



## Activity 1: Linear and binary search – Locating the TARDIS

### Guided activity for teachers

#### Teacher note – Curriculum links:

- Learning about key algorithms that reflect computational thinking (searching)
- Know that different algorithms exist for the same problem and that some algorithms have different performance characteristics for the same task

In our **Doctor Who and the micro:bit Live Lesson**, we'll be introducing students to two different types of search algorithms – linear and binary search.

As part of our 'Locating the TARDIS' activity, we'll be stepping through a demonstration of a linear and binary search. Students will be asked to find a direction or bearing for the TARDIS by pressing buttons on their micro:bits (using the 'Locating the TARDIS' program).

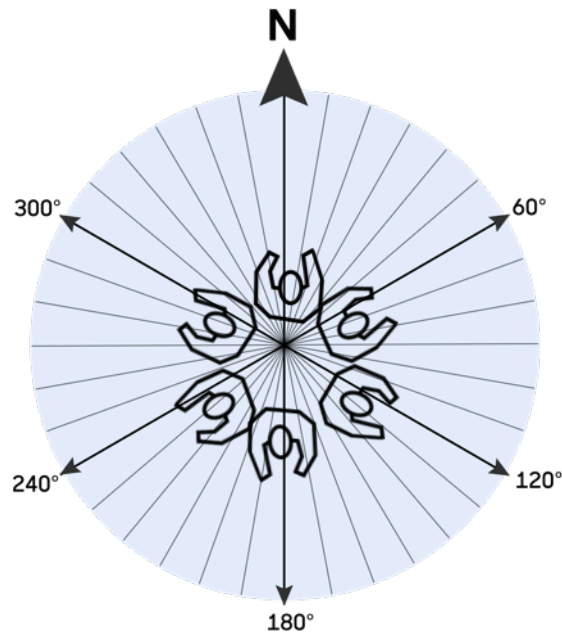
You can use this teacher-facing guide to help you recreate this demonstration in your class.

### Linear search

Linear search is an algorithm where you find a search term or search value within a list by checking each element one by one in sequence for the target value until a match is made.

You can demonstrate linear search in the context of our 'Locating the TARDIS' activity using the instructions below.

- First, find North in relation to your classroom. You can do this using any compass. You can also try putting your school's address and postcode into a map website online and use this to establish which direction is North.
- Mark out North on the floor, and arrange six students back to back in 60-degree angles from North.



- Get the student facing North to press button A on their micro:bit. If they have found the TARDIS, the word 'TARDIS' will scroll across the micro:bit LED screen.
- If they don't find the TARDIS, they'll have to turn clockwise slightly and try again. Repeat until it's time for the next student to take over the search.
- This sequential search will mean that it takes some time for the students to find the TARDIS. (The TARDIS is located between 190 degrees and 210 degrees in relation to North.)

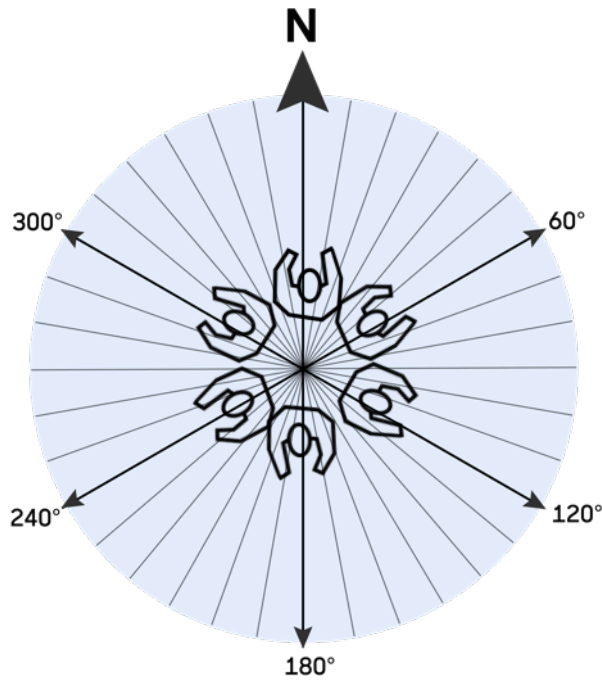
## Binary search

Binary search is an algorithm where you find a search term or search value within an ordered list or array. It sets up a start point and an end point, then compares the middle value of the array to the target.

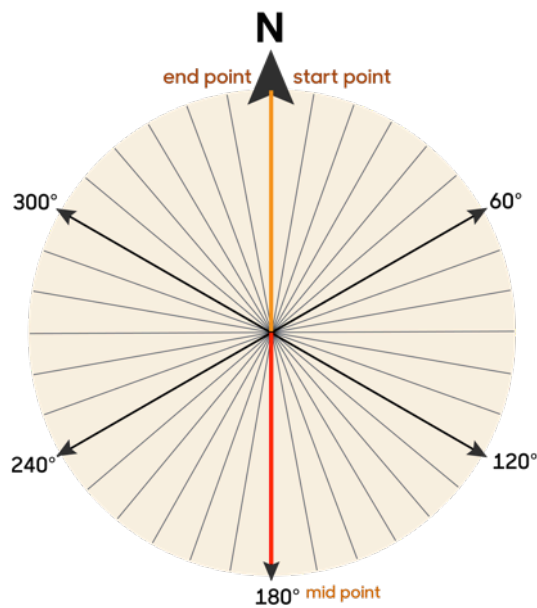
If the target is greater or less than the middle value, the half where the target doesn't lie is eliminated from the search, and the middle value becomes the new start or end point.

You can demonstrate binary search in the context of our 'Locating the TARDIS' activity using the instructions below.

- First, find North in relation to your classroom.
- Mark out North on the floor, and arrange six students back to back in 60-degree angles from North.



- As the midpoint between 0 and 360 degrees is 180 degrees, check if the bearing that the TARDIS is in is higher or lower than the midpoint by getting the student facing 180 degrees to press button B on their micro:bits.
- It should say 'Higher' or 'Lower' on their micro:bit, or 'TARDIS' if they've found it. In this case, it should say 'Higher' as the TARDIS is located between 190 degrees and 210 degrees.



- 180 degrees then becomes your new start point, and all the students between 0 and 180 degrees can sit down.
- Repeat the process until the TARDIS is found – this should take just four steps!

