

Retrograde Analysis

Prepared by Mark on January 25, 2025
Based on books¹ by Raymond Smullyan

Part 1: Introduction

To solve the problems in this handout, you mustn't be a chess master—you just need to know how the pieces move. I'd expect that you're all familiar with the basic rules of chess (ask questions if you aren't!). The odd ones are listed below.

Board orientation:

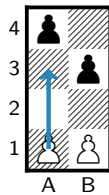
The bottom-left square of a chessboard is *always* black.

Starting pawns & en passant:

A pawn may move two squares on its first turn.

An opposing pawn may capture this pawn as it completes this move.

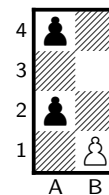
This is called an *en passant* capture (Which means “in passing” in French)



White moves two squares



Black captures en passant



Result

Promotion:

When a pawn reaches the last row of the board, it may be promoted to any other piece. (Except a king or a pawn, of course.)

Castling:

A king and rook can *castle* under the following conditions:

- No pieces are in the way
- The king has not yet moved
- The rook has not yet moved
- The king is not in check
- The king does not move through check while castling



Possible castle directions



Queenside castle result



Kingside castle result

¹ Most of the easy problems in this handout are from *The Chess Mysteries of Sherlock Holmes*. The rest are from *The Chess Mysteries of the Arabian Knights*.

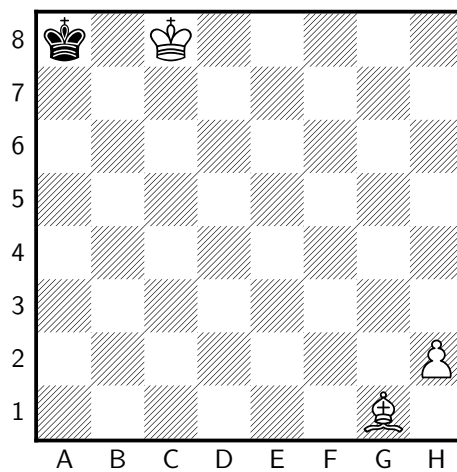
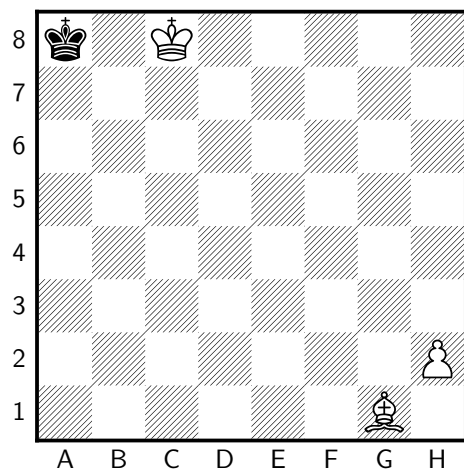
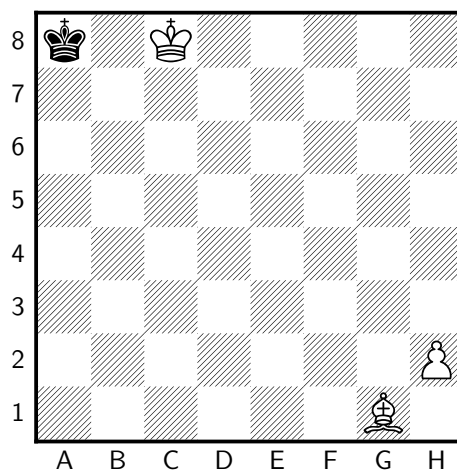
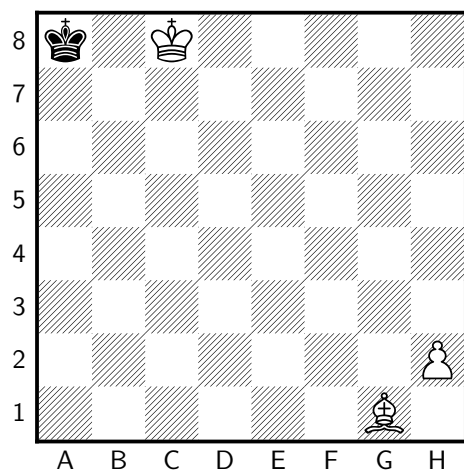
Part 2: Simple problems

Problem 1: A little exercise

Difficulty: ★★★★★

Black has just moved in the game below. White started on the south side of the board. What was Black's last move, and what was White's last move?

Note: The boards below are identical copies. Scribble to your heart's content. There are a few empty boards at the end of this handout as well.

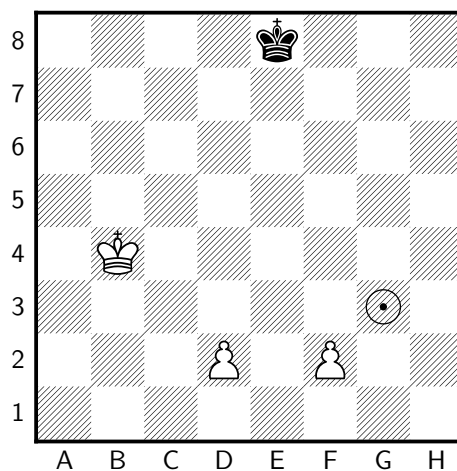
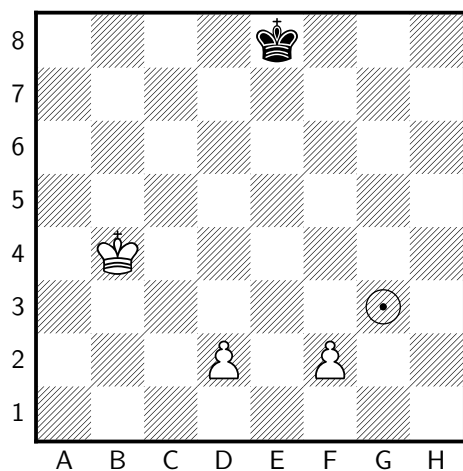
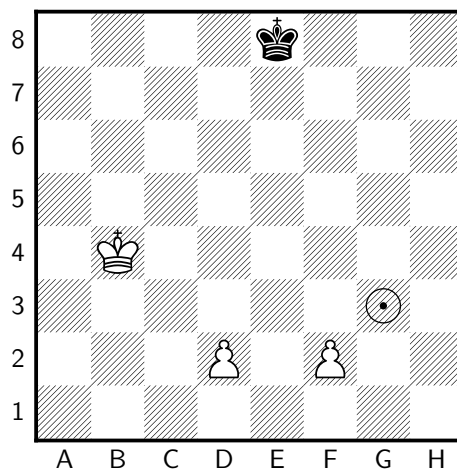


Problem 2: Which color?

Difficulty: ★★☆☆☆

In the game below, no pieces have moved from a black square to a white square, or from a white square to a black square. There is a pawn at G3. What color is it?

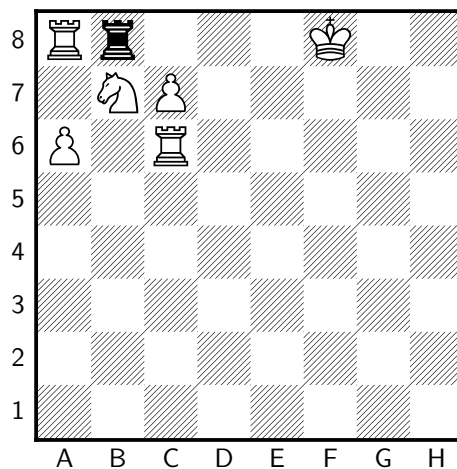
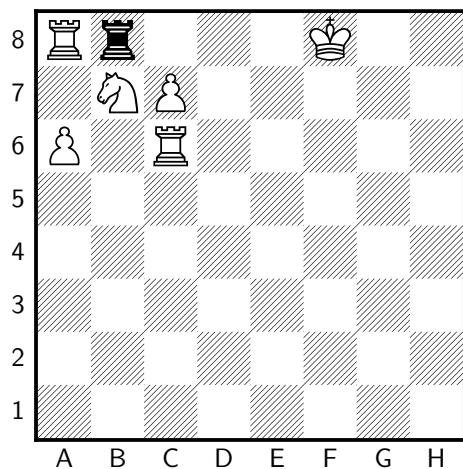
As before, White started on the bottom of the board.



Problem 3: Invisible, but not invincible

Difficulty: ★★☆☆☆

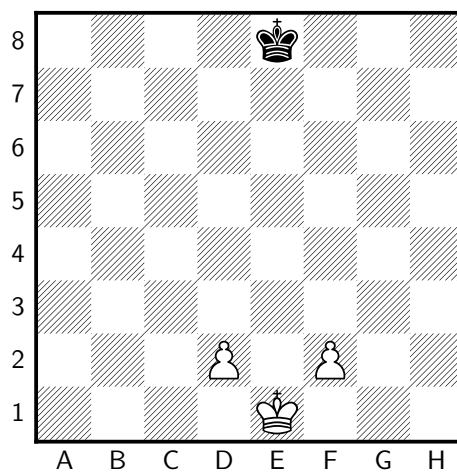
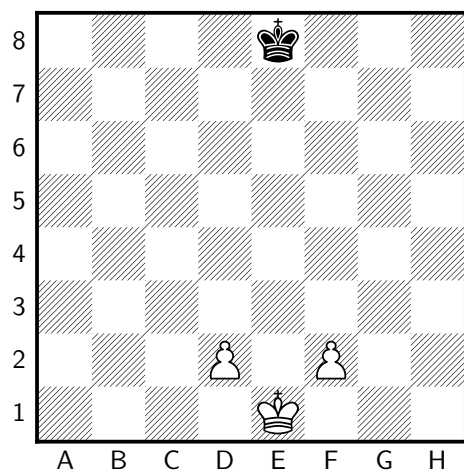
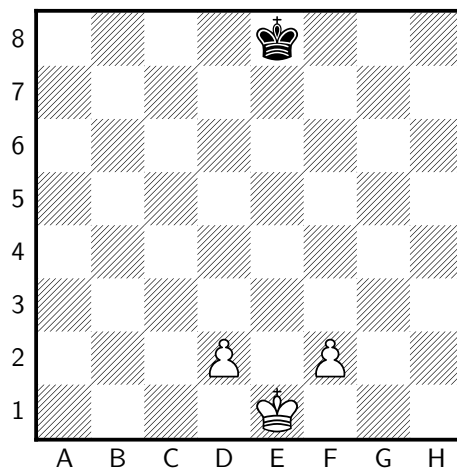
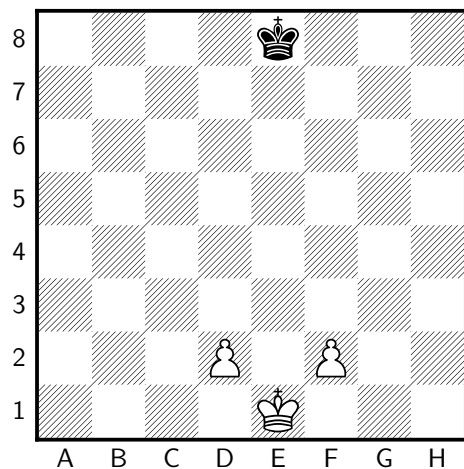
The black king has turned himself invisible. Unfortunately, his position is hopeless.
Mate the king in one move.



Problem 4: An empty board

Difficulty: ★★☆☆☆

In the game below, no pieces have moved from a black square to a white square, or from a white square to a black square. There is one more piece on the board, which isn't shown. What color square does it stand on?

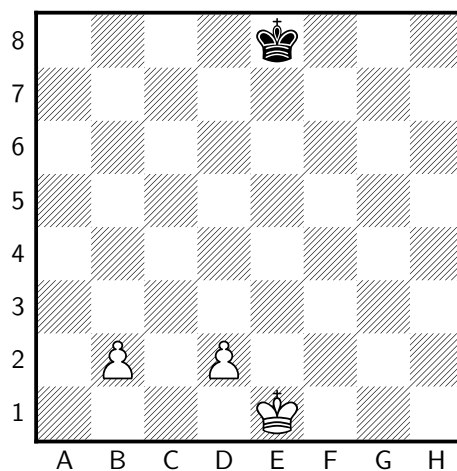
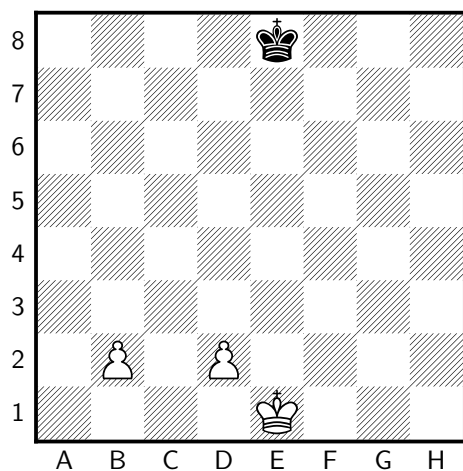
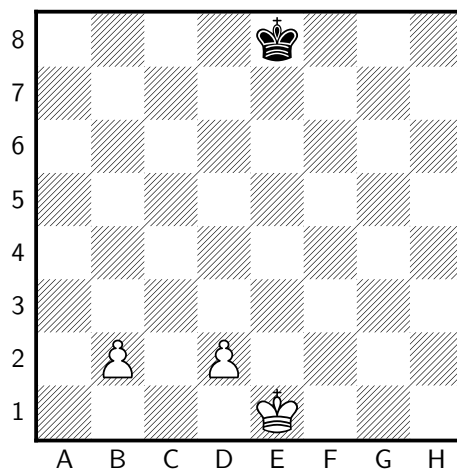
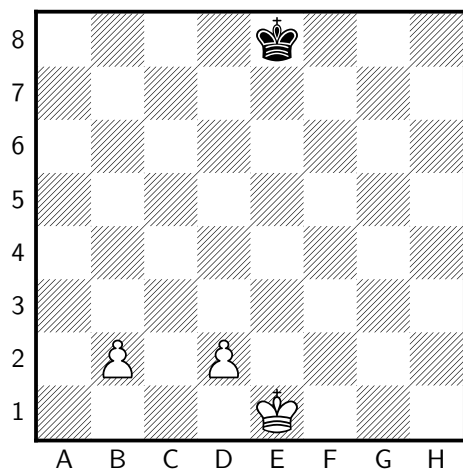


Problem 5: The knight's grave

Difficulty: ★★☆☆☆

In the game below, no pieces have moved from a black square to a white square, or from a white square to a black square. The white king has made less than fourteen moves.

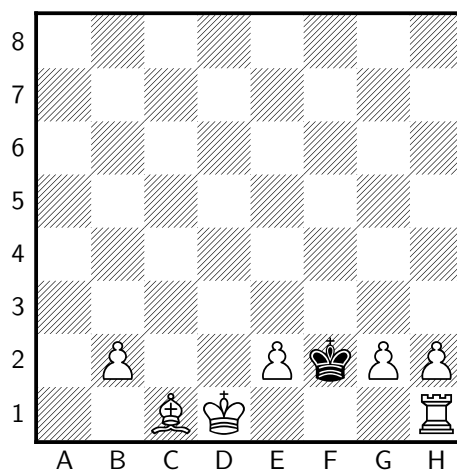
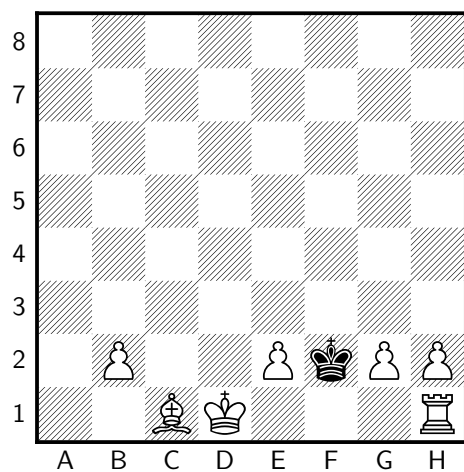
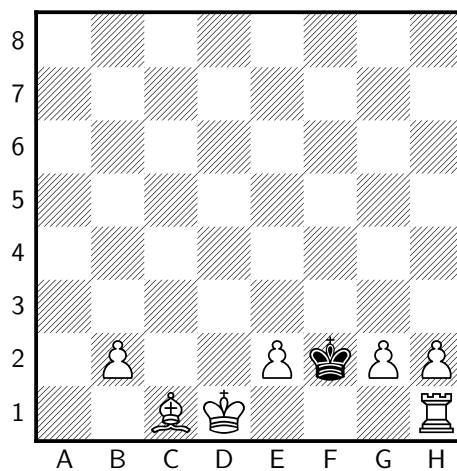
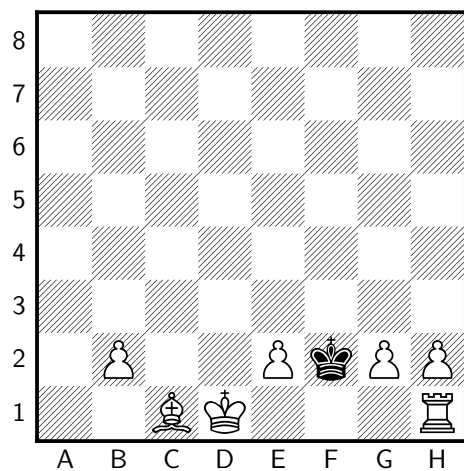
Use this information to show that a pawn was promoted.



Problem 6: Promotion?

Difficulty: ★★☆☆☆

It is White's move. Have there been any promotions this game?

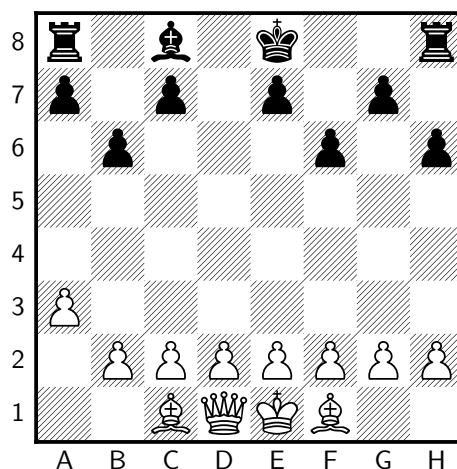
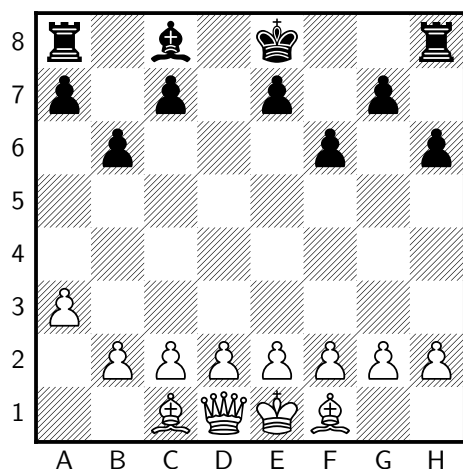
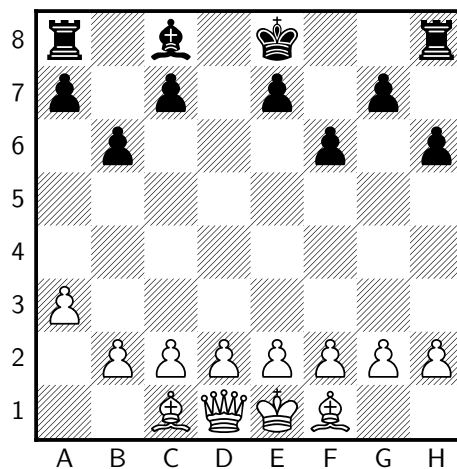
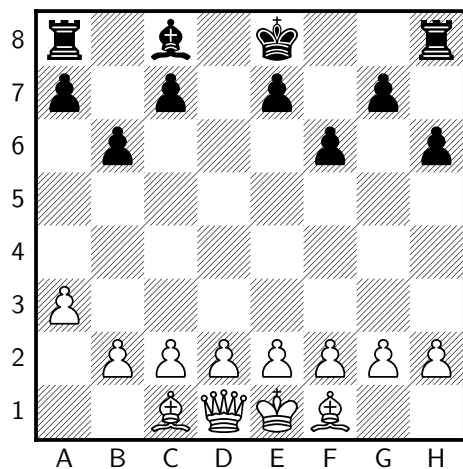


Problem 7: Whodunit

Difficulty: ★★☆☆☆

It is Black's move. Can Black castle?

Hint: Remember the rules of chess: you may not castle if you've moved your rook.



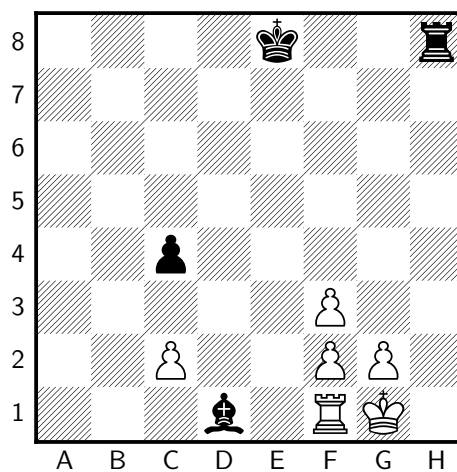
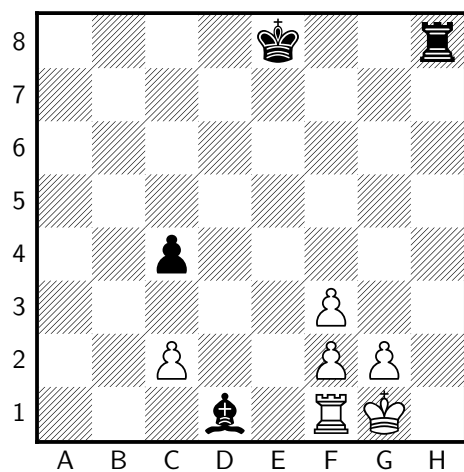
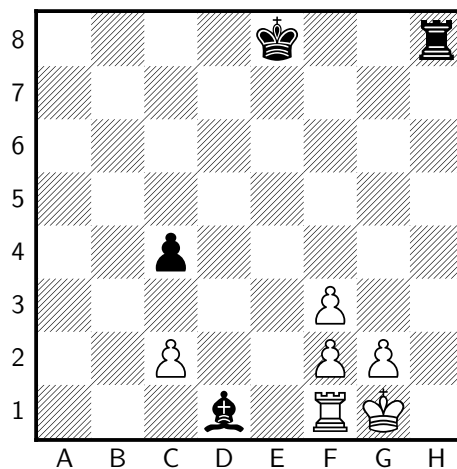
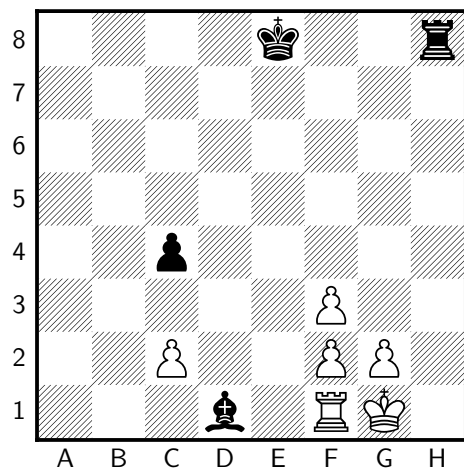
Problem 8: Castle contradiction

Difficulty: ★★☆☆☆

Neither Black nor White captured a piece on their last move.

It is Black's move. Can he castle?

Hint: What was White's last move? Check the cases.

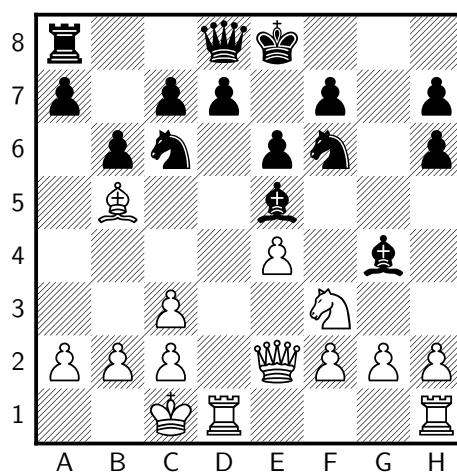
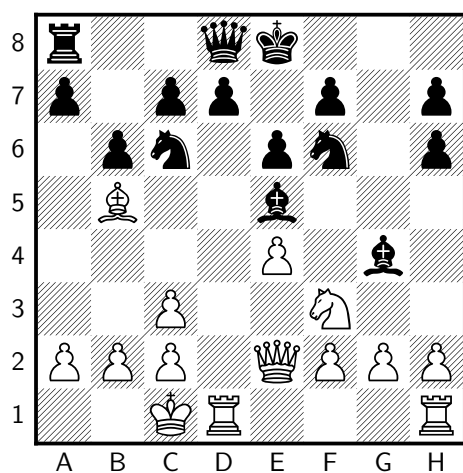
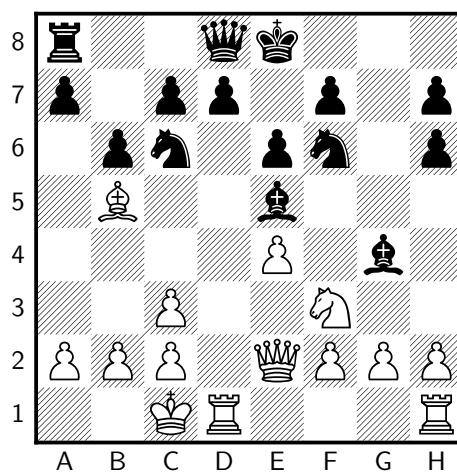
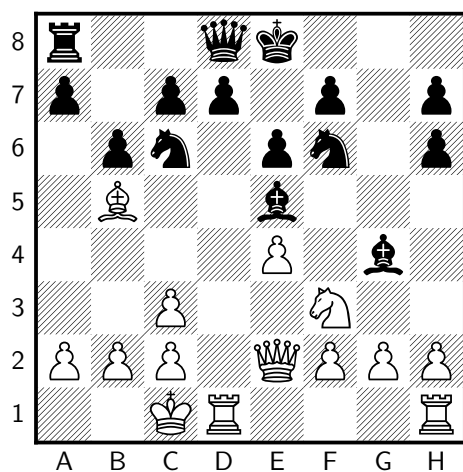


Problem 9: A matter of order

Difficulty: ★★☆☆☆

A black bishop captured a White piece earlier in this game.
Which bishop was it, and what did it capture?

Hint: Black and White start with 16 pieces each.



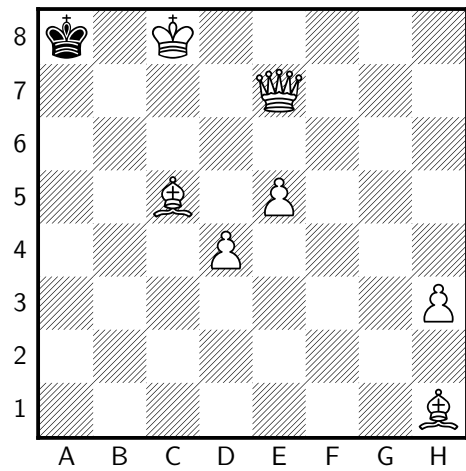
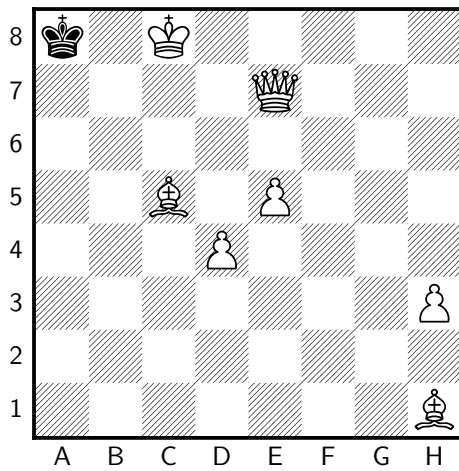
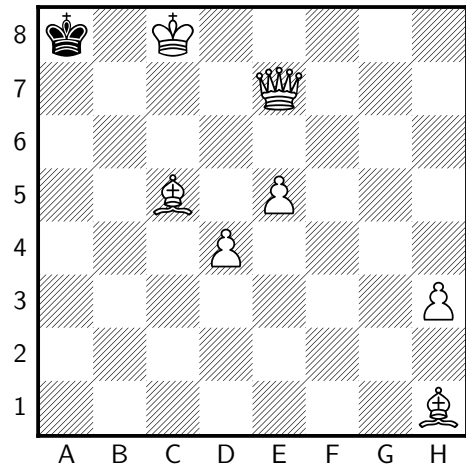
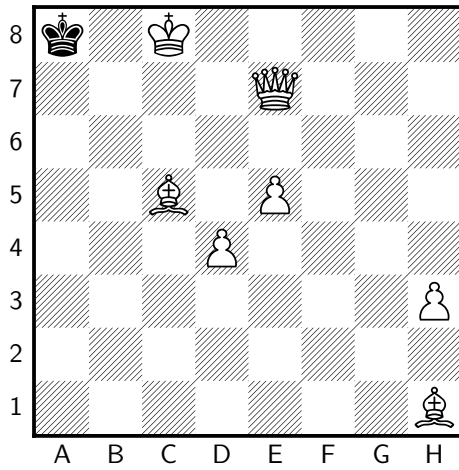
Part 3: Slightly harder problems

Problem 10: A matter of direction

Difficulty: ★★☆☆☆

The results of a game of chess are shown below.

Did White start on the north or south side of the board?

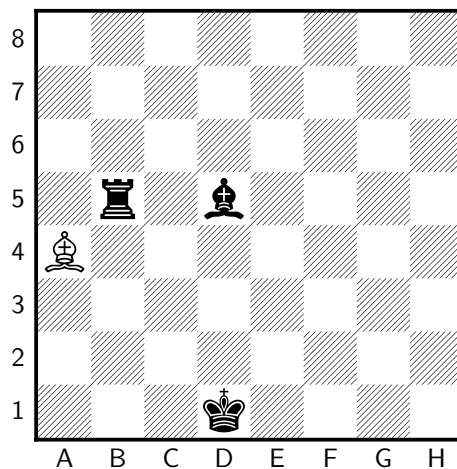
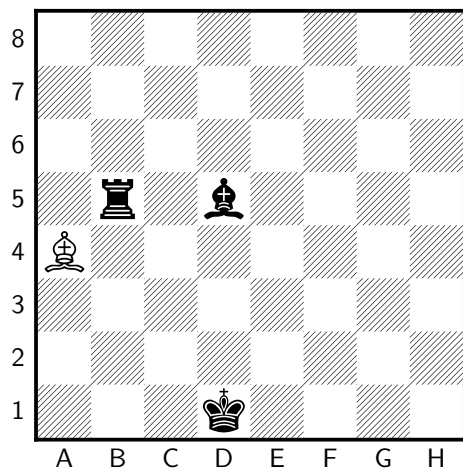
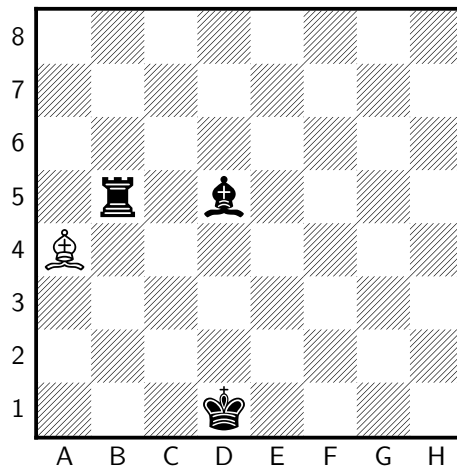
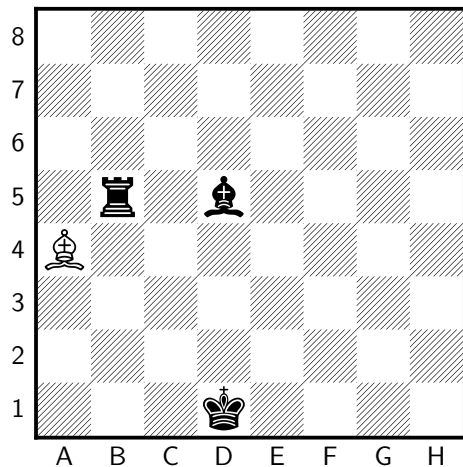


Problem 11: Where is the king?

Difficulty: ★★☆☆☆

The white king has again become invisible. Find him.

Hint: White started on the bottom. En passant.

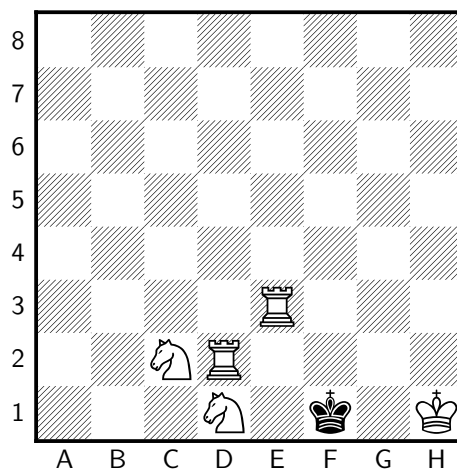
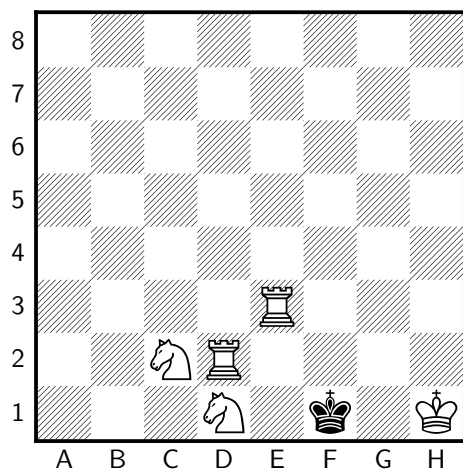
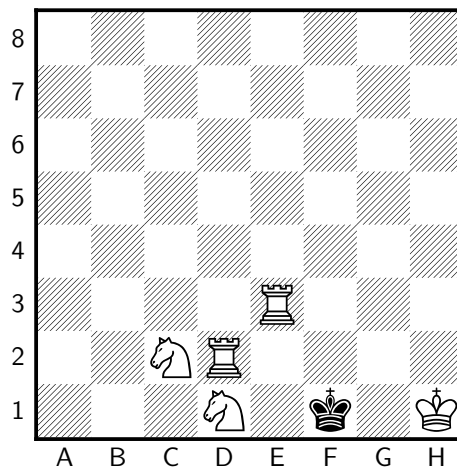
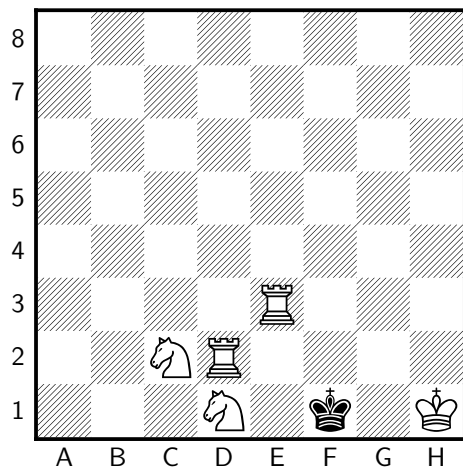


Problem 12: Double-checks

Difficulty: ★★☆☆☆

White to move. Which side of the board did each color start on?

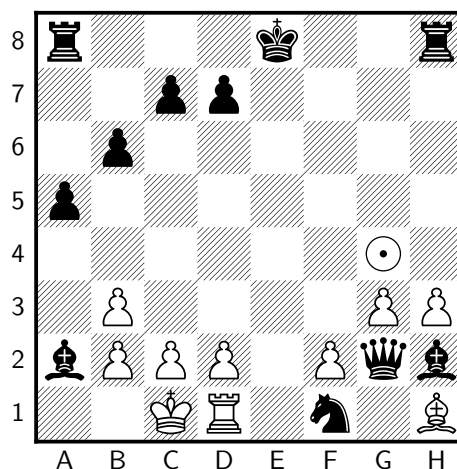
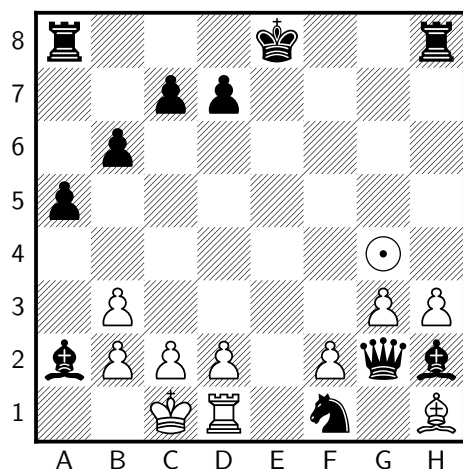
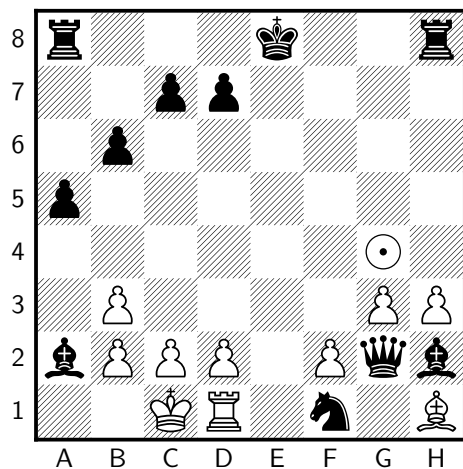
Hint: What was Black's last move?



Problem 13: A missing piece

Difficulty: ★★★★★

There is a piece at G4, marked with a ⊙.
What is it, and what is its color?

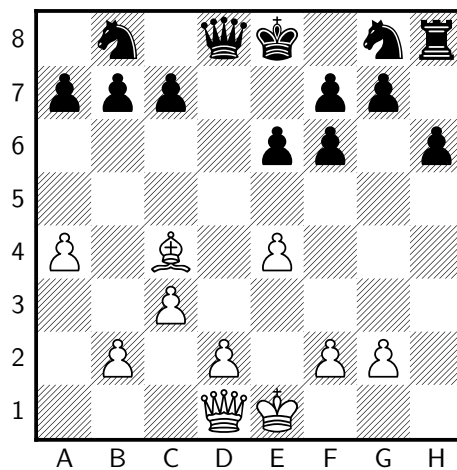
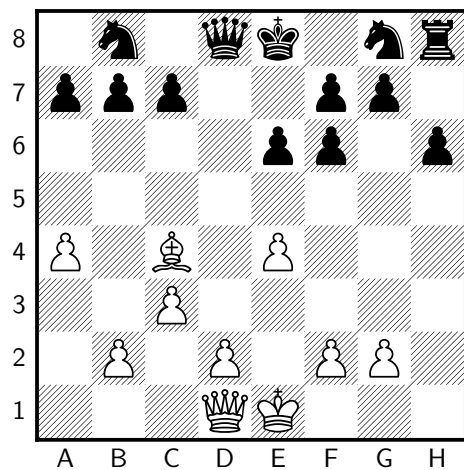
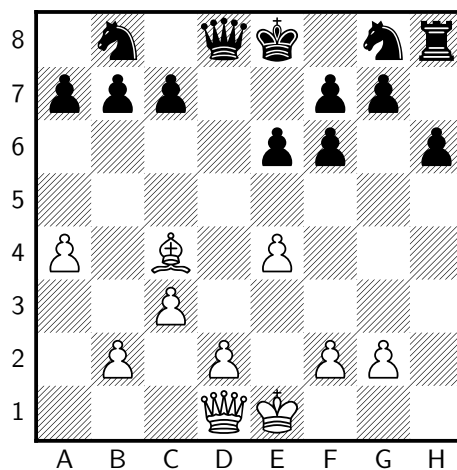
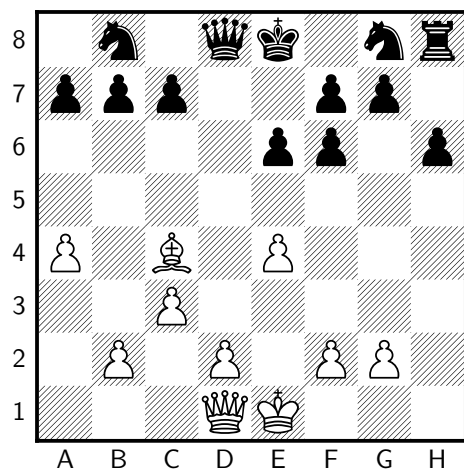


Part 4: Very difficult problems

Problem 14: The hidden castle

Difficulty: ★★★★★★★

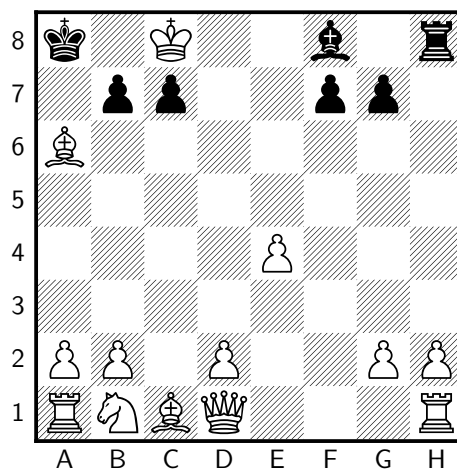
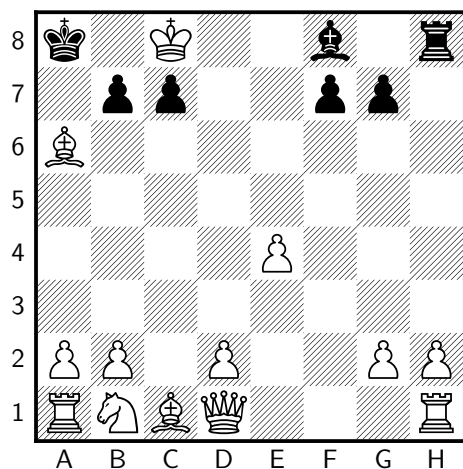
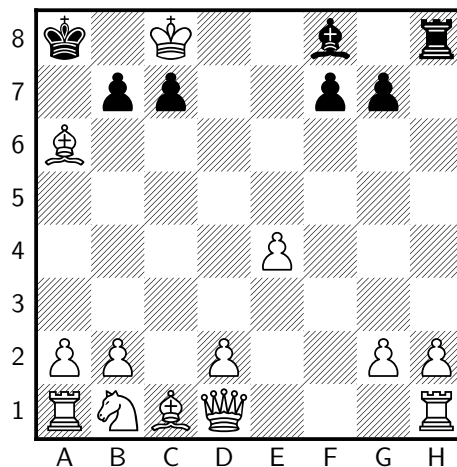
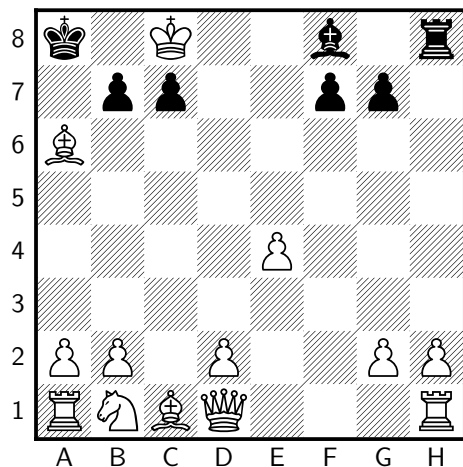
There is a white castle hidden on this board. Where is it?
None of the royalty has moved or been under attack.



Problem 15: Who moved last?

Difficulty: ★★★★★★

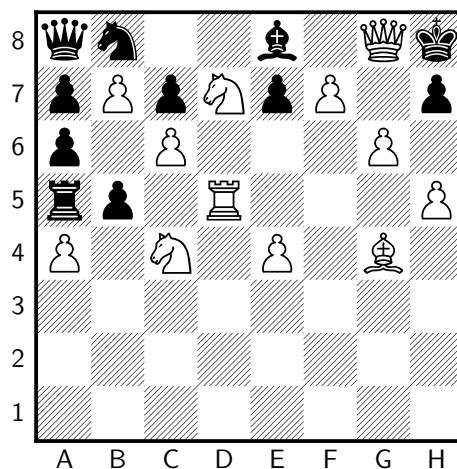
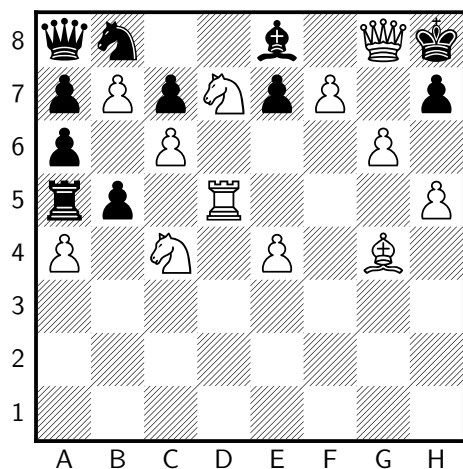
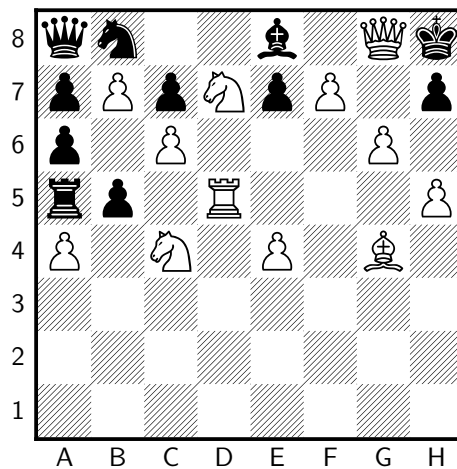
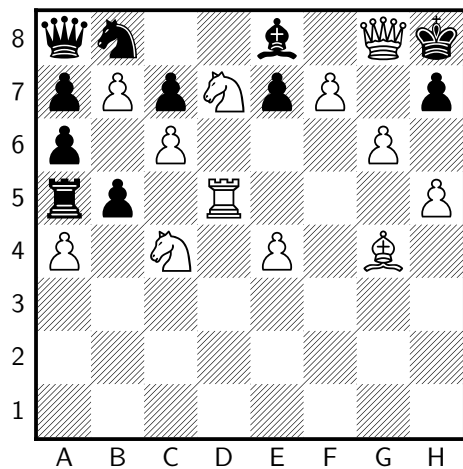
After many moves of chess, the board looks as follows.
Who moved last?



Problem 16: The king in disguise

Difficulty: ★★★★★★

The white king is exploring his kingdom under a disguise. He could look like any piece of any color. Show that he must be on C7.



Problem 17: The king in disguise once more

Difficulty: ★★★★★★

The white king is again exploring his kingdom, now under a different disguise. Where is he?

Hint: “different disguise” implies that the white king looks like a different piece!

