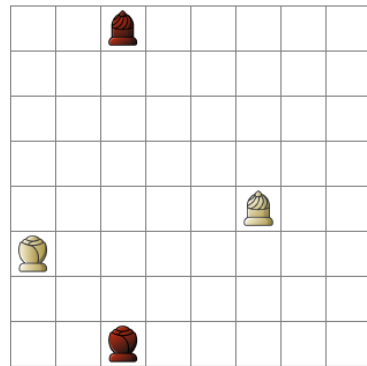
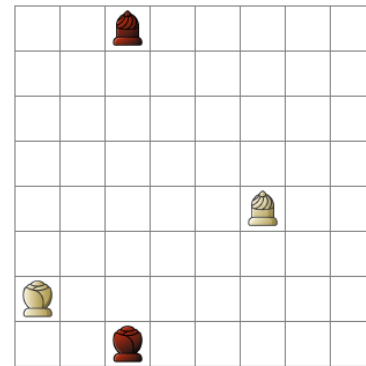


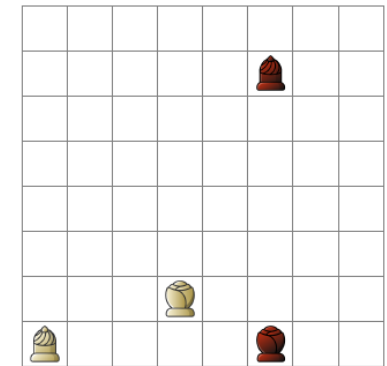
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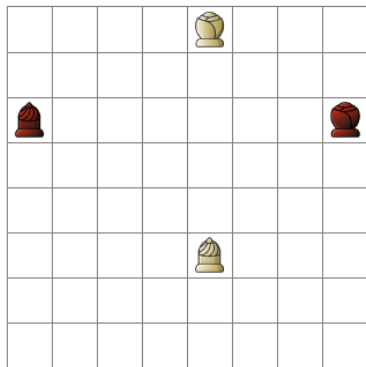
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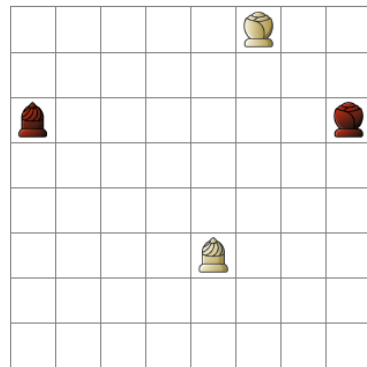
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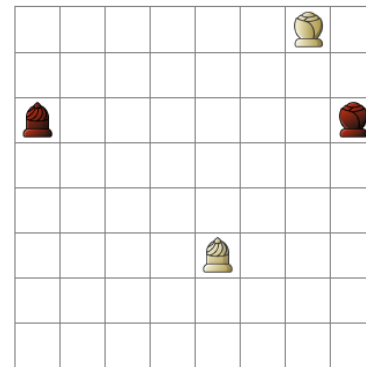
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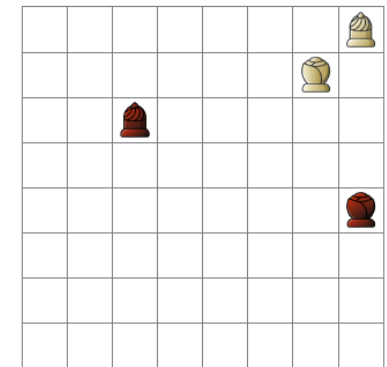
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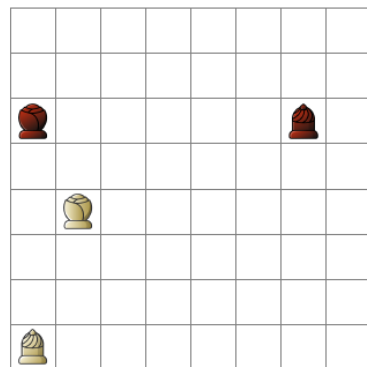
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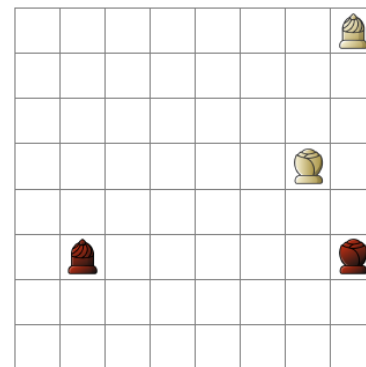
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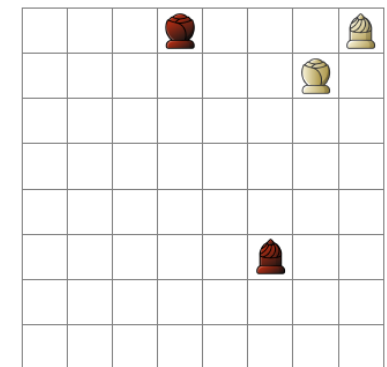
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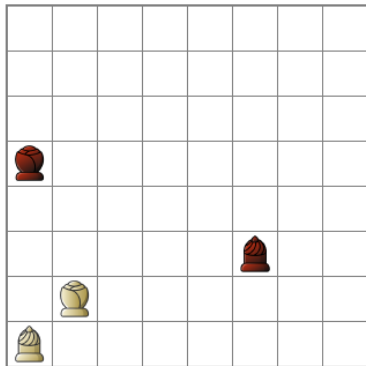
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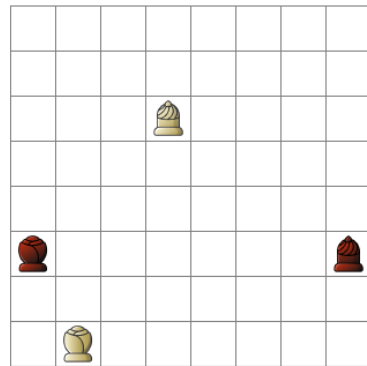
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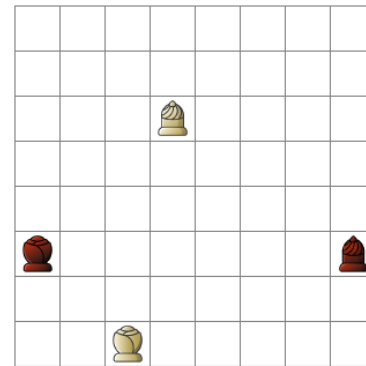
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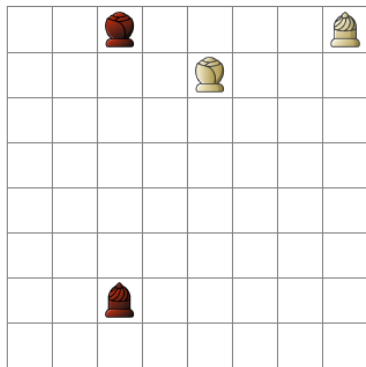
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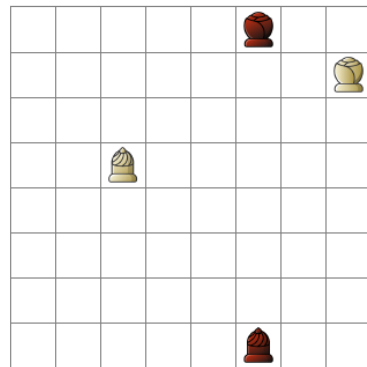
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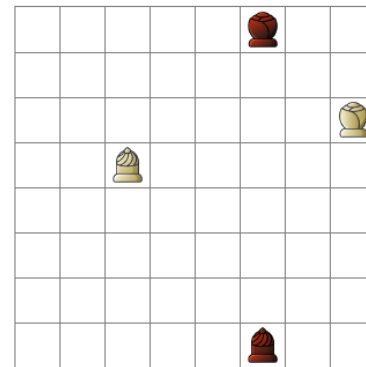
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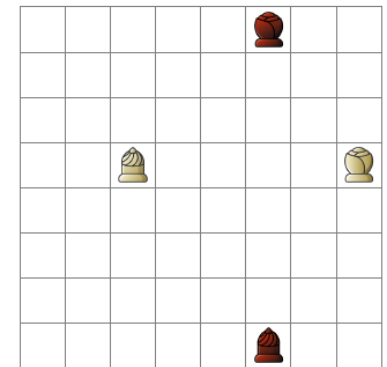
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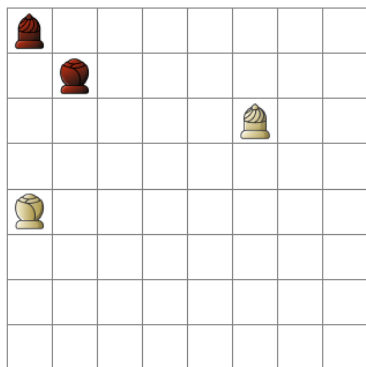
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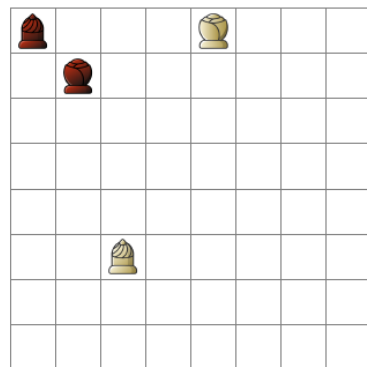
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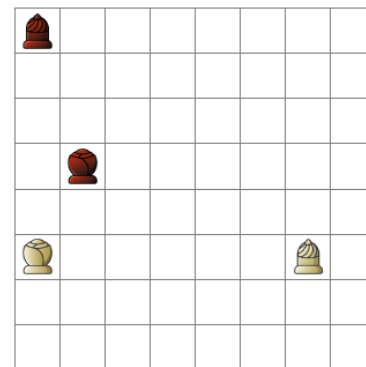
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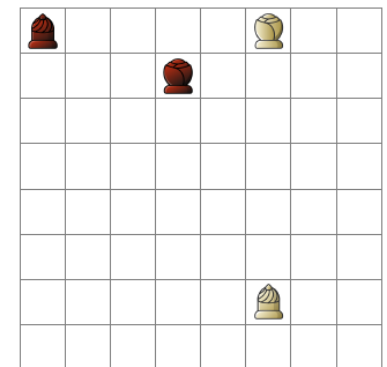
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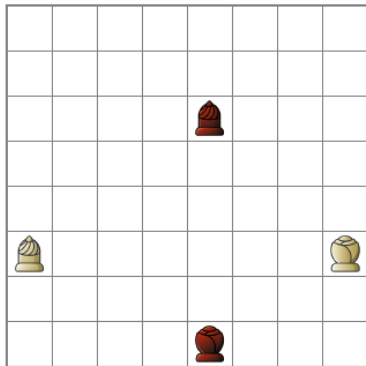
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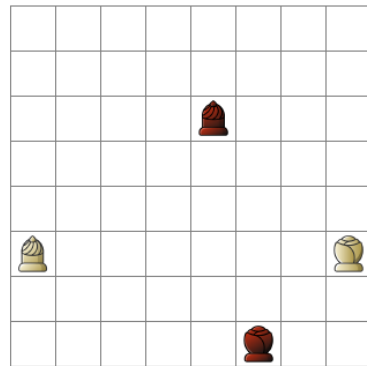
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FEN: q7/8/8/1k6/8/K5Q1/8/8 b - - 0 1



#24 dist\_to\_win=-63  
FEN: q4K2/3k4/8/8/8/8/5Q2/8 b - - 0 1



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FEN: 8/8/4q3/8/8/Q6K/8/4k3 b - - 0 1



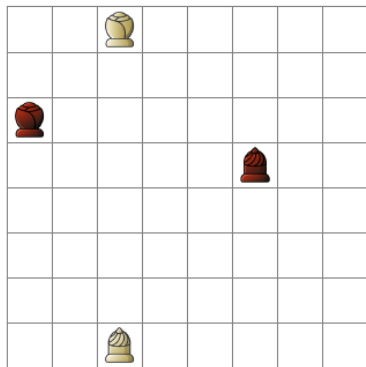
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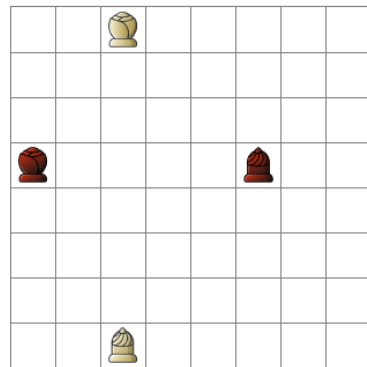
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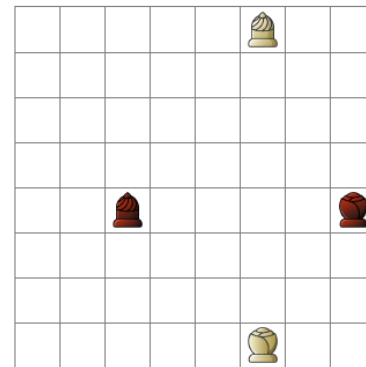
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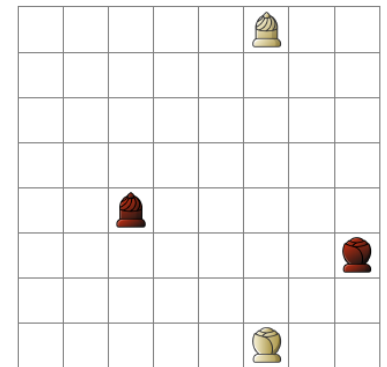
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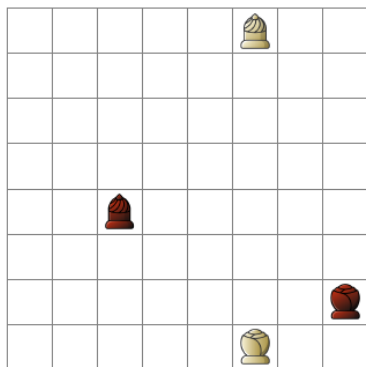
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FEN: 2K5/8/8/k4q2/8/8/8/2Q5 b - - 0 1



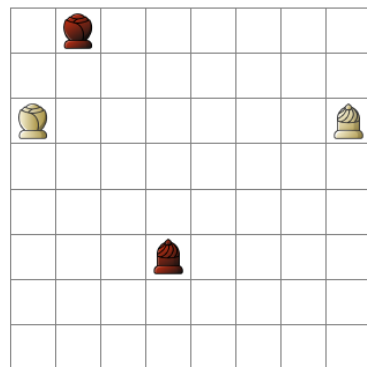
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FEN: 5Q2/8/8/8/2q4k/8/8/5K2 b - - 0 1



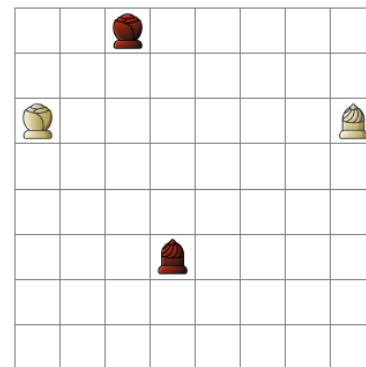
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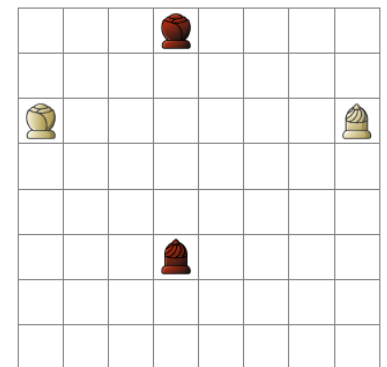
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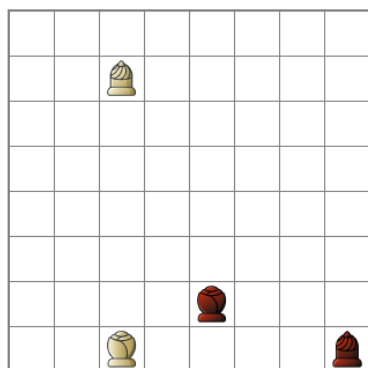
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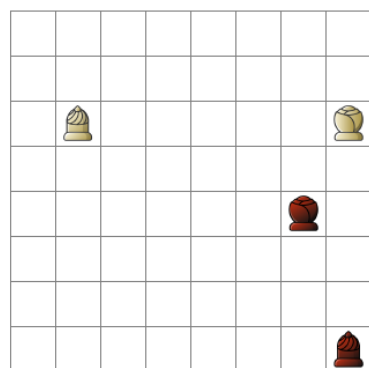
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FEN: 2k5/8/K6Q/8/8/3q4/8/8 b - - 0 1



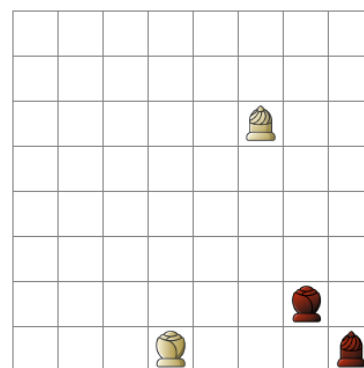
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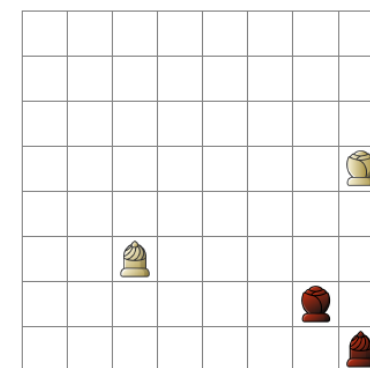
#37 dist\_to\_win=-63  
FEN: 8/2Q5/8/8/8/4k3/2K4q b - - 0 1



#38 dist\_to\_win=-63  
FEN: 8/8/1Q5K/8/6k1/8/8/7q b - - 0 1



#39 dist\_to\_win=-63  
FEN: 8/8/5Q2/8/8/6k1/3K3q b - - 0 1

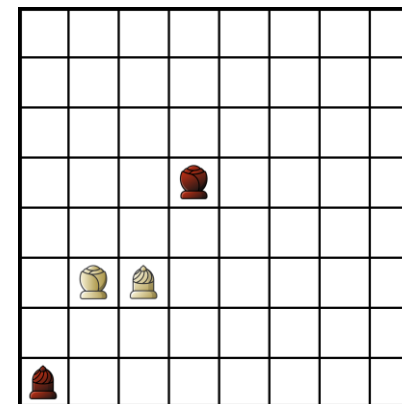


#40 dist\_to\_win=-63  
FEN: 8/8/8/7K/8/2Q5/6k1/7q b - - 0 1

## Background and story on Suli's Diamond Reverse-Ferz Problems

The 40 reverse-ferz problems above are similar, in terms of both the number and type of pieces, to the Suli's Diamond problem that appears in Kitab ash-Shatranj, the world's first chess strategy book written during the Golden Age of Islamic Science, in which one of the earliest and most famous chess masters, as-Suli, gave the correct first move, several partial solutions and presented the problem's difficulty as a timeless challenge. In canonical Suli's Diamond, (FEN: 8/8/8/3k4/8/1KQ5/8/q7 w - - 0 1), the puzzle is an endgame study with shah and ferz pieces on both sides. The shah piece kept its original movement in modern chess and moves like the modern king. The ferz piece, meaning vizier or advisor, moves and attacks like a checkers piece, diagonally only one square. In canonical Suli's diamond, the ferz pieces move on the same diagonals so they can attack and capture each other.

Many languages continue to refer to old and new forms of chess with the same word. In shatranj, the historical form of chess, a player normally wins by capturing all of the opponent's pieces. An exception applies when the side reduced to a lone king can, on the next move, capture the opponent's last remaining non-king piece; in that case, the result is a draw. Suli's Diamond puzzle asks if White can capture Black's ferz cornered on a1 square, without losing his own ferz by a counterattack by the black king.



Suli's Diamond  
8/8/8/3k4/8/1KQ5/8/q7 w

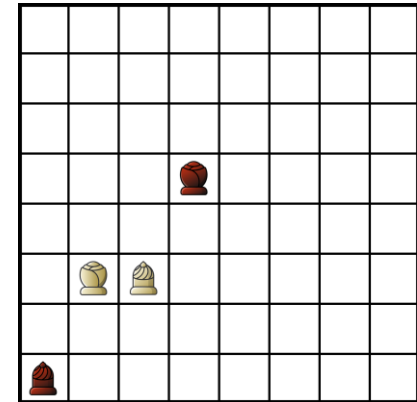
For historical consistency reasons with Kitab ash-Shatranj and the terminology of shatranj, I will use S letter for Shah and F letter for Ferz piece in the analysis below. Feel free to swap them yourself with K for King and Q for queen. I will also use lowercase letters for black moves, to make tracking easier with computer FEN analysis. Full solution to Suli's diamonds in 39 plies:

1. Sb4 sd6 2. Sc4 se6 3. Sd4 sf6 4. Sd5 sf7 5. Se5 sg7 6. Se6 sf8! 7. Sd6 se8 8. Sc6 sd8 9. Sb6 sc8 10. Sc5 sd7 11. Sb5 se6 (11. ... sc7 12. Sc4! sd6 12. Sb4! se5 13. Sa3! sd5 14. Sb3! and white wins; 11. ... sc7 12. Sc4! sd6 13. Sb4! sc6 14. Fd2 sd5 15. Sc3! se4 16. Sb3 sd3 17. Fc1 se2 18. Sa2 sd1 19. Sb1! se2 20. Sxa1 and white wins) 11. Sb5 se6 12. Sa4 (12. Fd2 also wins) sd6 13. Sb4! se5 14. Sa3! sd5 15. Sb3! sc5 16. Fd2 sd4 17. Sc2 se4 18. Sb1 sd3 19. Fc1 se2 20. Sxa1 and white wins.

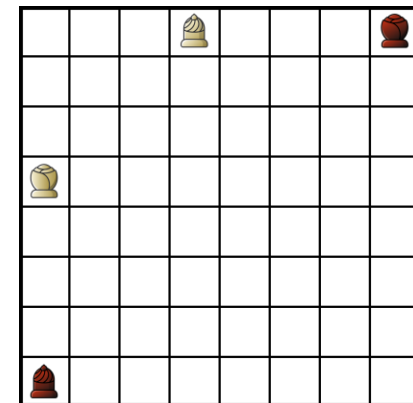
Although many chess masters over the centuries attempted and failed to solve the thousand-year-old Suli's Diamond problem, the correct first move and essential parts of the winning method were already demonstrated by as-Suli in Kitab ash-Shatranj. Later, the ending was reexamined by the endgame expert and Soviet Chess Federation president Yuri Averbakh, who treated as-Suli's analysis with great respect. In light of as-Suli's identification of the key winning moves Kb4 and Kd6, his conclusion that White is winning, and the related two other analytical positions preserved in Kitab ash-Shatranj, Averbakh considered it likely that as-Suli had understood the solution in all its essential subtleties. Although many modern online sources present Averbakh as the first solver of Suli's Diamond, the principal winning line associated with him had already been recorded by as-Suli. Averbakh's role is therefore better seen as a modern confirmation and reconstruction of as-Suli's analysis. At the same time, both versions are slightly incomplete, because a stronger defense was later shown to exist with 6...Kf8 instead of 6...Kg8. It should also be noted that after 6...Kg8, the move 7.Ke7 wins in 29 plies faster, whereas the line shown in Kitab ash-Shatranj and by Averbakh 7.Kf6 Kh8 8.Kf7 requires 31 plies to win.

Previously, harder versions of Suli's Diamond puzzles were discovered for same diagonal ferz version, extending the solution length from 39 to 53 moves. The discoverer, John Tromp, named one puzzle from this harder puzzle category as 'as-Suli's rough diamond.' (FEN: 3Q3k/8/8/K7/8/8/8/q7 w)

The AI-assisted confirmation and explanation of the full coding solution to both Suli's Diamond and Suli's Rough Diamond was carried out within the Erasmus+ Shatranj.ai project coordinated by FSMVU. Lesson 16 of the curriculum is devoted to solving Suli's Diamond and to developing the dynamic-programming-based AI code that solves it. The lesson materials are openly accessible after a free registration at: <https://lms.shatranj.ai>



Suli's Diamond (Canonical)  
8/8/8/3k4/8/1KQ5/8/q7 w

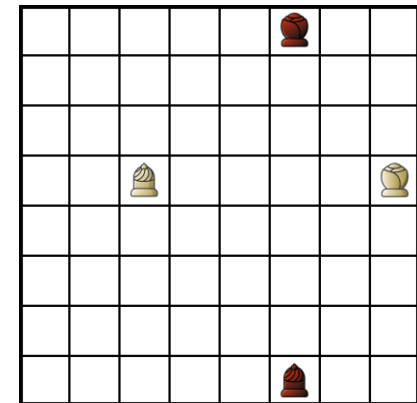


Suli-Tromp Rough Diamond  
3Q3k/8/8/K7/8/8/8/q7 w

In the reverse-ferz problem category, because the two ferz pieces move on different diagonal complexes, they cannot attack or capture one another. For this reason, their solutions differ in strategy from that of the original Suli’s Diamond and require a much longer winning sequence: 63 moves instead of 39.

Thus, these positions are not only about 50% longer in solution length, but also substantially more difficult in their underlying complexity. This puzzle category evaded human discovery for the longest time. Here is a full solution to a particular one, shaped like a diamond quadrilateral, which is also explained further in the shatranj.ai curriculum.

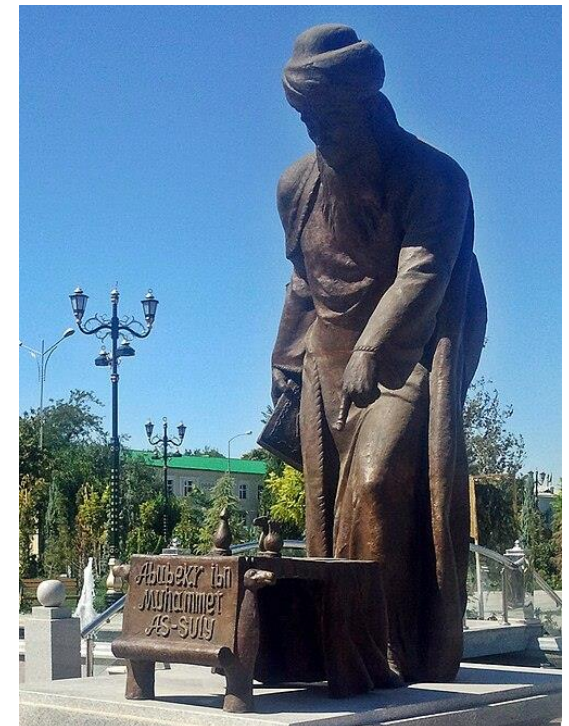
1.Sg6 2.se7 3.Sf5 4.sd7 5.Se4 6.sc6 7.Fd4 8.sb5 9.Sd3 10.sc6 11.Se3 12.sd5 13.Fc3 14.fg2 15.Fd2 16.fh3  
 17.Sf4 18.sd4 19.Sf3 20.sd3 21.Fe1 22.sc2 23.Se2 24.fg4 25.Ff2 26.ff5 27.Se3 28.fe6 29.Sd4 30.sd2  
 31.Se4 32.se2 33.Fg3 34.sf1 35.Sf3 36.sg1 37.Ff4 38.sh2 39.Fe3 40.ff7 41.Sf4 42.sg2 43.Fd4 44.sf2  
 45.Fe5 46.fe8 47.Fd6 48.se2 49.Se5 50.sd3 51.Fc7 52.sc4 53.Sd6 54.sb5 55.Fd8 56.ff7 57.Se7 58.fg8  
 59.Sf8 60.fh7 61.Sg7 62.sa6 63.Sxh7



Suli-Karatekin Tough Diamond  
 5k2/8/8/2Q4K/8/8/8/5q2 w

According to the TDV Encyclopedia of Islam, Abu Bakr al-Suli was born in Baghdad between 255–257 AH (869–871 CE). In addition to the nisba “Baghdadi,” he was known as “Shatranji” because he was the strongest chess player of his time, and as “Suli” because he was descended from Sul-Tegin, the Turkish ruler of Jurjan during the early Islamic conquests. Sul-Tegin’s son, Abu Umara Muhammad, was one of the leading propagandists of the Abbasid revolution. As-Suli was an editor-poet, chronicler, and the strongest chess player of his era. [https://en.wikipedia.org/wiki/Abu\\_Bakr\\_bin\\_Yahya\\_al-Suli](https://en.wikipedia.org/wiki/Abu_Bakr_bin_Yahya_al-Suli)

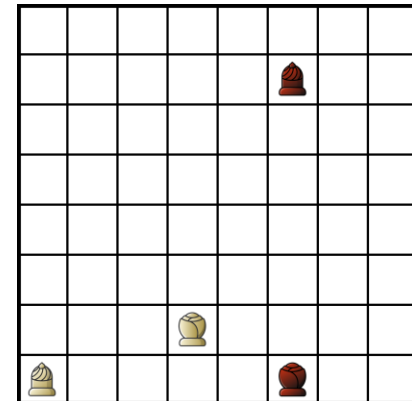
“Tegin” (or “tigin”) is one of the old Turkish political titles and, in its most basic sense, means “prince,” that is, a male dynastic member belonging to a ruling house; indeed, reliable sources explain this title directly as “prince.” Over time, however, its range of use expanded, and in some periods it could refer not only to a biological dynastic member but also to military-political elites from the dynastic circle and to lords who exercised actual governing authority. Therefore, the safest way to understand the element “-tegin” in historical names in Turkish is as “prince,” or depending on context as “a dynastic lord/governor”; for example, the name “Sul-Tegin” most likely carries layers of meaning such as “a prince of the Sul dynasty” or “a dynastic ruler associated with the Sul principality.”



As-Suli statue, Ashgabat, Turkmenistan

This reverse-ferz “King+Vizier vs. king+vizier” problem group related to Suli’s Diamond endgame study was first discovered and composed by Turkish National Chess Champion Tamer Karatekin during the lesson-preparation stage on “Suli’s Diamond” for the Erasmus+ Shatranj.ai curriculum project. Kitab ash-Shatranj contains a reverse-ferz king+vizier vs. king+vizier problem, but that position is a relatively simple example that ends in a draw. As a result, the mistaken assumption that reverse-ferz problems in historical chess would generally end in a draw—much like opposite-colored bishop endings in modern chess—was never seriously questioned for more than a thousand years, possibly partly because of the influence of that easier example in Kitab ash-Shatranj.

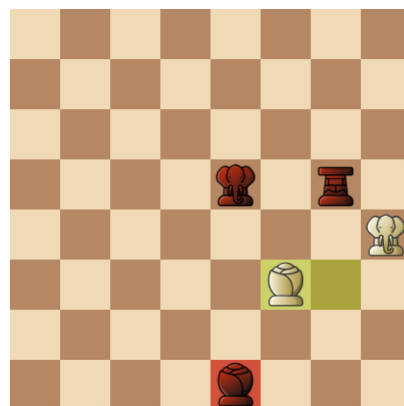
Since the surname Karatekin is derived from tegin, and since tegin denotes princely or dynastic affiliation, while al-Suli’s grandfather and family are associated with the name Sul-Tegin, we therefore refer to this harder family of related problems as the “Suli-Karatekin Diamonds.” The 40 reverse-ferz problems can be categorized into two geometrical piece motifs. In 24 of the puzzles, the geometry of the pieces evokes a diamond-shaped quadrilateral. For this reason, a particular puzzle from this group was the “Suli-Karatekin Diamond.” The FEN is: 5k2/8/8/2Q4K/8/8/8/5q2 w - - 0 1 and its solution can be found in the shatranj.ai curriculum documents and whitepapers.



Suli-Karatekin  
 Concave Tough Diamond  
 White wins in 63-depth  
 8/5q2/8/8/8/8/3K4/Q4k2

## How reverse-ferz versions of Suli's diamond were discovered

While preparing the lesson 14 for the shatranj.ai curriculum, the topics included various mathematics and logic problems of historical importance around the chessboard. Those were: "Wheat and the Chessboard, Rook Polynomials, Smullyan type logic puzzles, and Magic Squares". Raymond Smullyan is a mathematical logician with two excellent works on chess logic puzzles: "The Chess Mysteries of Sherlock Holmes" (1979) and "The Chess Mysteries of the Arabian Knights" (1981). The puzzle on the book cover comes from a logic puzzle composed in 1950 by Branco Pavlovic.

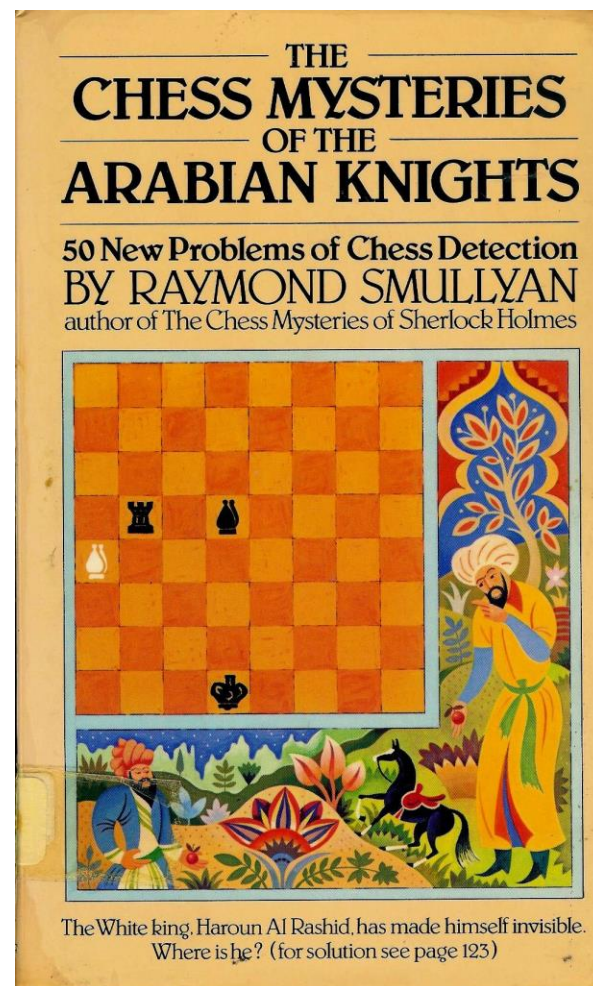


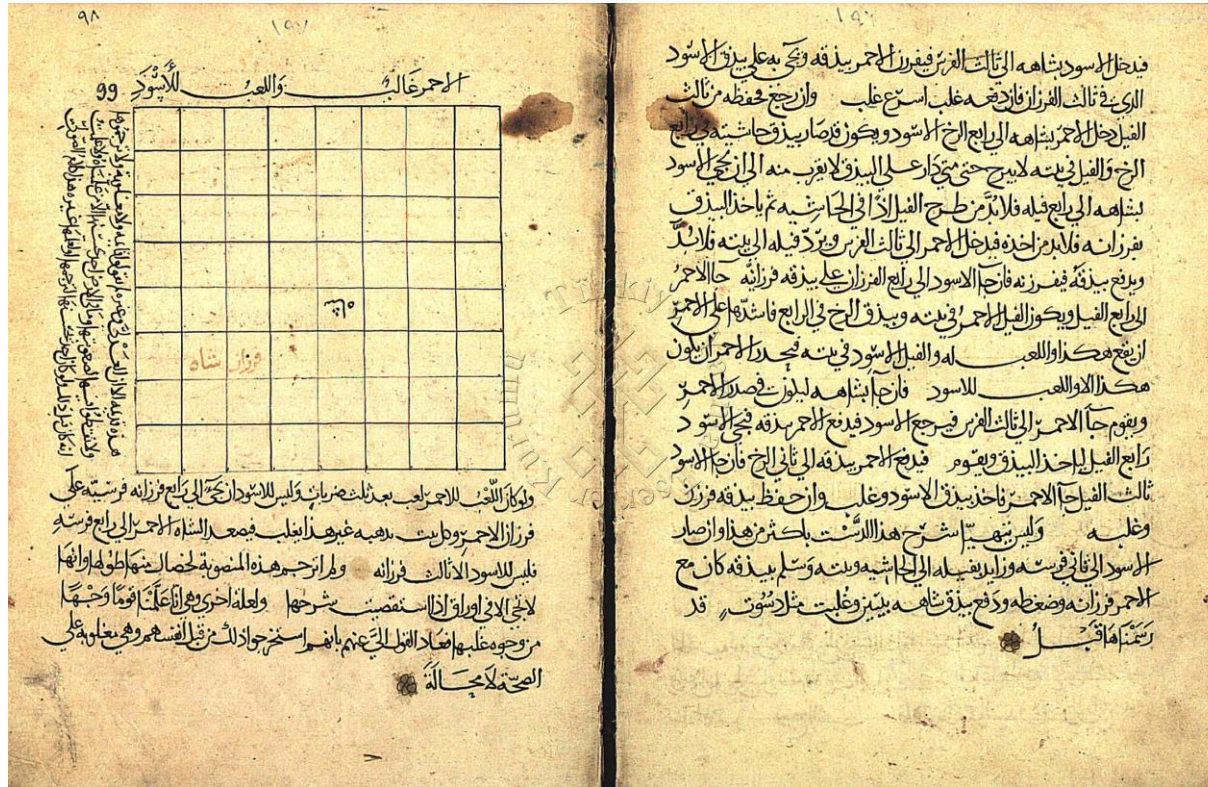
Branco Pavlovic 1950  
What was white's last move?

Smullyan adopted this original puzzle by Branco Pavlovic and asked the location of the white king, with a fictional backstory of Haroun Al-Rashid from the "1001 Arabian Nights" literature. It turns out the only logical square for the white king to be is c3, and black's last move must have been Pawn b4xc3 en passant (capturing white's pawn on c4, which just moved from c2 to c4 to block Black's check from d5)

Simultaneously, we were working on translating Kitab ash-Shatranj from the Suleymaniye Library in Istanbul. The lesson 16 of the shatranj.ai curriculum was on Suli's diamond and its solution via dynamic programming. Thus, we were investigating the original pages from Kitab ash-Shatranj, where this puzzle appeared for the first time.

We knew that in previous solution attempts to "Suli's Diamond" that it was reported that the shah (king) piece in this origin position was missing and that it was deduced from two other diagrams in the book and the solution given to this diagram that the black ferz (vizier) must have been on a1.



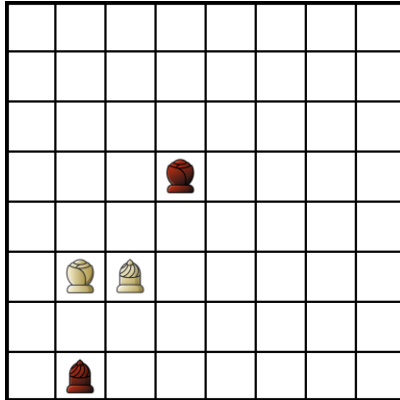


Suli's Diamond: 137th diagram (marked as 99th diagram) on page 101 from Kitāb al-Shaṭranj, also identified as Kitābū'l-Manṣūbāt fī eṣ-ṣaṭranç, attributed to Abū al-Faraj al-Muẓaffar b. Saʿīd al-Lajlaj (el-Lajlaj), reproduced in Fuat Sezgin, ed., Book on Chess: Kitāb al-Shaṭranj: Selected Texts from al-ʿAdlī, Abū Bakr al-Ṣūlī and Others (Frankfurt am Main: Institute for the History of Arabic-Islamic Science, 1986), facsimile of Süleymaniye Library, Lala İsmail Collection, MS 560, Istanbul

The rough translation is as follows: "This game is ancient. Moreover, neither al-ʿAdlī nor those who came after him stated to whom it belonged, or who was victorious or defeated. Because this game was so difficult, they neither explained it nor dwelled on it. Our teacher used to say: there is no one else on earth who could accomplish this. If there had been someone capable of it, he would either have solved it himself or taught it to someone else. This was said by al-Suli." The text gives the first best moves as: Black Shah to d5, Red (White) Shah b4 and Black Shah to d6.

There was a lot of similarity between trying to guess where the black vizier was on the board for the Suli's Diamond puzzle and Smullyan's logic puzzle on guessing where the Haroun Al-Rashid's white king must have been on the board. If this position (Suli's Diamond) as referred in the translation is indeed ancient, it might have been first composed during the reign of Haroun al-Rashid or his son al-Ma'mun.

The solutions provided so far until 2026 for Suli's diamond assumed that the black vizier must have been on a1, but we noticed a winning idea for the position when the black vizier is on b1. This was the first reverse ferz position we analyzed. Surprisingly, this winning idea is shaped like a diamond maneuver, thus, we decided to call this position as "Suli's Little Diamond".



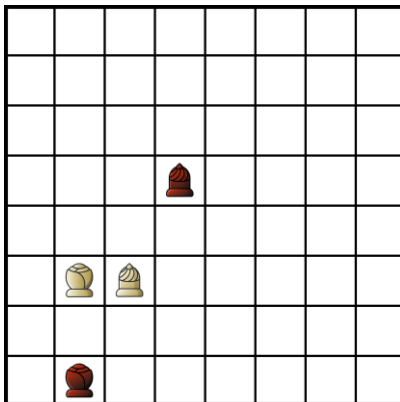
Suli's Little Diamond with a diamond maneuver:

8/8/8/3k4/8/1KQ5/8/1q6 w - - 0 1

1. Fb4! (the only move to win) sc6 2. Fa3 sb5 (2... Sc5 3. Sb2 sb5 4. Sxb1 white wins) 2... Sb5 3. Fb2 sc5 4. Fa1 (or Fc1) sd4 5. Sb2 sd3 6. Sxb1 and white wins. Notice the Fc3-b4-a3-b2 diamond maneuver.

1. Fd2? leads to a draw. 1... sd4! 2. Sb2 sd3 3. Fc1 fc2 and the black shah and ferz protect each other, hence white cannot win anymore and it is draw. 1. Sb2? is also draw after 1... sc4 2. Fd2 sd3 3. Fc1 fc2.

It should be noted that Suli's Diamond starts with 1. Sb4! winning move while Suli's Little Diamond starts with 1. Fb4! winning move. The b4 square is key in both puzzles.

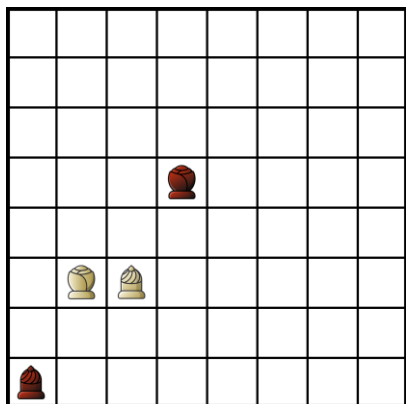


After solving Suli's Little Diamond, we decided to swap the black shah and ferz positions to explore reverse ferz positions a bit further. It seems in this new position, 1. Fb4! is still the only way to win. We decided to call this position as "Suli's Flipped Diamond".

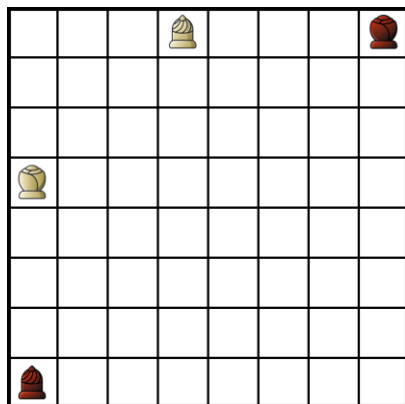
8/8/8/3q4/8/1KQ5/8/1k6 w - - 0 1

1. Fb4! fe4 2. Sc3! ff5 3. Fc5 sa2 4. Fd6 sa3 5. Sd4 fe6 6. Fe7 sb4 7. Se5 fd7 8. Sd6 fe8 9. Fd8 ff7 10. Se5 sa3 11. Sf6 Fe8 12. Se7 fd7 13. Sxd7 white wins. 1. Fd4? leads to a draw. 1... sc1 2. Sc3 fe4! 3. Fc5 ff3 4. Sd3 sd1 5. Se3 fe2 and black shah and vizier connect, hence draw. 1. Fd2? also leads to a draw. 1... fe4! the only move for draw. 2. Sc3 ff3! 3. Sd3 sb2! 4. Se3 sc2 5. Fe1 sd1 6. Ff2 fe2 draw. (1. Fd2? fe6? (black loses) 2. Sc3 ff7 3. Fe3 sc1 4. Sd3 sd1 5. Fd4 fe8 6. Fe5 se1 7. Fd6 sf2 8. Sd4 sf3 9. Se5 fd7 10. Fc7 sc6 11. Sd6 fb7 12. Fd8 fa8 13. Sc7 sg2 14. Sb8 sh1 15. Sxa8 white wins.)

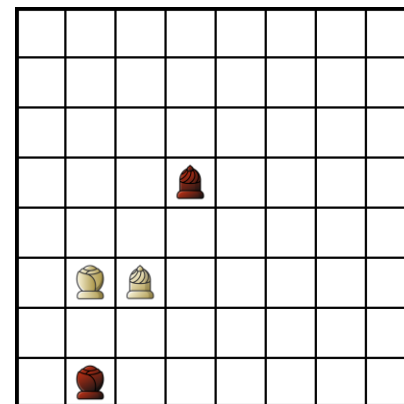
After these two interesting reverse-ferz examples in which white was winning via perfect play, we realized that there might be deeper positions where the winning sequence might be longer. This curiosity led us to upgrade our dynamic programming code for Suli's Diamond with reverse-ferz positions, which led to the discovery and composition of 40 hardest versions of Suli's diamond puzzle, with solutions at depth 63. The original Suli's Diamond has a 39-depth solution, while Suli's Rough Diamond has a 53-depth solution.



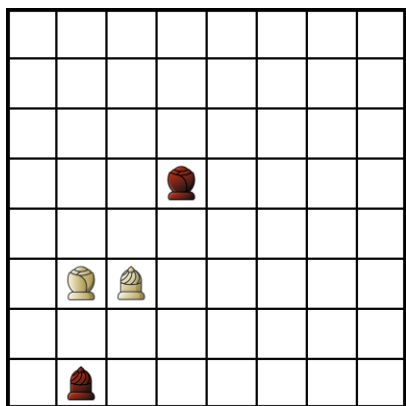
Suli's Diamond  
8/8/8/3k4/8/1KQ5/8/q7 w  
White wins at 39-depth



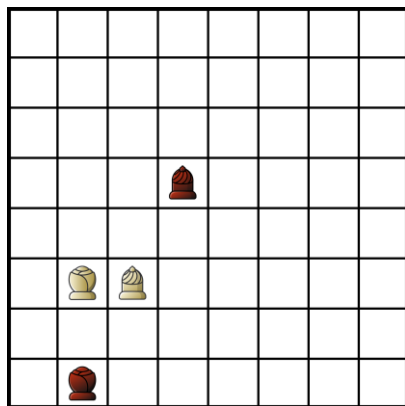
Suli-Tromp Rough Diamond  
3Q3k/8/8/K7/8/8/8/q7 w  
White wins at 53-depth



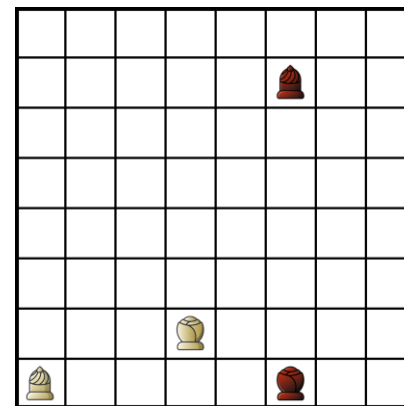
Suli-Karatekin Tough Diamond  
5k2/8/8/2Q4K/8/8/8/5q2 w  
White wins at 63-depth



Suli's Little Diamond  
3Q3k/8/8/K7/8/8/8/q7 w  
White wins at 11-depth



Suli's Flipped Diamond  
8/8/8/3q4/8/1KQ5/8/1k6 w  
White wins at 25-depth



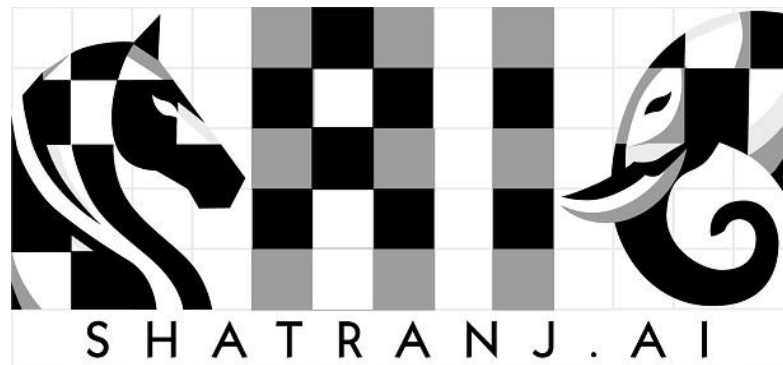
Suli-Karatekin Concave Tough Diamond  
8/5q2/8/8/8/8/3K4/Q4k2  
White wins in 63-depth

To play shatranj yourself or against AI and setup these puzzles with FEN, you can use the play and study tool at the shatranj.ai project: <https://play.shatranj.ai>

The chess fonts used in this presentation and throughout the shatranj.ai project are also freely available to use in your personal and commercial projects: <https://github.com/TamerKaratekin/shahi-chess-shatranj-font> The shah/king's top design in these fonts was also partially inspired from the headwraps of early chess masters such as As-Suli and Stamma. Ferz/vizier/queen top design is inspired by a military helmet.

Shatranj.ai, "An Artificial Intelligence Curriculum based on Historic Mind and Board Games" is a project funded by the European Union's Erasmus+ Youth program. You can access the lessons at <https://lms.shatranj.ai> after a free registration. For our digital exhibit on chess sets, pieces, and terminology, visit <https://www.shatranj.art>

**About the author:** Tamer Karatekin was born in Yugoslav Macedonia and learned chess from his father and grandfather, the latter a physics teacher and one of the first authors of Turkish-Yugoslav and Turkish-Albanian dictionaries in the Balkans. The first chess problem he learned was Morphy's 1856 mate-in-two, taught to him by his grandfather. Beginning in the 1990s, Tamer became a frequent visitor to the Istanbul Chess Association, where retired local chess masters regularly challenged him with endgame studies. He became a multiple youth and junior champion of Turkey and eventually the national champion of Turkey in 2000. He learned much of his endgame technique from German translations of Averbakh's endgame books, Shereshevsky's Endgame Strategy, Panchenko's Theory and Practice of Chess Endings, and the endgame encyclopedias of Šahovski Informator. In 1997, he held Kasparov and Karpov to draws in simultaneous exhibitions, with both games reaching endgames. During the 1998 Zonal in Crete, he was coached by former World Senior Chess Champion GM Evgeni Vasiukov. Tamer is an alumnus of the EECS Department at the Massachusetts Institute of Technology, where he played first board on the MIT chess team. He holds FIDE titles as a master, trainer, and school instructor, and has coached medal-winning students in international school and youth championships. He served as the technical and curriculum coordinator of the shatranj.ai Erasmus+ Youth project, an artificial intelligence curriculum based on chess and other historic board games.



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