Goal

To explore powers of 2, and discover 2^x by halving.

Introducing the Game

This is an easy game. You can always win!

I'm thinking of a number from 1 to 15. Figure out my number by guessing a whole number. I'll answer "higher" or "lower" or "that's right!" You get three guesses.

Later – Let's make the game twice as hard!
I'm thinking of a number from 1 to 31. You get four guesses.
I'm thinking of a number from 1 to 63. You get five guesses.

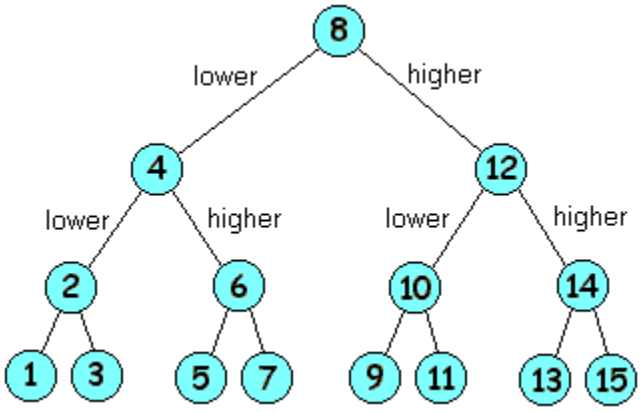
Example

The game is always winnable *if* you use the right strategy!

The first guess should be 8. The answer may be lower, higher or correct.

Follow this tree for guessing the next number.

After three guesses, if you haven't hit the number itself, then you *know* what the answer must be!



Instructor Notes

Flip a coin to choose a random number. Show the students the flip, but not the result. (This is intended to suggest powers of two, again.)

Questions for class discussion:

- How do I get 1 through 15 with a simple coin?
  A: By assigning 1 or 0 to each flip, and composing a binary number.

- What is the *most* number of guesses needed?
  A: Suppose the strategy is guess by counting from 1 to the maximum. If the maximum is 15, then "maximum –1" will be needed.

- What is the *least* number of guesses needed?
  A: Suppose the strategy uses the decision tree shown above. If the maximum is 15, then at most three guesses are needed.

