

# Evo Guesses a Number

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## Introduction

Guessing a number (integer) between 1 and  $N$  is a game that nearly everyone has played at some time or another. Doing this with the least number of wrong guesses is the challenge. Many quickly realize that guessing 1, then 2, then 3, *etc.*, is not particularly efficient. This becomes quite evident when  $N$  is large, say 100 for example. Such a technique is referred to as *linear search* by computer scientists.

Evo uses a very efficient algorithm referred to as a *binary search*. This algorithm essentially reduces the number of possibilities by about 50% with each guess. Figure 1 shows the Ozomap used by Evo to guess a number between 1 and 15. A pdf file with this Ozomap accompanies this lesson.

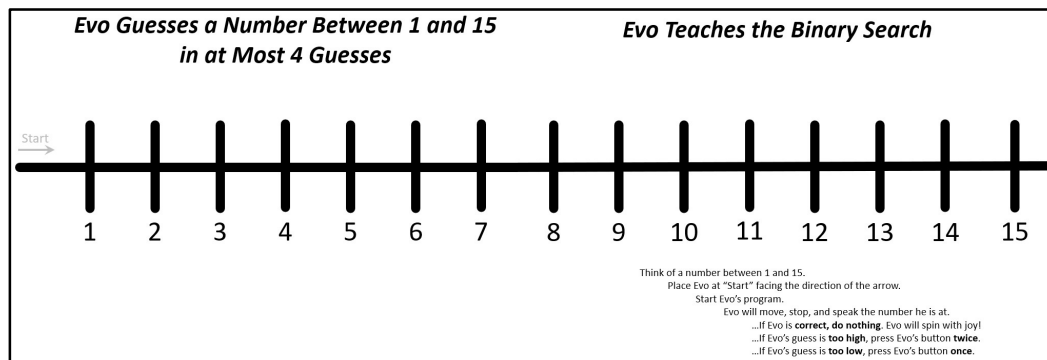
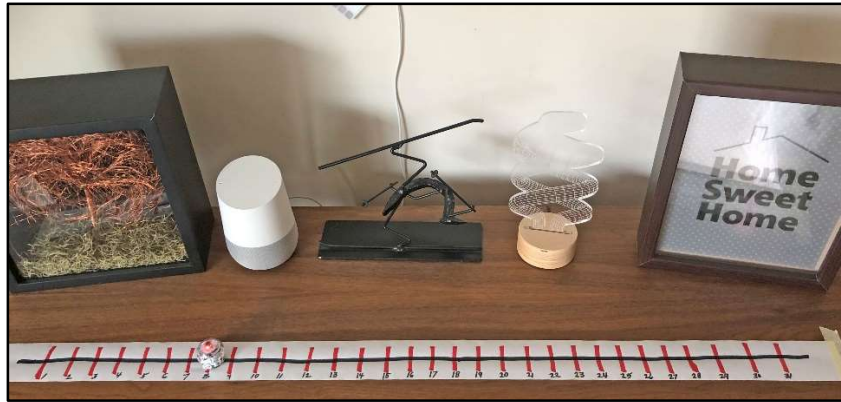


Figure 1

The user thinks of a number between 1 and 15. Evo is loaded with the program *Guess Number.ozocode* and is placed at the start location facing the direction of the arrow. The program is then started. Evo moves, stops, and speaks the number of the location he is at. If the number matches the number that the user is thinking, the user does nothing. Evo then spins with joy upon guessing the number. If Evo's guess is **too high**, the user has four seconds to press Evo's button **twice**—indicating that the guess was too high. If the guess is too **low**, then the user presses Evo's button **once**. This process continues until Evo has guessed the number correctly. He will be able to guess the number correctly with a maximum of four guesses.

### ***Guessing a Number Between 1 and $N > 15$***

If you want, you can have your students create long Ozomaps using adding machine tape. An example is shown in Figure 2. In this example Evo guesses a number between 1 and 31. He can do this in at most five guesses.



*Figure 2*

This is fun for the students since they make their own Ozomaps. They will need to make one small change to the OzoBlockly program. There is a block near the beginning of the program that looks like the block shown in Figure 3. With  $N$  having a value of 31, the value 15 in this block needs to be changed to 31.



*Figure 3*

The highest value allowed for  $N$  is 127. This is because 127 is the largest integer that Evo is designed to understand. This could be a class project with each group of students constructing a portion of the Ozomap. The Ozomaps would then be taped together to make an Ozomap from 1 to 127. Make sure that the black horizontal line extends an inch or two to the right of 127. Evo will be able to guess the number in at most 7 guesses.

### ***Conclusion and Lesson Wrap-up***

After working with this lesson for a while, students should be able to see how the binary search algorithm cuts the number of possible guesses in half with each guess. Have a student in each group think of a number between 1 and 360. Students should be able to guess the number in at most 9 guesses if they follow the algorithm correctly.