

Activity 12: Artificial Intelligence

Today's activity will focus on a classic AI problem: how make decisions for winning a simple tile game. In the end, we will develop an algorithm for playing the game automatically.

Model 1 The 8-Puzzle

Imagine a 3x3 grid of tiles numbered 1 to 8 that can slide horizontally or vertically. The gray square below represents the empty space into which adjacent tiles can move.

1	2	3
4	5	6
7	8	

A (goal)

1	2	
4	5	3
7	8	6

B (easy)

7	4	8
1	5	3
	6	2

C (hard)

1		3
5	2	6
4	7	8

D (easy)

Explore the puzzle a bit by visiting mypuzzle.org/sliding, and make sure you understand how the tile movement works. Don't spend too much time actually trying to solve the puzzles yet.

Questions (20 min)

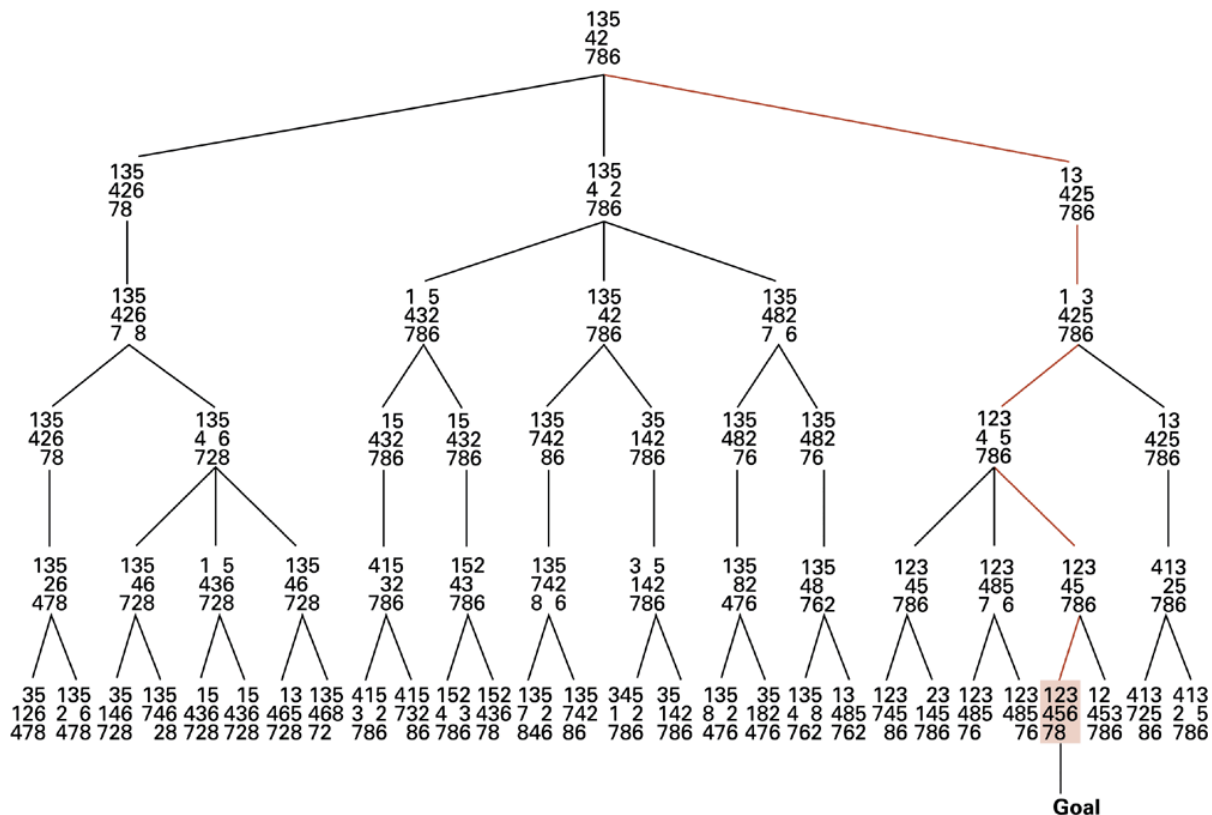
Start time: _____

1. How many different tiles can be moved in examples B and C? How many in example D? Describe a general way of classifying the number of moves from any given layout.

2. In the center of the space below, copy the grid from example B. Then draw the possible next grids, one on each side of B, and draw a line between B and each neighbor. Imagine you can transform the puzzle from one grid to another by traveling along the lines. Continue this process for all possible moves two steps from the original example B grid.

3. Imagine repeating #2 for example C. How big might the drawing get?
4. What makes example C harder to solve than B and D?
5. Assuming you could remove all the tiles and then place them back on the grid, how many different puzzle layouts are there?
6. Now consider the game of Tic-Tac-Toe (or see playtictactoe.org if you're unfamiliar with it). Draw a diagram similar to #2 for the first two moves, assuming X moves first, starting from an empty 3x3 grid. Don't worry about completely drawing all possible boards, but do sketch enough to illustrate you know how it works.
7. Name three ways the Tic-Tac-Toe diagram differs from what you did in the 8-Puzzle.
8. Would it be possible for a computer to store the solution for all possible 8-tile and tic-tac-toe games? Why or why not?

Model 2 Search Trees



Questions (15 min)

Start time: _____

9. In your own words, describe what the above diagram represents.

10. Given that there are always at least two possible moves, why do some board configurations seem to have only one branch?

11. Consider two methods for making the move choices at each step: *Random* (just choose randomly among all legal moves), and *Lowest* (always choose the lowest numbered available tile to move). Could either of these methods get to a solution?

12. If you were given several puzzle layouts and had to choose the easiest to solve, how would you choose?

13. Describe an algorithm that can take any 8-Puzzle grid and compute some measure of the difficulty. Use your thinking from the previous question: think about how to get to a number that is bigger, the harder the puzzle might be to solve.

14. Apply your algorithm to the second row of the model. You should get a number for each of the three board configurations.

15. Describe how you could use your algorithm from #13 to make a better next-step choice method than the methods in #11.