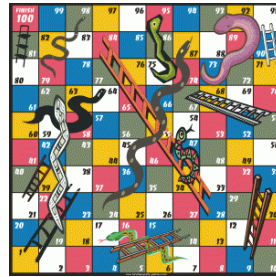


Activity

Snakes and Ladders – Breadth First Search



Summary

By turning Snakes and Ladders to a strategy game, students learn about and apply the Breadth First Search algorithm (graph theory).

Ages

12 and up

Skills

Problem solving, basic math

Materials

Each group of children will need:

Small snakes and ladders activity (2 pages)

A coin

[Optional]: A board of typical Snakes and Ladders game (it can be printed from various sources)

Snakes and ladders

Introduction

The basic idea behind this activity is to convert the Snakes and Ladders game into a strategy game. No dice are needed. Each player must choose the number of squares (from 1 to 6 of course) that will bring them closer to the end of the game. Whoever makes better decisions wins! What strategies will students follow?

Breadth First Search

In graph theory this problem is solved with Breadth First Search, because every edge has the same cost. The cost of each edge is **one** move, equivalent to one dice throw in the original version.

Let's assume that a player can advance 1 to n squares in a move, and that the board is of size m (usually m is a square number like 100).

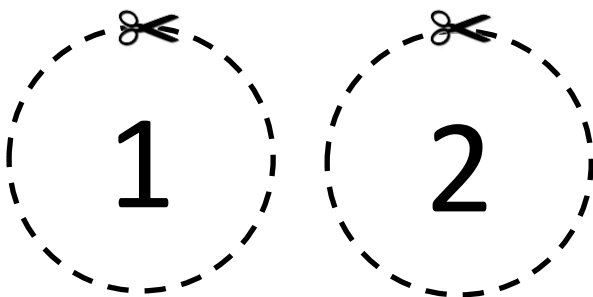
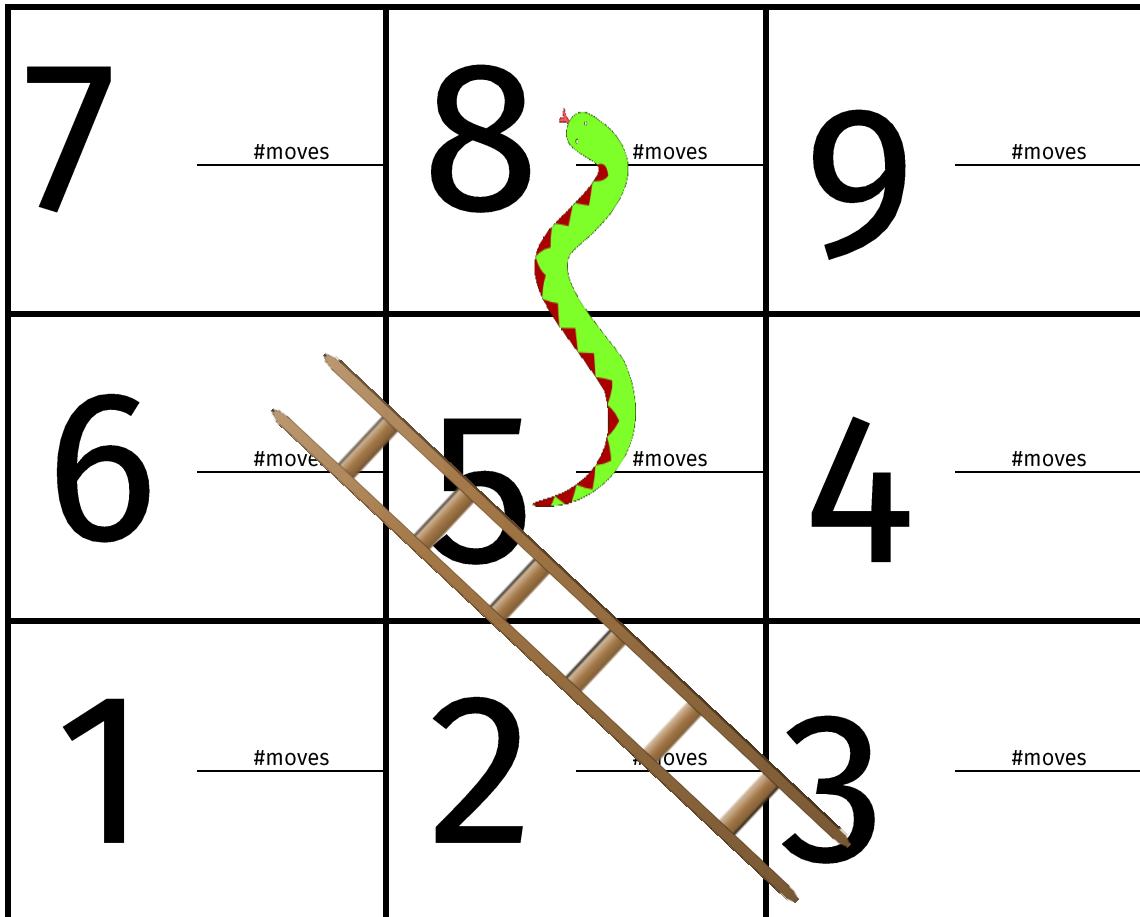
In pseudocode similar to the one used in the Wikipedia representation of the algorithm:

```
procedure SL():
  paint squares 1 to n red
  set previous of squares 1 to n to zero
  while square m is white:
    pick a red square t
    paint t green
    for d = 1 to n do:
      play move t + d and find square u
      if u is white:
        paint u red
        set previous of u to t
```

Algorithm 1: Breadth First Search for Snakes and Ladders

Worksheet Activity: Small Snakes and Ladders Game

To make Snakes and Ladders easier we made a 3x3 board with only one ladder and one snake. You can cut the two circles and attach them to a coin. Flip it and play. The luckier player wins! Each player can write their number of moves for any square.



Now hide the coin!

In every round each player will decide their move (1 or 2) in order to win! You must play smart to win.

Solution

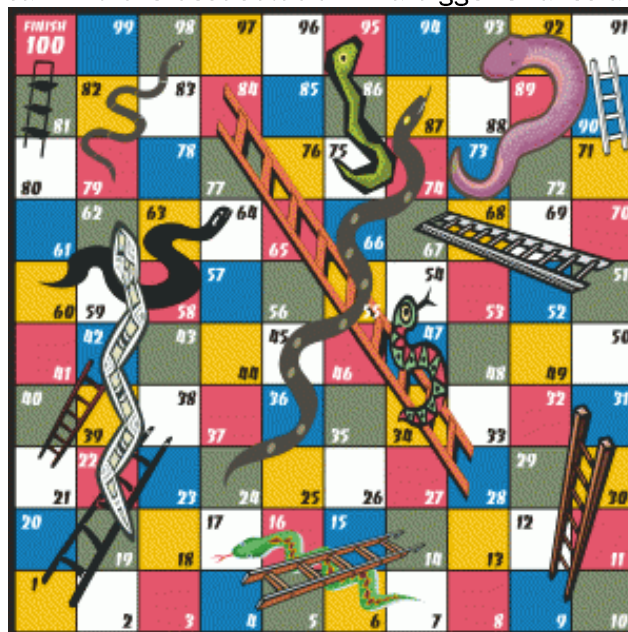
The best game is shown below (squares: (1 or 2), 6, 7, 9)

7	#moves 3	8	#moves	9	#moves 4
6	#moves 2	5	#moves 3	4	#moves 2
1	#moves 1	2	#moves 1	3	#moves

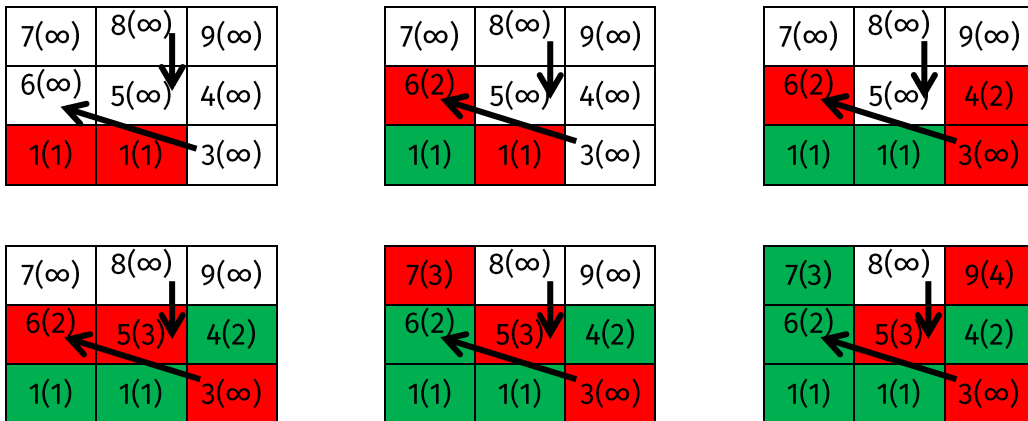
Did you find this solution?

What strategies did you apply to find the solution?

Do you think you can find the best solution in a bigger Snakes and Ladders game?



The steps of algorithm 1, for the Small Snakes and Ladders game.



Reached square 9 in 4 moves.

Images

1. <http://childfriendlynews.com/wp-content/uploads/2013/04/snakes-and-ladders.gif>
2. <http://www.clker.com/clipart-24280.html>
3. <http://www.clker.com/clipart-24279.html>
4. http://www.clipartguide.com/_pages/0808-0711-0913-4711.html

References

1. http://en.wikipedia.org/wiki/Breadth-first_search