Google adjacent grid squares

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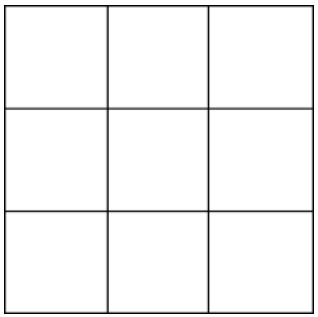
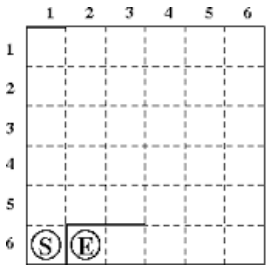
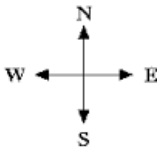
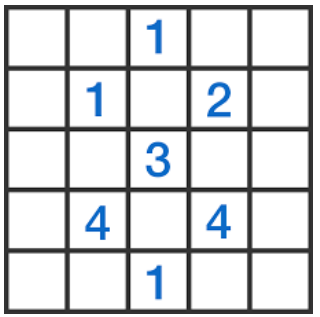
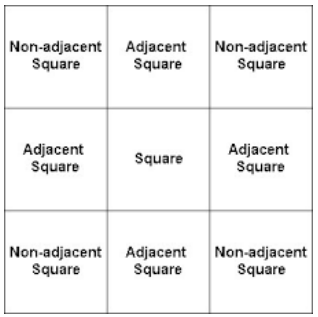
length corresponds target vertex consider diamonds puzzle moved numbers left minesweeper connected vertices router cafe

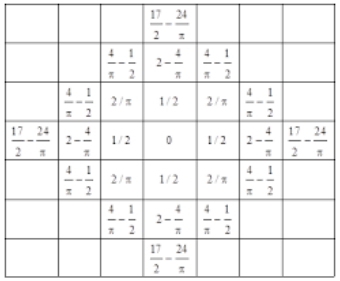


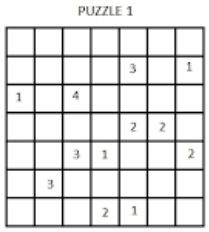


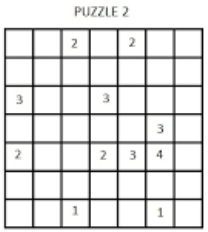


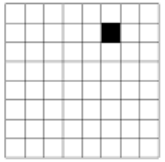


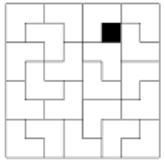


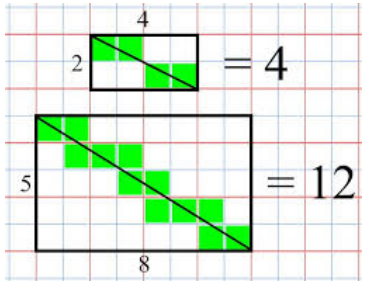


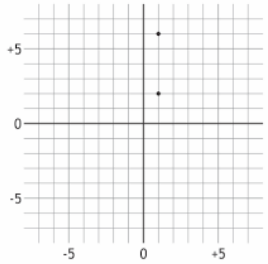


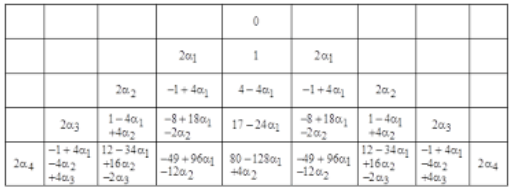


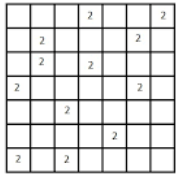


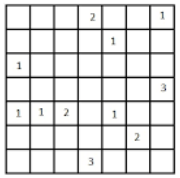


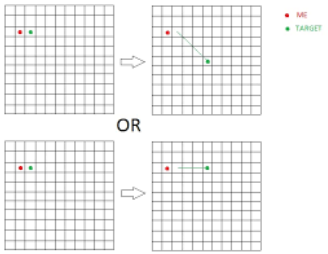


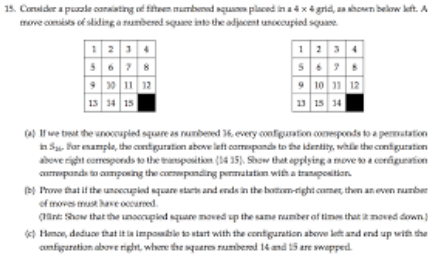











15. Consider a puzzle consisting of fifteen numbered squares placed in a 4 × 4 grid, as shown below left. A move consists of sliding a numbered square into the adjacent unoccupied square.

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	

1	2	3	4
5	6	7	8
9	10	11	12
13	15	14	

(a) If we treat the unoccupied square as numbered 16, every configuration corresponds to a permutation in S_{16}. For example, the configuration above left corresponds to the identity, while the configuration above right corresponds to the transposition (14 15). Show that applying a move to a configuration corresponds to composing the corresponding permutation with a transposition.

(b) Prove that if the unoccupied square starts and ends in the bottom-right corner, then an even number of moves must have occurred.
(Hint: Show that the unoccupied square moved up the same number of times that it moved down.)

(c) Hence, deduce that it is impossible to start with the configuration above left and end up with the configuration above right, where the squares numbered 14 and 15 are swapped.