

THE PUZZLING SIDE OF CHESS

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LOOPOLOGY V

Two Piece Single Loops

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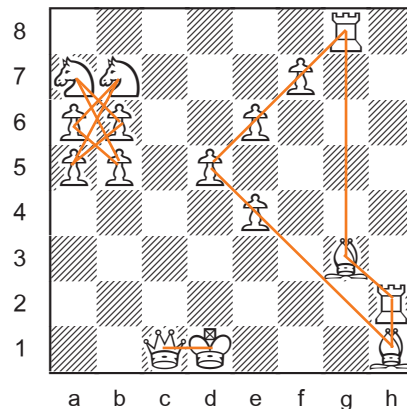
Loopology shifts gears this week. After a brief flashback to the origin of *defensive loops*, we switch topics from the double loops of the previous columns to the single loops ahead.

As far as I know, the first defensive loop to be published was in *Winning Chess Puzzles For Kids Volume 2* (2010). Though it would not be surprising if an earlier example is found.

The idea came from a problem in *Mathematical Diversions* (1963) by James Hunter and Joseph Madachy. The stipulation was to “arrange the sixteen pieces so that each one was defended exactly once”. There was no requirement for making a continuous chain. This was their solution:

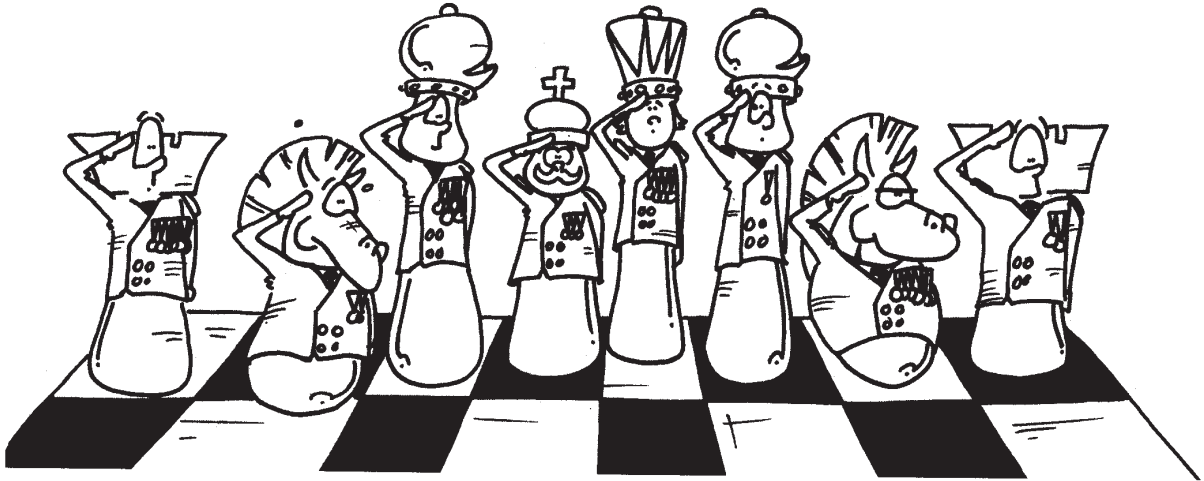
There are three separate groups of defence. The king and queen guard each other. The knights and pawns on the queenside form one loop and the remaining eight pieces another.

My contribution to this defensive task was making it mandatory to have a single continuous loop. From 2010:

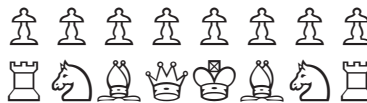
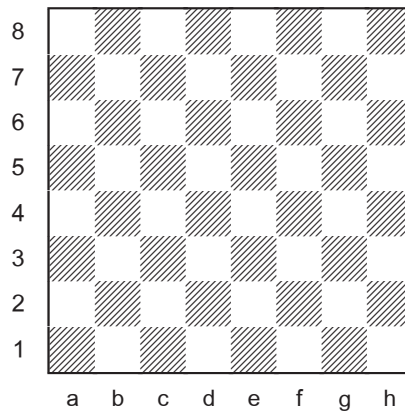


For an extra challenge, make a “loop of defence” where piece #1 guards #2, piece #2 guards #3, ..., and piece #16 guards #1.

So began loopology. The development of this problem-type over the last eight years owes a great deal to the expertise of Adrian Storisteanu (Toronto) and François Labelle (Montreal), who each wrote computer programs to solve defensive loops and determine optimal solutions.

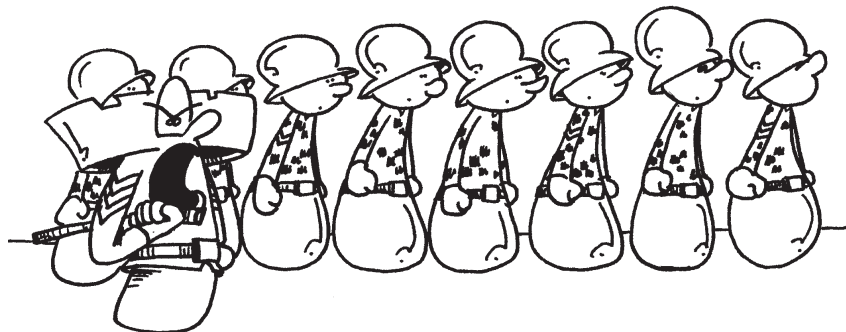


Full Set Loop



Place the sixteen white pieces so that each piece is defended exactly once and each piece defends exactly one other. Pawns may not be placed on the 1st rank. Bishops must be placed on opposite-colour squares.

The defensive chain must form a continuous *loop*. The first piece guards the second piece; the second guards the third; ...; and the sixteenth guards the first.



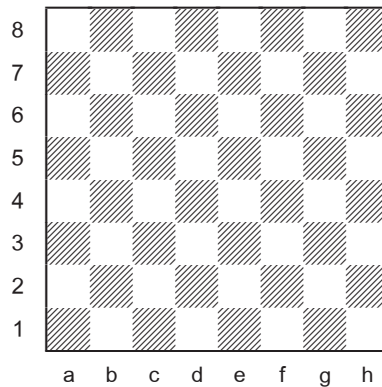
The rest of this column is about two-piece *single loops*. In a single loop, each piece is guarded once and each piece guards one other. Unlike a double loop, the chain of defence only goes in one direction.

Of the 15 possible piece groups, these six are unable to form a single loop: KQ, KP, QB, QR, QP, BP. Reciprocal protection is inevitable. The simple case Ke1-Qd1 with no other pieces on the board is not a loop. Each piece is guarded once and guards one other, but there is no sense of looping. Two points form a line. A loop requires at least three.

Six of the loopable pairs have appeared previously on the *Puzzling Side of Chess*. RN (column 86), RB (142), QN (143), KR KB KN (151).

That leaves three new single-loop pairs to present here: BN, RP, NP.

Single BN Loop



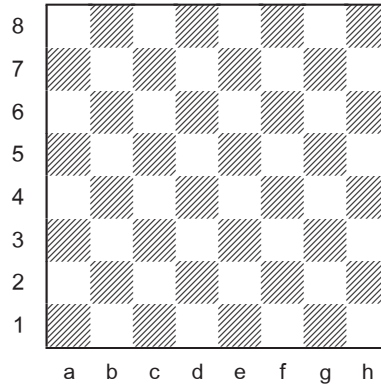
Place an equal number of bishops and knights on the board so that every piece is defended exactly once and every piece defends exactly one other. The chain of defence must form a continuous loop.

- a. 8 bishops and 8 knights
- b. 10 bishops and 10 knights



Taking care of business.

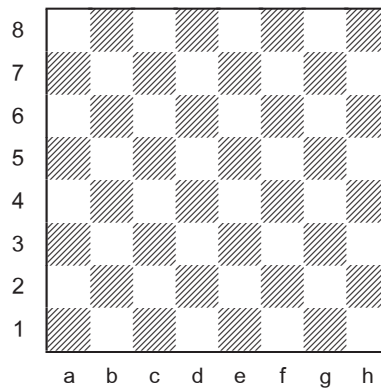
Single RP Loop



Place five rooks and five pawns on the board so that every piece is defended exactly once and every piece defends exactly one other. The chain of defence must form a continuous loop. Pawns may not be placed on the 1st rank.

A table showing the maximum piece count for two-piece single loops is given at the end of the solutions.

Single NP Loop



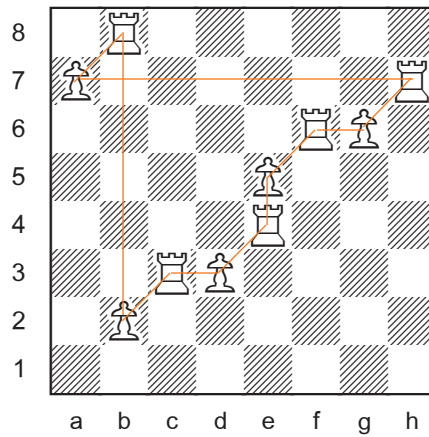
Place four knights and four pawns on the board so that every piece is defended exactly once and every piece defends exactly one other. The chain of defence must form a continuous loop. Pawns may not be placed on the 1st rank.

Stay tuned for Loopology VI. For any solvers looking for a head start, the topic will be pawnless three-piece single loops.

Single RP Loop

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Puzzling Side of Chess



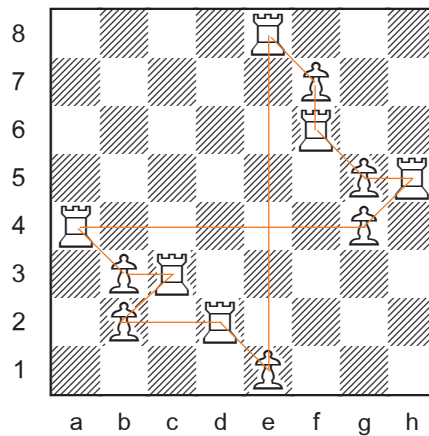
5 rooks, 5 pawns
each defended once in a continuous chain

There are 548 solutions, none symmetrical.

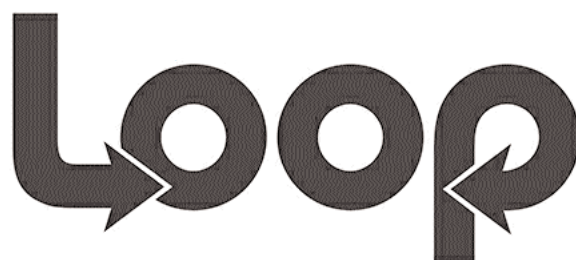
If pawns are miraculously allowed on the 1st rank, a loop with six pairs of rooks and pawns is possible.

François Labelle 2018

Puzzling Side of Chess



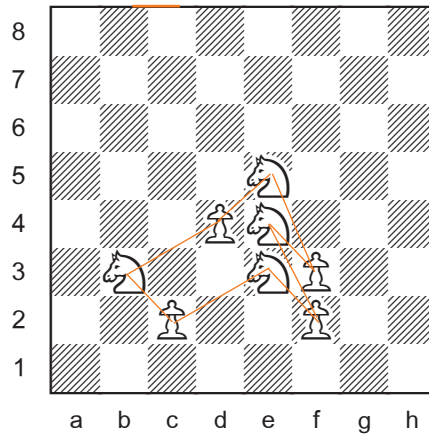
Can a pawn on the 1st rank advance two squares?!



Single NP Loop

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Puzzling Side of Chess

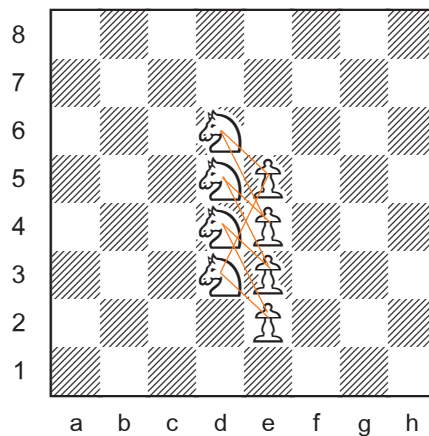


4 knights, 4 pawns
each defended once in a continuous chain

There are 163 solutions, none symmetrical. François found the following compact pattern which would neatly fit on a 2 x 5 board.

François Labelle 2018

Puzzling Side of Chess



Four pairs of knights and pawns is the maximum for a loop on boards of any size.

Three pair is impossible. Knights always move to a square of the opposite colour, so there must be an even number of each piece.



Maximum Pieces in Single Loop

Equal Number of Each Piece

BN	20
KB	20
KN	20
RN	16
RB	14
QN	12
KR	12
RP	10
NP	8

Until next time!

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