



# THE PUZZLING SIDE OF CHESS

Jeff Coakley

## LOOPOLOGY III

### Three Piece Double Loops

number 158

July 7, 2018

Here we go again. Another round of defensive loops. This time we present *three-piece double loops*. Each of the five problems has a different trio of pieces: QRB, KQR, KQB, KRB, KBP.

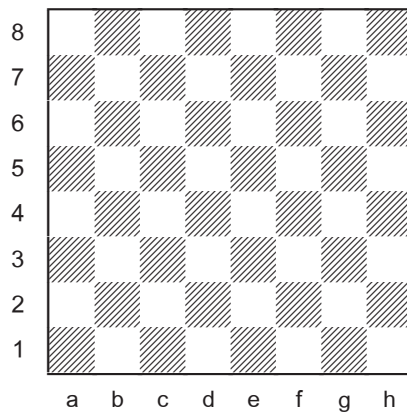
Because of their unique movement, knights can never be part of a multi-piece double loop. Reciprocal protection is impossible.

Double loops involving pawns are possible, but not with all piece groups. In fact, the only trio of pieces that includes pawns which can form a double loop with an equal number of each piece is KBP. Other groups are impossible (KQP, KRP, QRP, QBP, RBP).



"Is anyone else getting dizzy?"

## Double QBR Loop



Place an equal number of queens, rooks, and bishops on the board so that every piece is defended exactly twice and every piece defends exactly two others. The chain of defence must form a continuous loop.

What is the maximum number of pieces?

In double loops, it is not necessary to have a consistent repeating sequence of pieces. In this case, the order Q-R-B-Q-R-B is impossible. Rooks and bishops cannot be linked together.

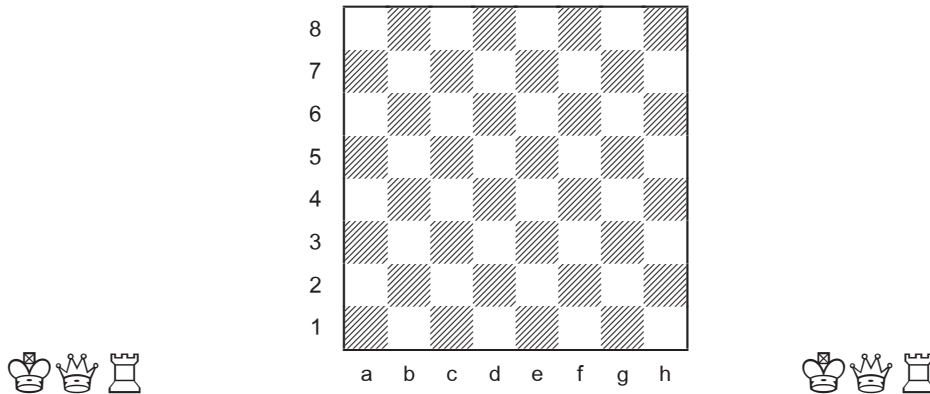
Thanks to François Labelle for providing optimal solutions to all the puzzles. His program also determined the number of different solutions.

Attention, solvers. Matching the record positions is a major challenge. Good luck!



*Stay focused.*

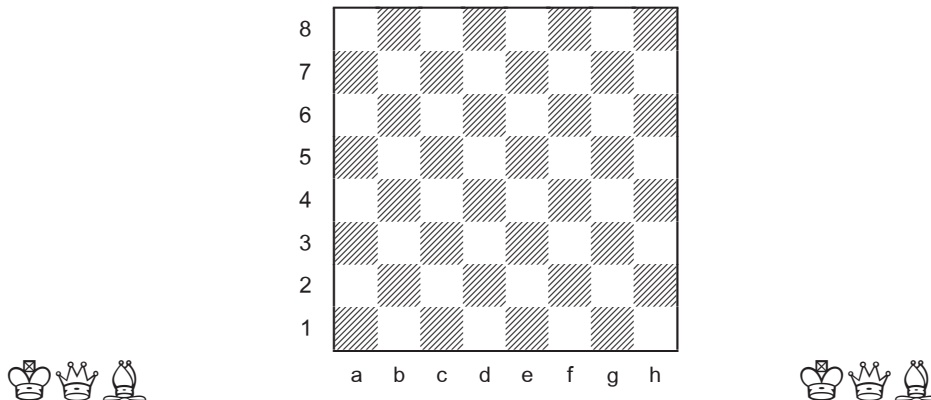
## Double KQR Loop



Place an equal number of kings, queens, and rooks on the board so that every piece is defended exactly twice and every piece defends exactly two others. The chain of defence must form a continuous loop.

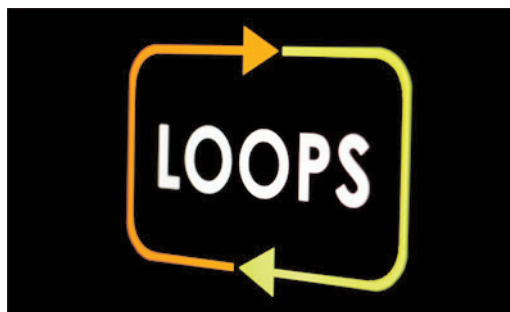
What is the maximum number of pieces?

## Double KQB Loop

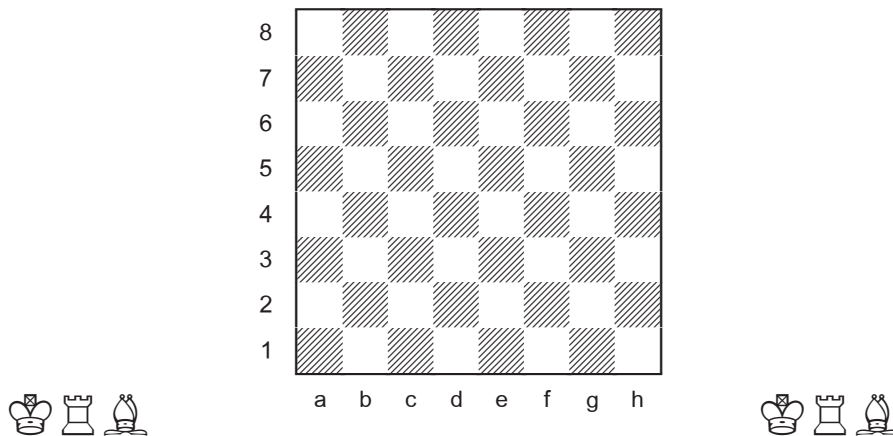


Place an equal number of kings, queens, and bishops on the board so that every piece is defended exactly twice and every piece defends exactly two others. The chain of defence must form a continuous loop.

What is the maximum number of pieces?



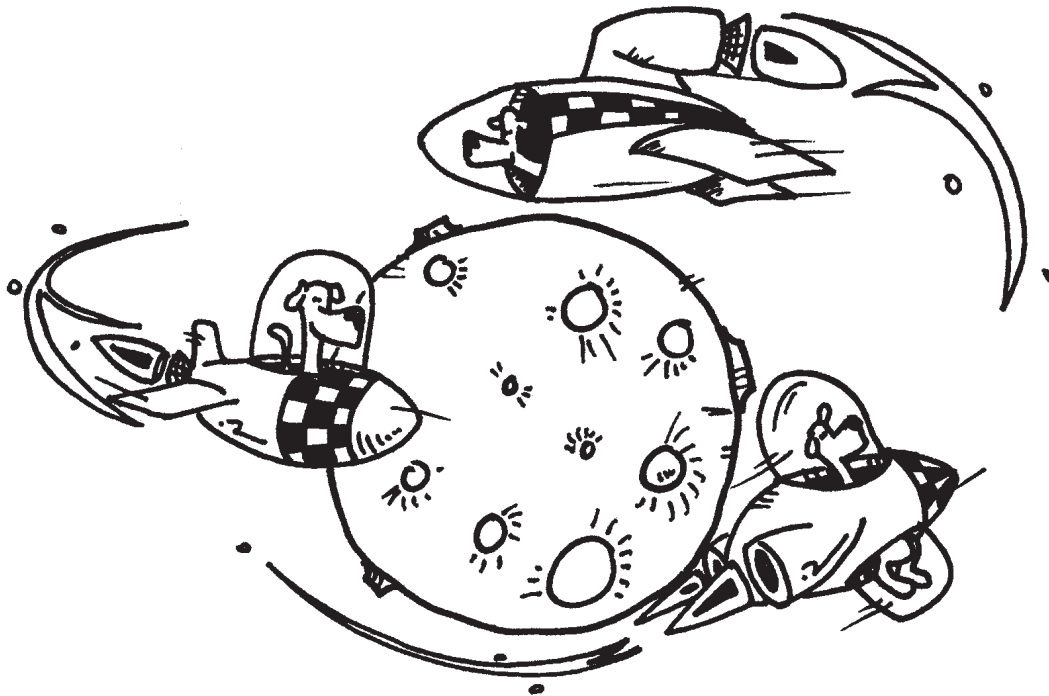
## Double KRB Loop



Place an equal number of kings, rooks, and bishops on the board so that every piece is defended exactly twice and every piece defends exactly two others. The chain of defence must form a continuous loop.

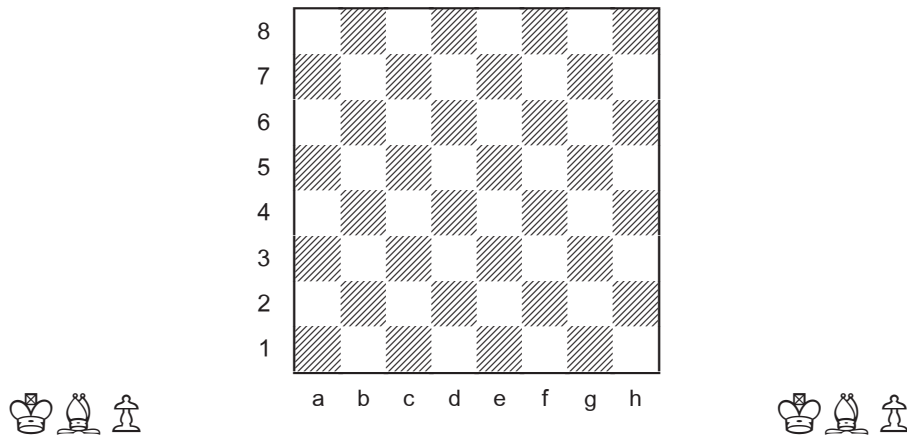
What is the maximum number of pieces?

An updated table showing the maximum values for double loops with equal numbers of each piece is given at the end of the solutions.



*Three-Roo Revolving Loop*

## Double KBP Loop



Place an equal number of kings, bishops, and pawns on the board so that every piece is defended exactly twice and every piece defends exactly two others. The chain of defence must form a continuous loop. Pawns may not be placed on the 1st rank.

What is the maximum number of pieces?



*Loopological Progressions*

## SOLUTIONS

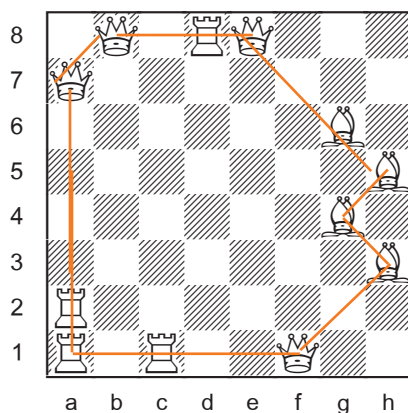
**PDF hyperlinks.** You can advance to the solution of any puzzle by clicking on the underlined title above the diagram. To return to the puzzle, click on the title above the solution diagram.

**Archives.** Past columns and a detailed index of problem-types and composers are available in the *Puzzling Side of Chess* archives.

### Double QRB Loop

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*Puzzling Side of Chess*



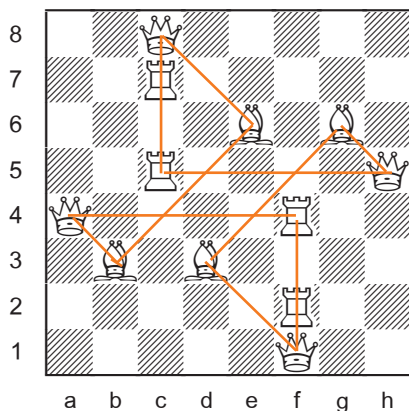
4 queens, 4 rooks, 4 bishops  
each defended twice in a continuous chain

There are 5902 solutions. This total does not include positions with the same pattern that are reflections or rotations of a previously counted solution, a convention used for all problems in the column.

This is the only three-piece double loop in which my human efforts achieved the optimal solution. Here is one of the two symmetrical positions found subsequently by the computer.

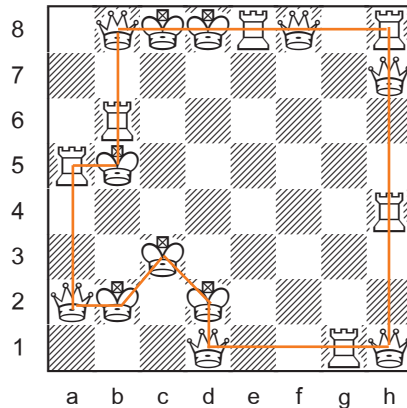
François Labelle 2018

*Puzzling Side of Chess*



## Double KQR Loop

François Labelle 2018  
*Puzzling Side of Chess*

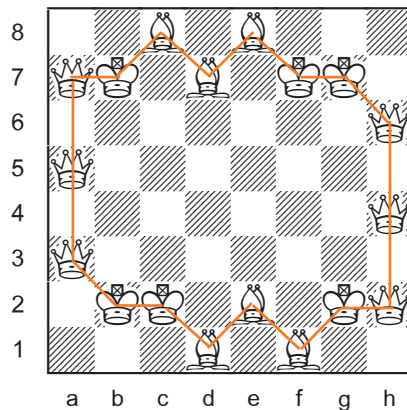


6 kings, 6 queens, 6 rooks  
 each defended twice in a continuous chain

There are 16 solutions.

## Double KQB Loop

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*Puzzling Side of Chess*



6 kings, 6 queens, 6 bishops  
 each defended twice in a continuous chain

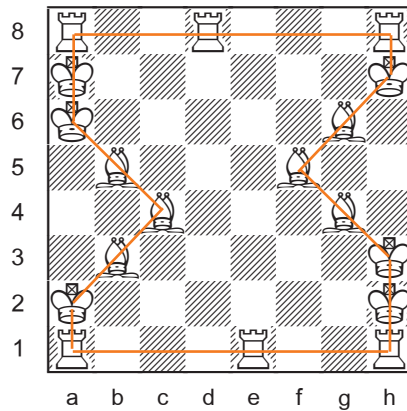
There are 192 solutions.

The diagram shows the first of the four symmetrical patterns.

Bd1 Kc2 Kb2 Qa3 Qa5 Qa7 Kb7 Bc8 Bd7 Be8 Kf7 Kg7 Qh6 Qh4 Qh2 Kg2 Bf1 Be2  
 Bd1 Kc2 Kb3 Qa3 Qa5 Qa7 Kb7 Bc8 Bd7 Be8 Kf7 Kg6 Qh6 Qh4 Qh2 Kg2 Bf1 Be2  
 Bf1 Be2 Kd3 Bc2 Kb3 Qa3 Qa5 Qa7 Kb7 Bc8 Bd7 Ke6 Bf7 Kg6 Qh6 Qh4 Qh2 Kg2  
 Qh1 Bg2 Kf3 Be2 Kd3 Bc2 Kb3 Qa3 Qa5 Qa8 Bb7 Kc6 Bd7 Ke6 Bf7 Kg6 Qh6 Qh4

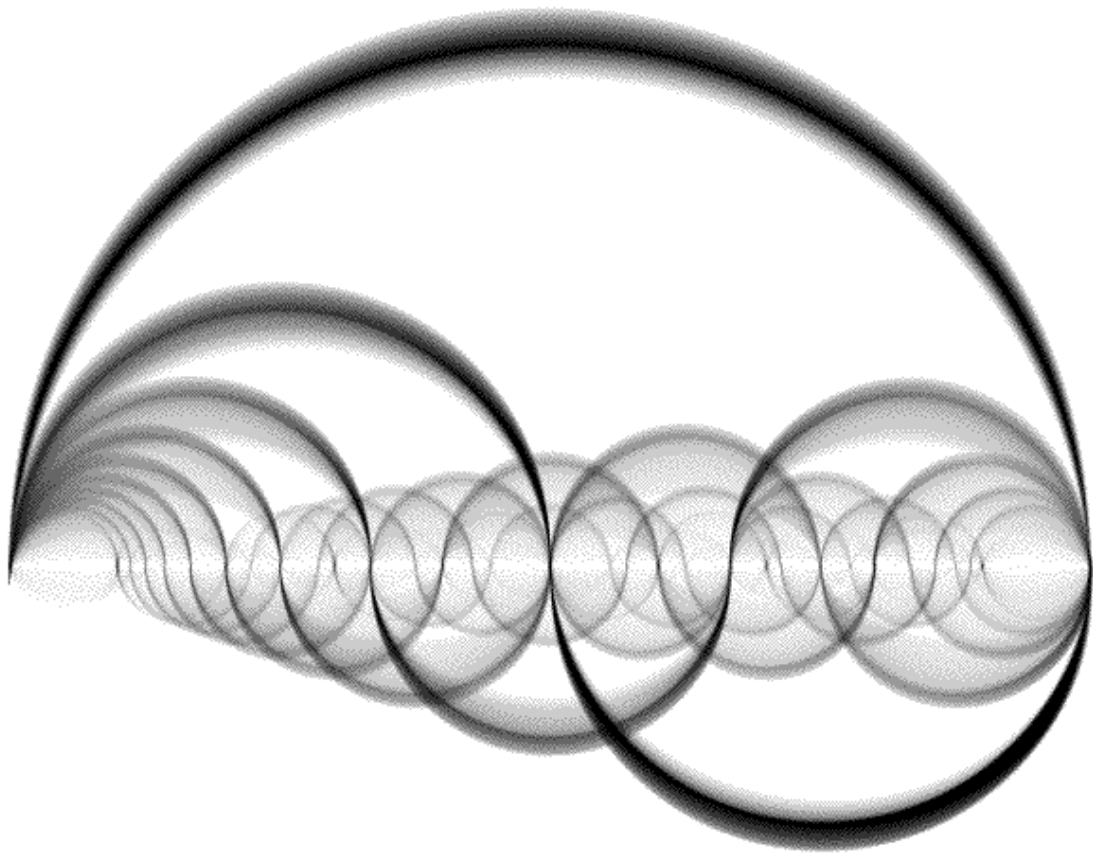
## Double KRB Loop

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*Puzzling Side of Chess*



6 kings, 6 rooks, 6 bishops  
each defended twice in a continuous chain

There are 1462 solutions.  
The diagram is one of 49 that are symmetrical.



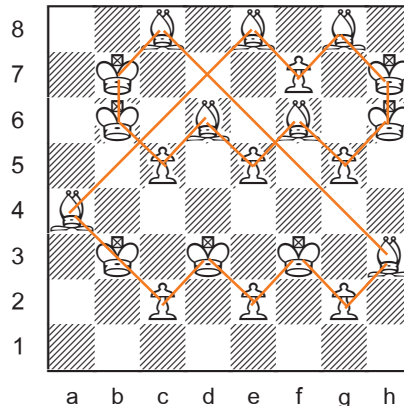
*The Nature of Space and Time*



## Double KBP Loop

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*Puzzling Side of Chess*



7 kings, 7 bishops, 7 pawns  
each defended twice in a continuous chain

There are only 6 solutions. The diagram is first in the list.

Pc2 Kb3 Ba4 Be8 Pf7 Bg8 Kh7 Kh6 Pg5 Bf6 Pe5 Bd6 Pc5 Kb6 Kb7 Bc8 Bh3 Pg2 Kf3 Pe2 Kd3  
Pc2 Bb3 Bg8 Kh7 Kh6 Pg5 Kf6 Pe5 Bd6 Bc5 Pb4 Ka5 Ka6 Bb7 Pc6 Bd7 Bh3 Pg2 Kf3 Pe2 Kd3  
Pc2 Bb3 Bg8 Kh7 Kh6 Pg5 Bf6 Pe5 Bd6 Bc5 Pb4 Ka5 Ka6 Kb7 Pc6 Bd7 Bh3 Pg2 Kf3 Pe2 Kd3  
Pd2 Bc3 Bg7 Kf8 Pe7 Bd8 Pc7 Bb8 Ka7 Ka6 Pb5 Bc6 Pd5 Be6 Pf5 Bg6 Kh5 Kh4 Kg3 Pf2 Ke3  
Pd2 Bc3 Bg7 Bf8 Pe7 Kd8 Pc7 Bb8 Ka7 Ka6 Pb5 Bc6 Pd5 Be6 Pf5 Bg6 Kh5 Kh4 Kg3 Pf2 Ke3  
Pd2 Bc3 Bg7 Bf8 Pe7 Bd8 Pc7 Kb8 Ka7 Ka6 Pb5 Bc6 Pd5 Be6 Pf5 Bg6 Kh5 Kh4 Kg3 Pf2 Ke3

Perhaps surprisingly, a KBP double loop with two of each piece is impossible. The task is also impossible with any equal number of pieces on a 7x7 board.

### Maximum Pieces in Double Loop

Values for multi-piece loops are with an equal number of each piece.

N	32	KB	26	KBP	21
K	31	KR	22	KQR	18
R	16	KQ	16	KQB	18
Q	14	QR	16	KRB	18
B	12	QB	14	QRB	12

Until next time!

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