are made about which details are shown. Google Maps uses an algorithm that finds the shortest route when giving directions. Look at the network graph below. The letters in circles are nodes that represent different towns, and the lines and numbers represent the distances between nodes.

Knowledge check: The greedy algorithm

Vending machines and self-service machines have a way of working out the best way to give change. The best way is the one that uses the smallest number of coins. This is known as a 'greedy algorithm', which starts with the largest possible coin value and reduces the problem to progressively smaller amounts.



Test yourself: Calculate the shortest route from town C to town W. Now express this solution as an algorithm.



Computing

Test yourself: What is the smallest number of coins that can be used to give change of 87p?