

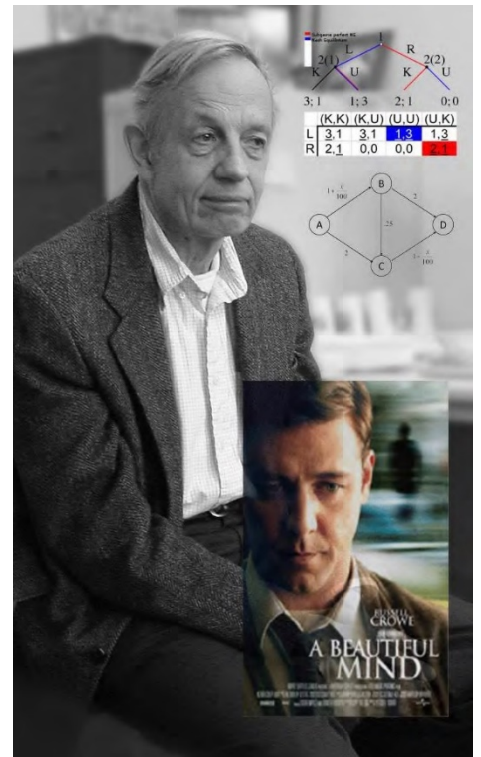
Connection Games

Hex

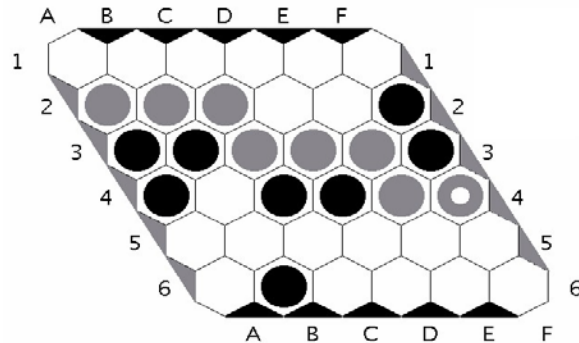
Hex is a board game played on a hexagonal grid, theoretically of any size and several possible shapes, but traditionally as an 11x11 rhombus, as seen above.

Other popular dimensions are 13x13 and 19x19 as a result of the game's relationship to the older game of Go. According to the book *A Beautiful Mind*, John Nash (one of the game's inventors) advocated 14x14 as the optimal size. John Nash won the Nobel prize for economics in 1994.

Each player has an allocated color, Red and Blue being conventional. In this book, we will use Black and Gray instead. Players take turns placing a stone of their color on a single cell within the overall playing board. The goal is to form a connected path of your stones linking the opposing sides of the board marked by your colors, before your opponent connects his or her sides in a similar fashion. The first player to complete his or her connection wins the game.

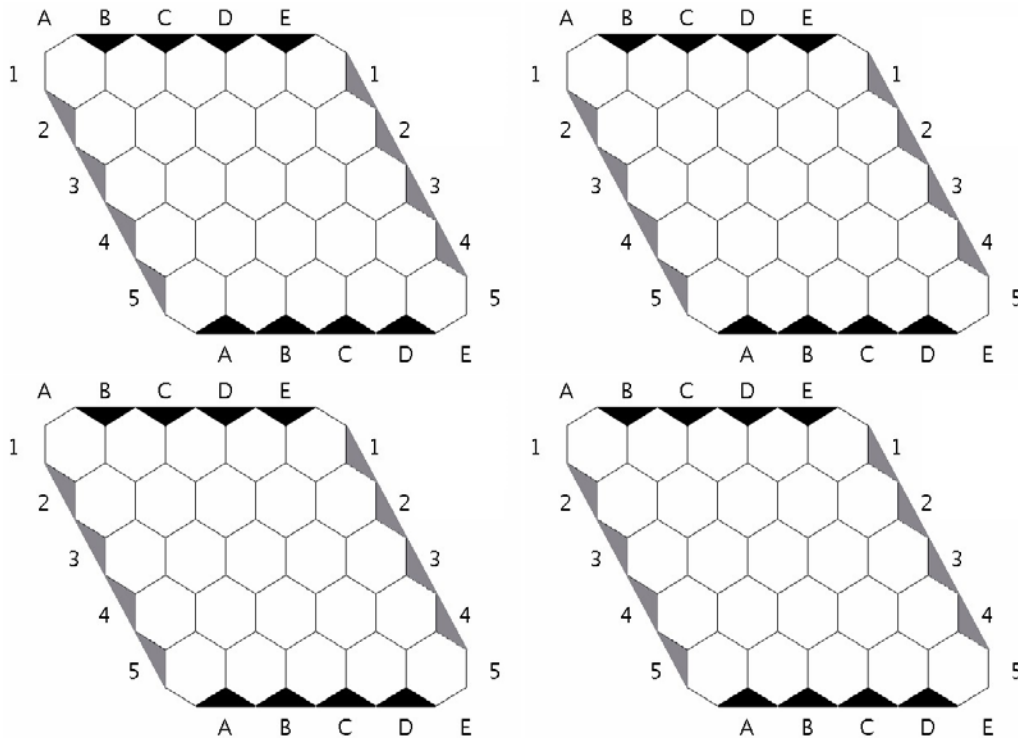


The figure below shows an example of Gray forming a complete path connecting both sides thereby winning the game. The four corner hexagons each belong to two sides. As you place a stone, you don't have to place it adjacent to another of your color. Any open hexagon on the board can be chosen.



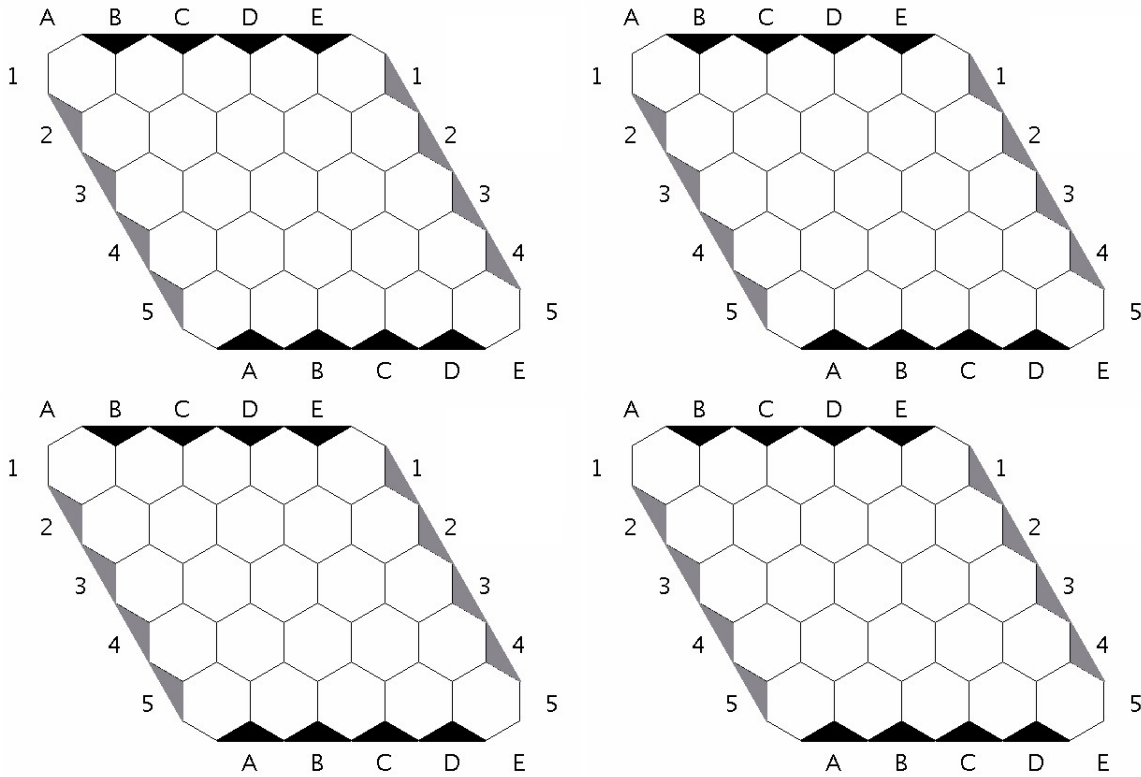
In class, you have opponents to play against. If you want to practice at home or explore strategies on your own, you can find Hex applets online¹ or download an application. For some of these, you can play against a computer or against somebody else on the net.

1. Play the game a certain number of times. Record important stages of your games using the boards below. Write down your strategies.



¹ The most popular sites are boardspace for real-time play, <http://www.ludoteka.com/> for real-time play, <http://games.wtanaka.com/hex/> for real-time or turn-based play, igGameCenter (<http://www.iggamecenter.com/>)

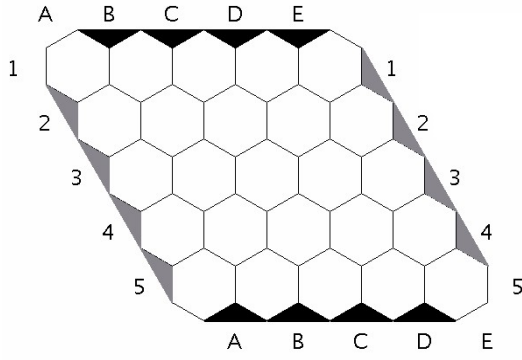
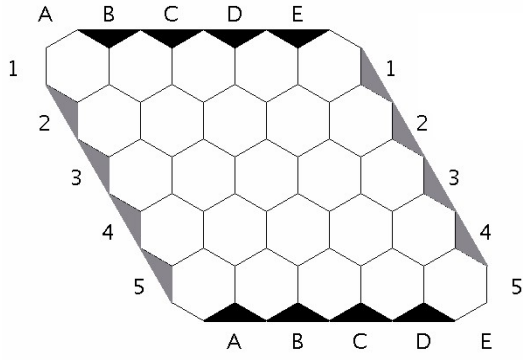
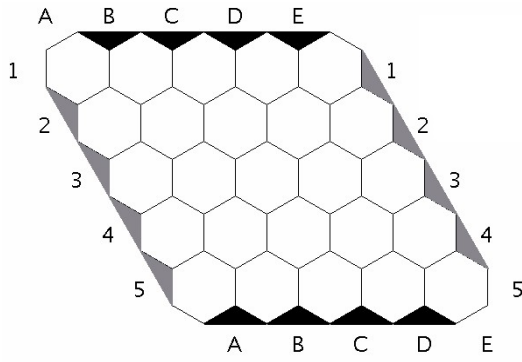
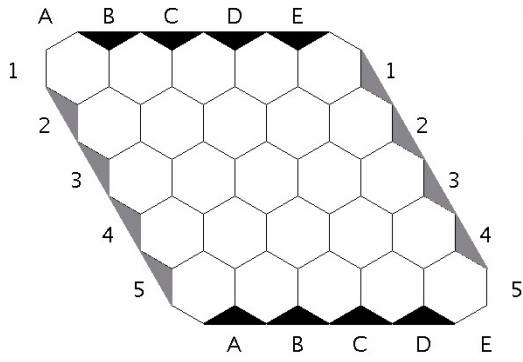
2. Try playing against different people.



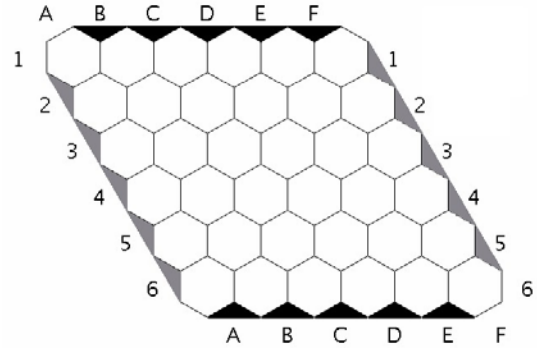
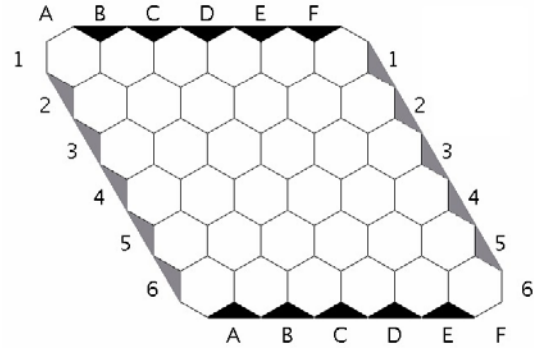
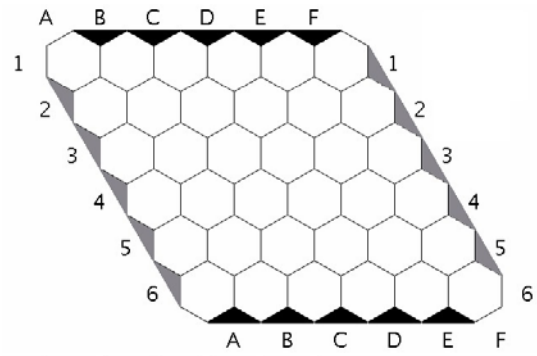
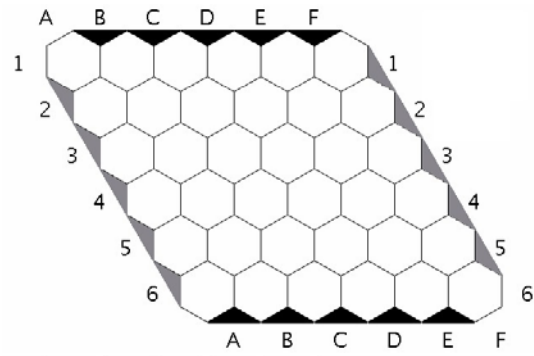
History of Hex

The game was invented by the Danish mathematician Piet Hein, who introduced the game in 1942 at the Niels Bohr Institute, and also independently invented by the mathematician John Nash in 1947 at Princeton University. It became known in Denmark under the name Polygon (though Hein called it CON-TAC-TIX); Nash's fellow players at first called the game Nash. According to Martin Gardner, some of the Princeton University students also referred to the game as John (according to some sources this was because they played the game using the mosaic of the bathroom floor.). However, according to Sylvia Nasar's biography of John Forbes Nash *A Beautiful Mind*, the game was referred to as "Nash" or "John" after its apparent creator. John Nash was said to have thought of this game, independent of Hein's, during his graduate years at Princeton. In 1952 Parker Brothers marketed a version. They called their version "Hex" and the name stuck. Hex is an abstract strategy game that belongs to the general category of "connection" games. Other connection games include Omni, Y and Havannah. All of these games are related to the ancient Asian game of Go; Nash's version of Hex, in particular, was done as a response to Go.

3. Writing Assignment: Research further information about the people mentioned above or about some of the other "connection" games that are mentioned and write a short paper about your findings.



5 × 5 boards

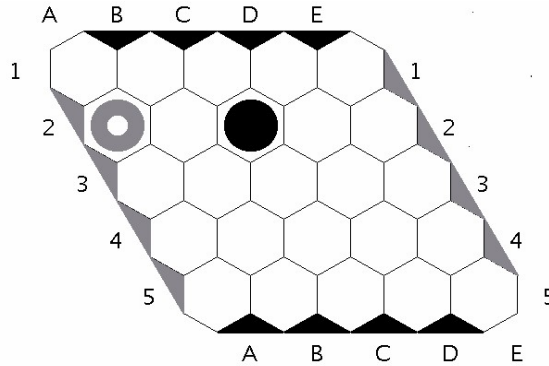


6 × 6 boards

4. Where do you think is the best place for the first stone? Explain.

Examples

Consider the board below. Notice that the gray stone has a white circle inside it, indicating that this was the most recent move on the board. Black's turn to play.



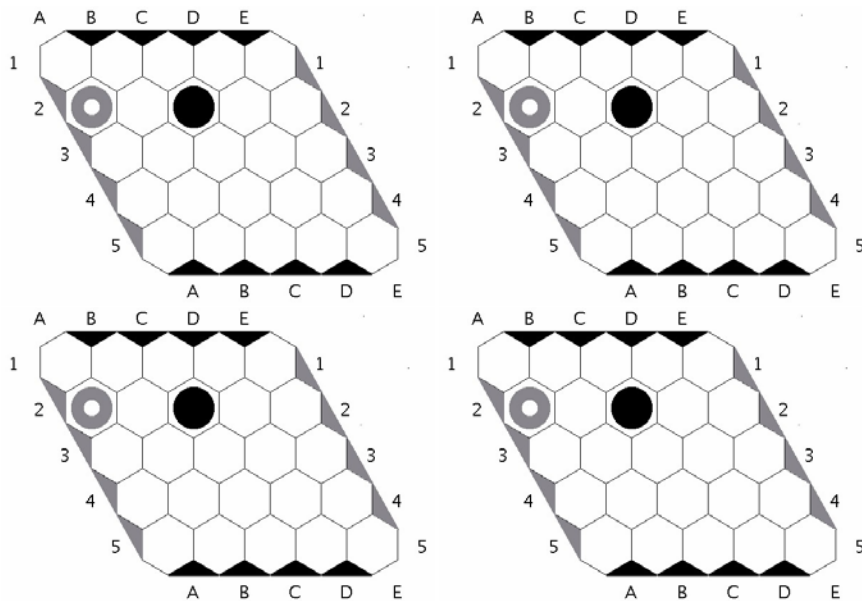
5. Playing for black, where would you place the next stone? Record your moves on the boards below.

6. Playing for gray, how would you counter these moves?

7. Continue the game to see whether your choices were good choices.

8. Working with a partner, take turns to explore different strategies.

9. On your own, write down your detailed observations and strategies.



Now consider the board below. Black's turn to play.

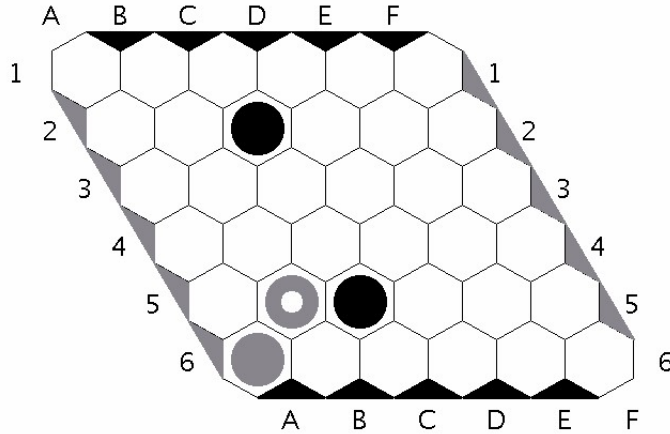
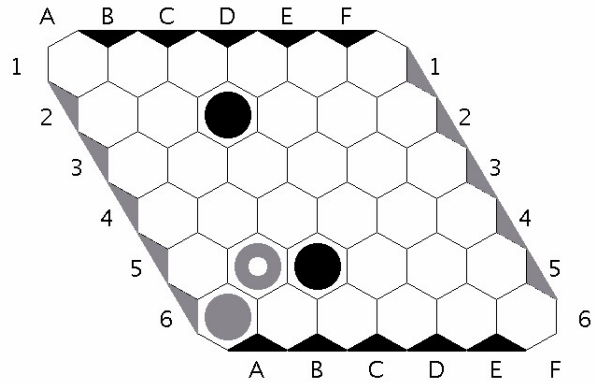
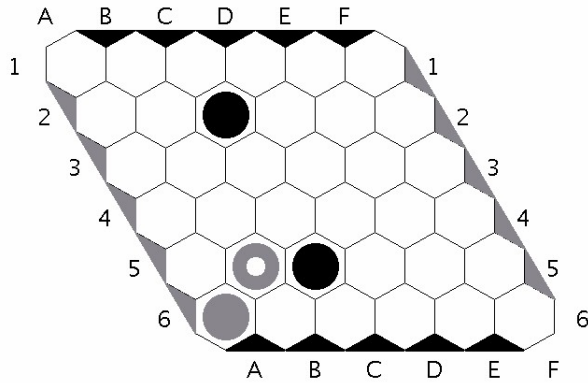
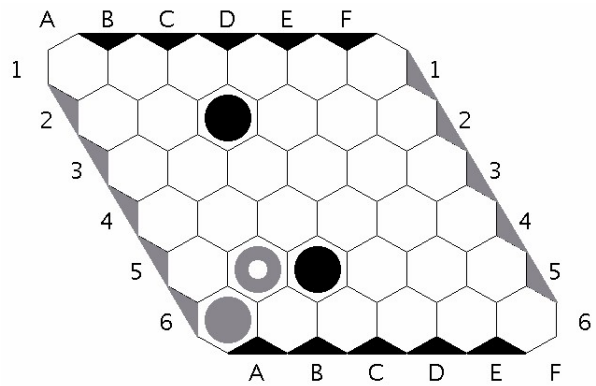
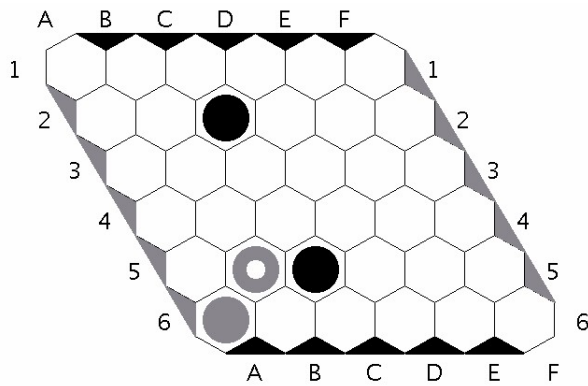


Figure 4.8: Black's turn to play. Which is the best move?

10. Playing for black, where would you place the next stone? Record your moves on the boards below.



11. Playing for gray, how would you counter these moves?

12. Continue the game to see whether your choices were good choices.

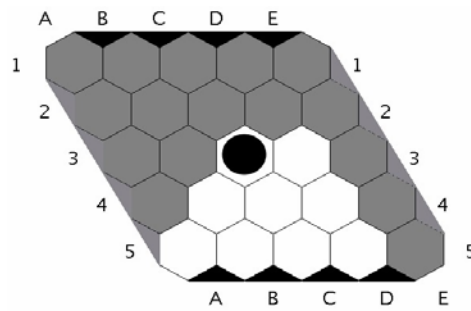
13. Working with a partner, take turns to explore different strategies.

14. On your own, write down your detailed observations and strategies.

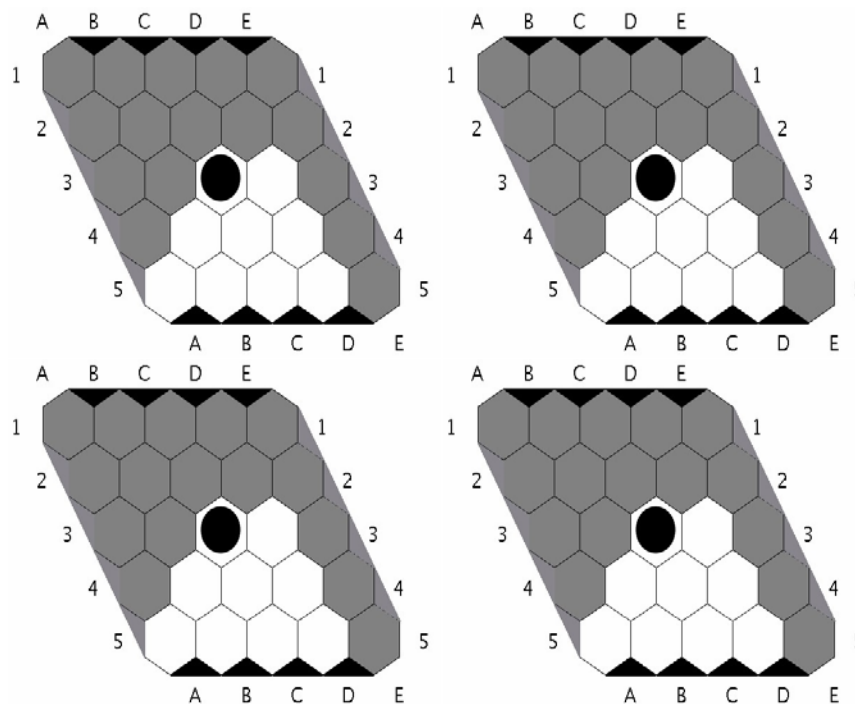
15. Writing Assignment: Find a situation in your life outside of school where you needed to use strategies similar to the strategies used in Hex.

Edge Templates

In order to better understand some strategies underlying Hex, let us consider so-called *Edge Templates*; see below. **Rules:** Stones can now be placed only in the unshaded hexagons. Black's goal is to reach the lower black edge. Gray is trying to block Black from doing so. Gray to go first.



16. With a partner, taking turns, explore the edge template. Use the boards below to record your moves.



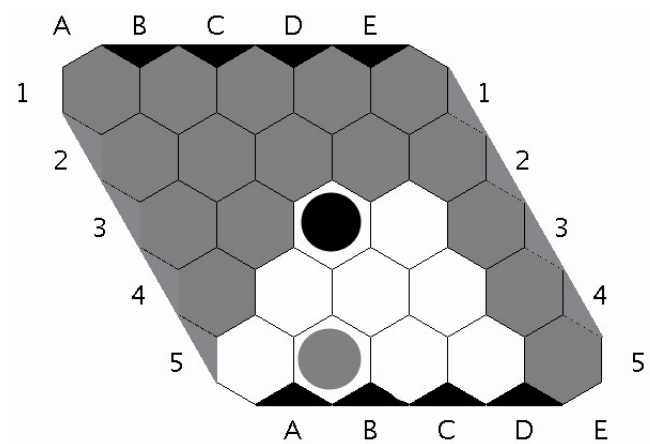
17. What do you notice?

18. Is there a pattern in whether Black or Gray is able to win?

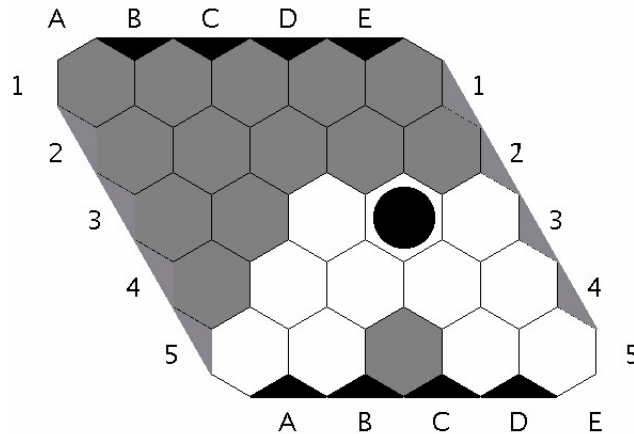
19. If you notice that one of the players always wins, how can you be sure this happens when playing against other people? Explain.

20. Play against your teacher to check your strategy.

21. How about the board in Figure below where Gray has placed a stone to block Black. Playing for Black and using your strategy, how would you respond?



Next consider all the above questions for the Edge Template in the Figure below.

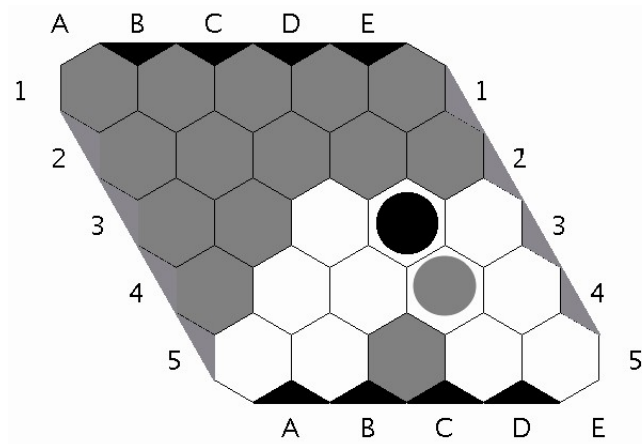


22. With a partner, taking turns, explore the edge template. Use the boards in Figure 4.14 to record your moves.

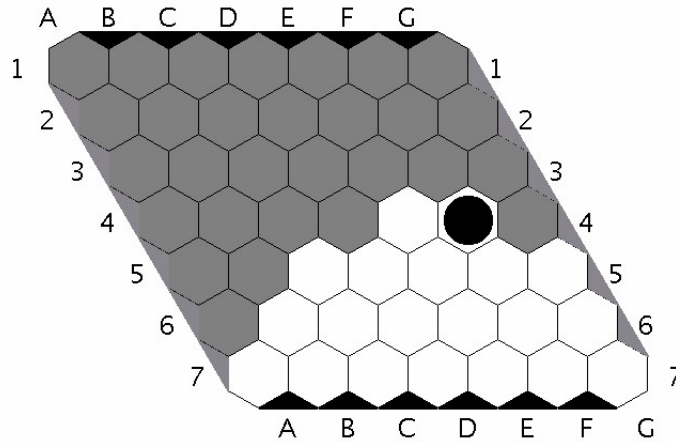
23. What do you notice?

24. Is there a pattern in whether Black or Gray is able to win?

25. How about the board pictured below where Gray has placed a stone to block Black. Playing for Black and using your strategy, how would you respond?



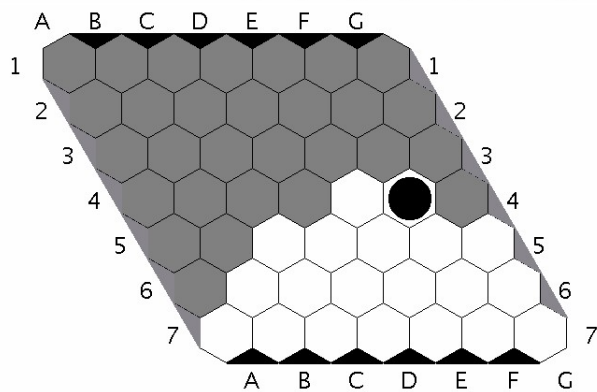
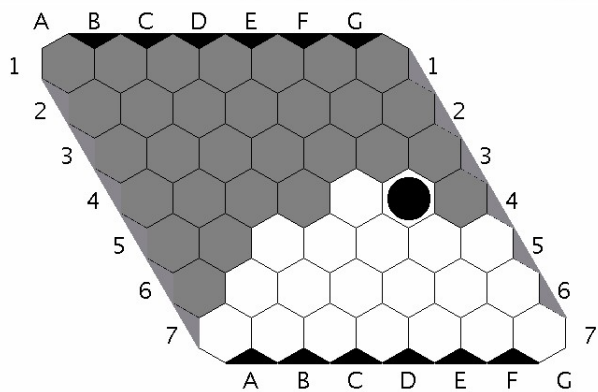
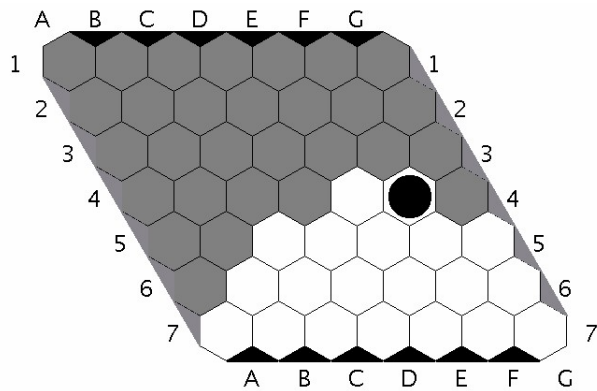
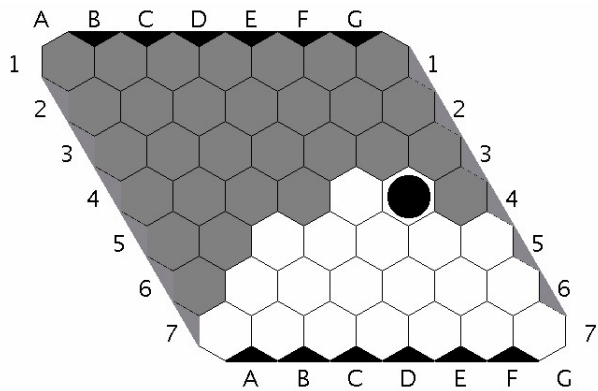
Finally, consider all the above questions for the Edge Template pictured below.



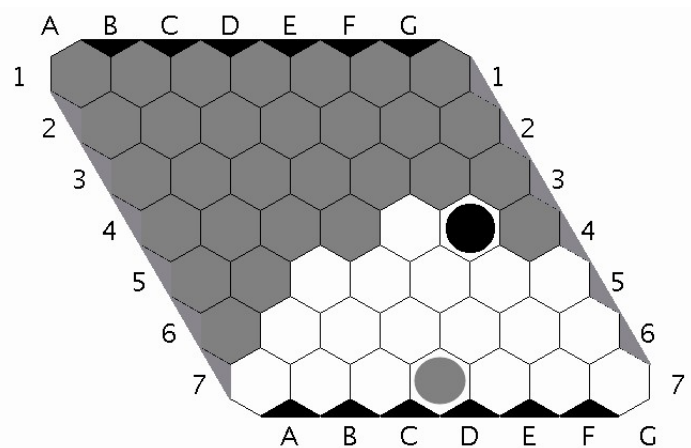
26. With a partner, taking turns, explore the edge template. Use the boards below to record your moves.

27. What do you notice?

28. Is there a pattern in whether Black or Gray is able to win?



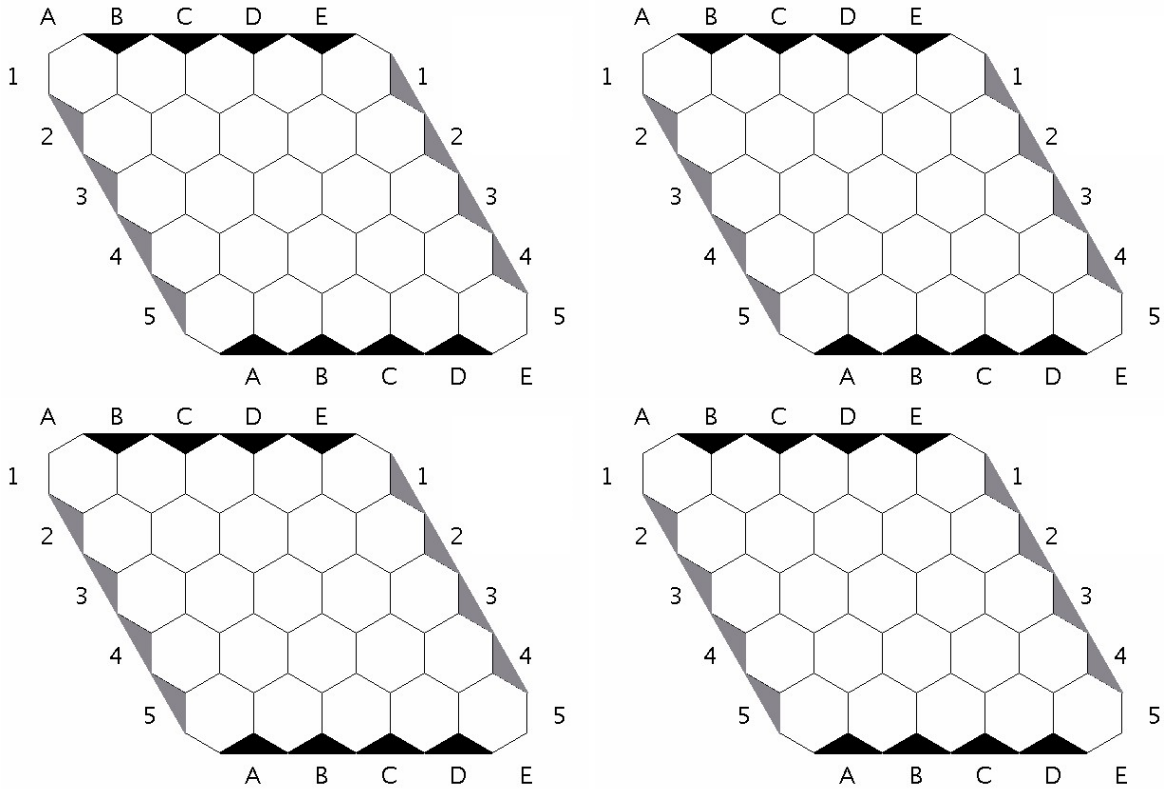
29. Challenge question: How about the board below where Gray has placed a stone to block Black. Playing for Black and using your strategy, how would you respond?



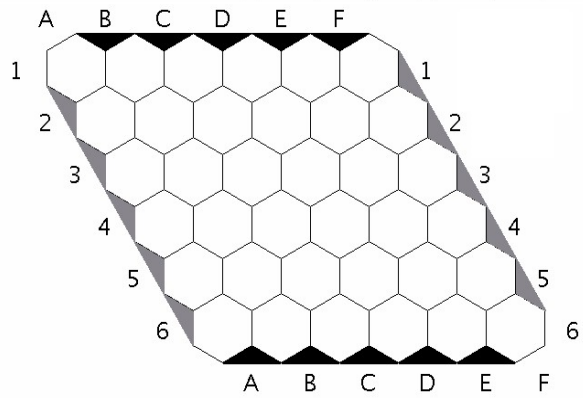
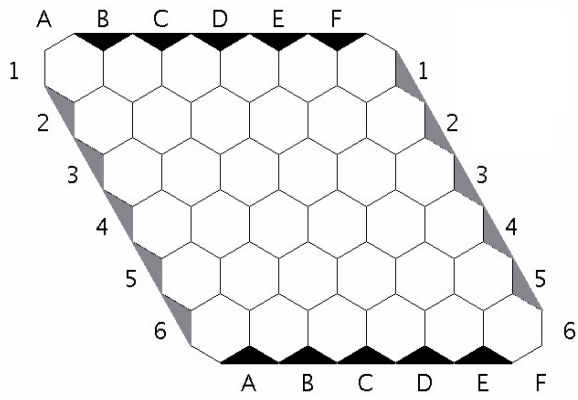
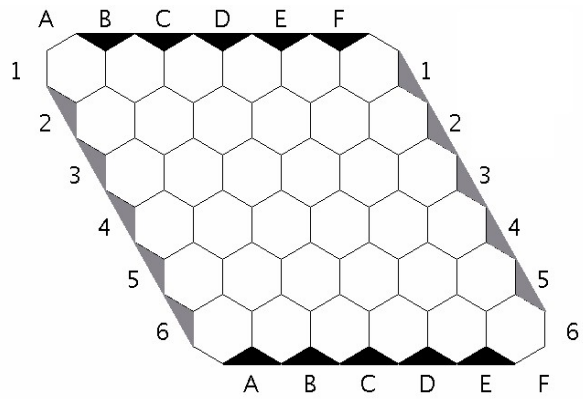
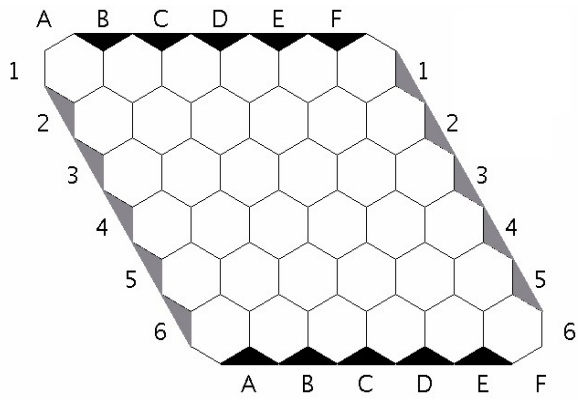
Back to the full board

30. Having worked with Edge Templates, go back to the full 5×5 or 6×6 Hex boards and decide where to place the first stone. Explain.

31. Did you use the idea of edge templates in your thinking? Why, or why not.



5 × 5 boards



6 × 6 boards