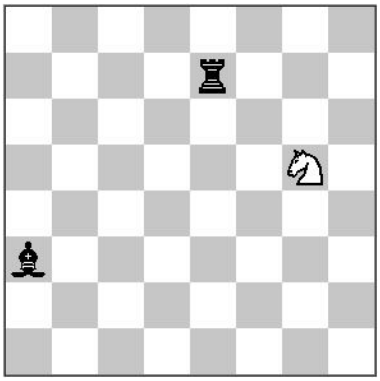
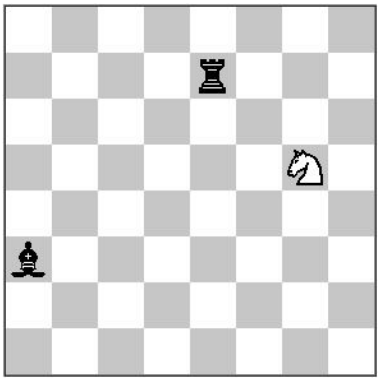
Warning: this homework requires you to know how chess pieces move. If you need a refresher, there are many tutorials online.

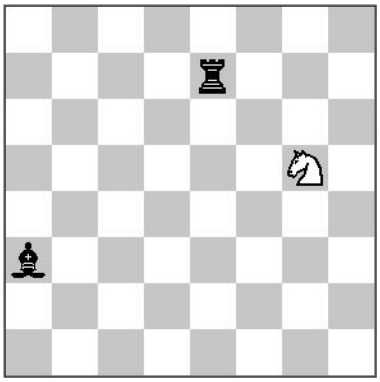
Problem 1. *Show where each figure can move, if this is a normal chess board. Can the bishop or rook take the knight?*



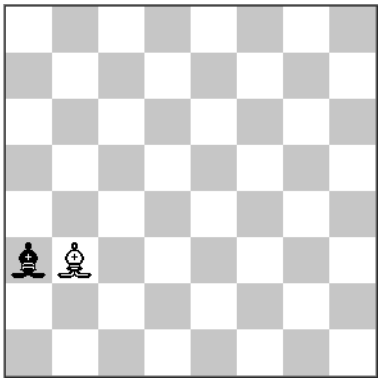
Problem 2. *Suppose now that we glue together the top and bottom sides of the chessboard (like we did with the paper in class). Show where each piece can move. Can the bishop or rook take the knight?*



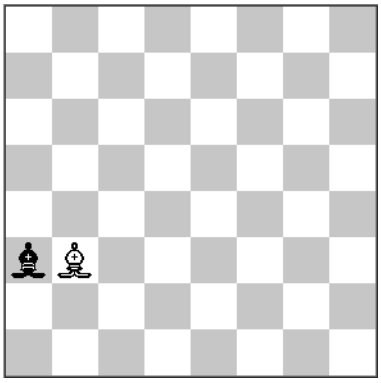
Problem 3. *Suppose now that we glue the top to the bottom, and the left to the right (making a donut shape). Show where each piece can move. Can the bishop or rook take the knight?*



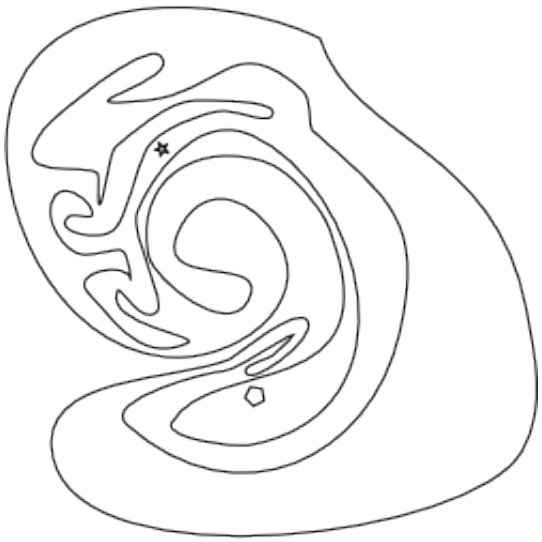
Problem 4. *Suppose I glue the left and right sides of the chessboard with a twist, so that the bottom left corner is glued to the* top *right corner. What points can the black bishop get to? Does the black bishop stay on the black tiles?*



Problem 5. *Suppose we glue the chessboard as in Problem 4, and also along the top (in the normal way). Can either bishop hit the other?*



Problem 6.

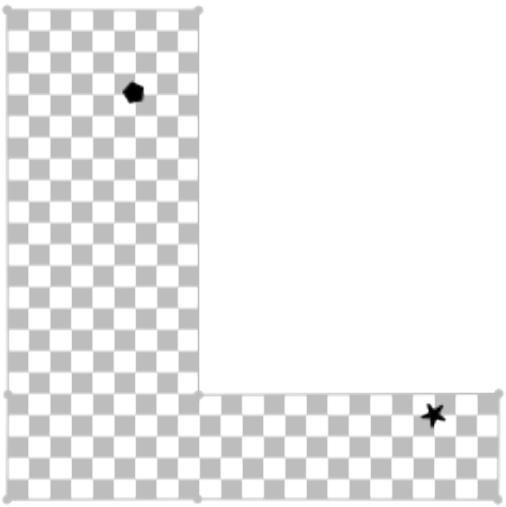


(a) Is the star inside or outside the loop? Why?

(b) Is the pentagon inside or outside the loop? Why?

(c) After answering the first two parts, shade in the inside of the squiggle to check your answer.

Problem 7. *Suppose we glue together the parallel sides of the L (imagine folding the two long parts) to create a surface:*



(a) How many vertices, edges, and faces do we start with (in the picture above)?

(b) How many vertices, edges, and faces to we end up with (after gluing)?

(c) What is the Euler characteristic (from Friday's lecture) of the resulting surface?

(d) Find the genus of the surface and use it to draw the surface.

(e) In the original picture, find two different geodesics between the star and the pentagon. Can you find two that don't intersect?