# Knight's Tour: Many Solutions
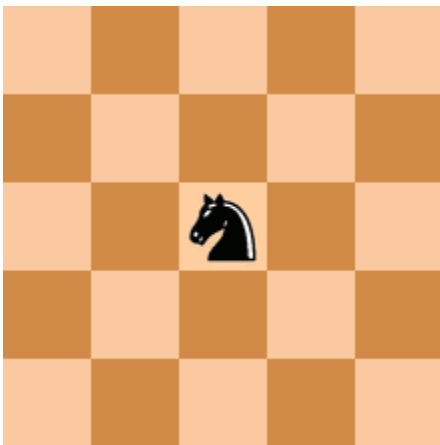
*Unplugged Computer Science Fair Demonstration*

## Summary

Participants will come up with a sequential solution to the 'Knights Tour Problem' and then see how many other solutions there are as well.

## Overview

A knight's tour is a sequence of moves of a knight on a chessboard such that the knight visits every square exactly once.



HS Students will first help a participant practice moving a knight in a variety of directions.  Then, the challenge will be explained.  The HS Student will help & record the sequence of movements (algorithm) the participant comes up with.  If a complete Knight's Tour is found, congratulations are due!!

The variety of complete solutions should be collected and made available for all to see.  (It may help to organize them alphabetically by recording the sequence of locations (with the locations labeled with letters of the alphabet).

*Bonus: Keep count of the number of different solutions that have been found during the event, with a portable flap-based scoreboard.*

## Computer Science Connection

Algorithm – An algorithm is a sequence of steps to accomplish a task.
Programming - Writing a sequence of instructions for a computer to follow.

# Supplies

- Large Chess Knight Piece
- Large 5x5 Chess Board for the demo piece
- [Self-Inking Stamp](#)
- Photocopies of a 5x5 board with list of 25 steps.  (Cut apart.)
- Optional: [Portable flap-based scoreboard](#).

# Notes:

- The Knight must start on a square the same color as the middle/corner.
- There are 64 unique solutions that start from the center.  There are 304 unique solutions from each of the corners.  And, there are 56 unique solutions starting from each of the other correct squares.

# References

- https://docs.google.com/presentation/d/1-BwThMS24s7VYUKt21CIzJSBOXYd0WhBKDTM7clib28/
- https://en.wikipedia.org/wiki/Knight%27s_tour
- Try it: https://www.maths-resources.com/knights/
- https://oeis.org/A165134

## Chess Board:

| | | | | |
|---|---|---|---|---|
| A | B | C | D | E |
| F | G | H | I | J |
| K | L | M | N | O |
| P | Q | R | S | T |
| U | V | W | X | Y |

Start on any gray square.

# Example Solutions:

| | | | |
|---|---|---|---|
| 1. A | 1. | 1. | 1. |
| 2. L | 2. | 2. | 2. |
| 3. U | 3. | 3. | 3. |
| 4. R | 4. | 4. | 4. |
| 5. Y | 5. | 5. | 5. |
| 6. N | 6. | 6. | 6. |
| 7. E | 7. | 7. | 7. |
| 8. H | 8. | 8. | 8. |
| 9. K | 9. | 9. | 9. |
| 10. B | 10. | 10. | 10. |
| 11. I | 11. | 11. | 11. |
| 12. T | 12. | 12. | 12. |
| 13. W | 13. | 13. | 13. |
| 14. P | 14. | 14. | 14. |
| 15. G | 15. | 15. | 15. |
| 16. D | 16. | 16. | 16. |
| 17. O | 17. | 17. | 17. |
| 18. X | 18. | 18. | 18. |
| 19. Q | 19. | 19. | 19. |
| 20. F | 20. | 20. | 20. |
| 21. C | 21. | 21. | 21. |
| 22. J | 22. | 22. | 22. |
| 23. S | 23. | 23. | 23. |
| 24. V | 24. | 24. | 24. |
| 25. M. | 25. . | 25. . | 25. . |
| 1. Y | 1. A | 1. | 1. |
| 2. R | 2. H | 2. | 2. |
| 3. U | 3. E | 3. | 3. |
| 4. L | 4. N | 4. | 4. |
| 5. A | 5. Y | 5. | 5. |
| 6. H | 6. R | 6. | 6. |
| 7. E | 7. U | 7. | 7. |
| 8. N | 8. L | 8. | 8. |
| 9. W | 9. C | 9. | 9. |
| 10. P | 10. J | 10. | 10. |
| 11. G | 11. S | 11. | 11. |
| 12. D | 12. V | 12. | 12. |
| 13. O | 13. K | 13. | 13. |
| 14. X | 14. B | 14. | 14. |
| 15. Q | 15. I | 15. | 15. |
| 16. F | 16. T | 16. | 16. |
| 17. C | 17. W | 17. | 17. |
| 18. J | 18. P | 18. | 18. |
| 19. S | 19. G | 19. | 19. |
| 20. V | 20. D | 20. | 20. |
| 21. K | 21. O | 21. | 21. |
| 22. B | 22. X | 22. | 22. |
| 23. I | 23. Q | 23. | 23. |
| 24. T | 24. F | 24. | 24. |
| 25. M. | 25. M. | 25. . | 25. . |