

Activity Sheet 16

1. You will play the following game: There are two players, the *guesser* and the *adversary*. The goal of the game is to guess a target number from 1 to n with as few questions as possible. Here are the rules:
 - On each turn, the guesser asks the adversary a yes/no question about the target number, and the adversary must respond.
 - After the specified number of turns, the guesser must guess a number. The adversary must also say what their number is.
 - If the adversary's number does not agree with the answers to the questions, then the guesser wins.
 - If the guessed number matches the adversary's number, then the guesser wins.
 - Otherwise the adversary wins.
 - The adversary does not have to choose a specific number beforehand. They only need to provide a number at the very end.
 - The adversary must make sure that whatever the number ends up being, the answers they gave to the questions are correct for that number. For instance if the first question is "is the number at least 5?", then the adversary can answer yes or no, but whatever they answer must be consistent with the future decision.

Play the following variations of this game, twice for each game taking turns on who is the guesser and who the adversary. Record (in the guesser's sheet* the names of the players, the questions and answers, and the final number.

- numbers 1 through 10. 4 turns allowed.
- numbers 1 through 20. 5 turns allowed.
- numbers 1 through 30. 5 turns allowed.

2. This is another guesser-adversary game. In this game we have 5 objects, A, B, C, D and E. These objects are in a certain order, from smallest to largest. This order is up to the adversary to decide, and they don't need to decide it beforehand.

- The guesser is allowed to ask the adversary for comparisons between objects. For instance the guesser can ask the adversary: "Is C greater than A"?
- The adversary's answers must be consistent with a total order of the objects.
- After a number of questions, the guesser must guess which of the objects is the largest of all. The adversary must also reveal an order for the objects.
 - If the order of the objects contradicts one of the answers that the adversary gave, then the guesser wins 10 points.
 - If the guesser's object is the largest one based on the adversary's order, then the guesser wins 10 points minus the number of questions they asked.
 - Otherwise the guesser gets no points.

The players take turns switching roles, for a total of 4 games. The winner is the one with the most points at the end.

Record on the guesser's sheet the comparisons/questions made, the final guess and the corresponding order and how many points you got.