# Donimoes: Puzzles with Dominoes

There are two kinds of puzzles: blocking and capturing.

The Blocking Puzzle's Goal

The goal is to slide all the dominoes into a rectangle, without sliding any matching numbers next to each other.

Moves

Move a domino one space along its long axis so that none of its numbers match an adjacent number on a neighbouring domino. In this example, the lower domino can move to the right, because the three doesn't match the two, and the four doesn't match the 3. You couldn't move it another space to the right, because then the threes would be right next to each other.
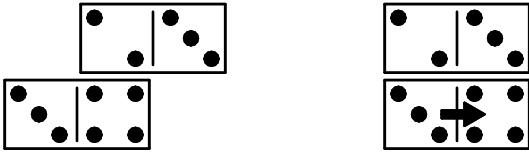
Stay Connected

All the dominoes in the puzzle have to be connected in one solid group, diagonal connections don't count. When you move a domino, it can be disconnected during the move, as long as it is connected at the start and the end of the move. Remember that it can only move one space at a time, though.
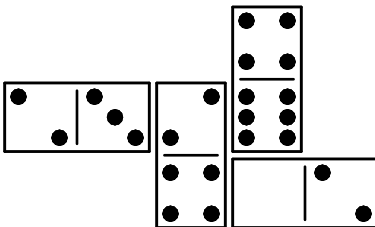
Blocking Donimoes Problems

Here are the starting positions for several Blocking Donimoes problems. The solutions are listed at the end.
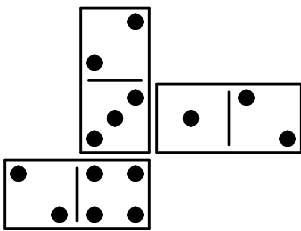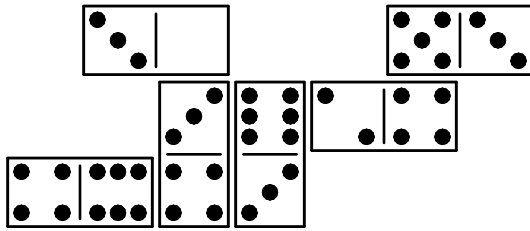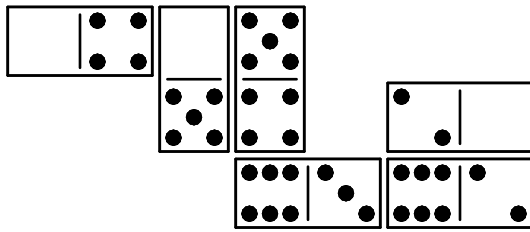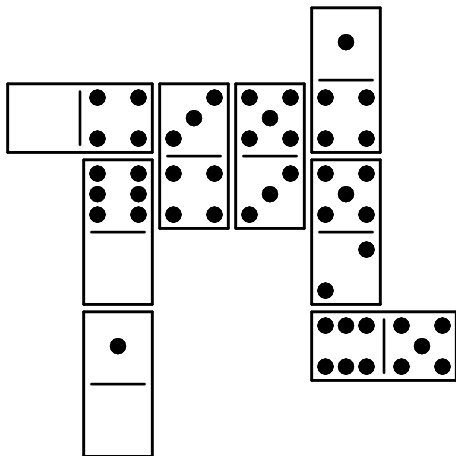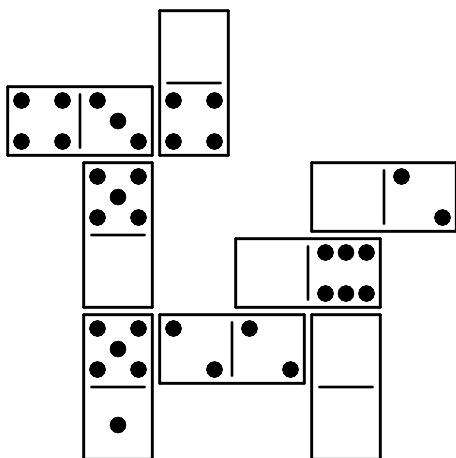
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Problem 2

Problem 3

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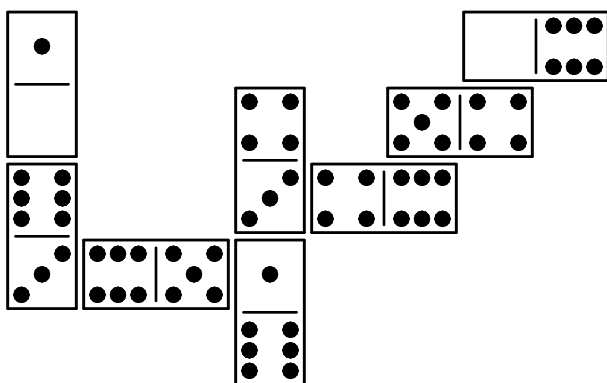
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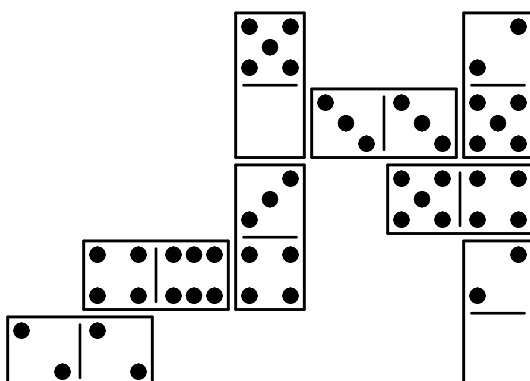
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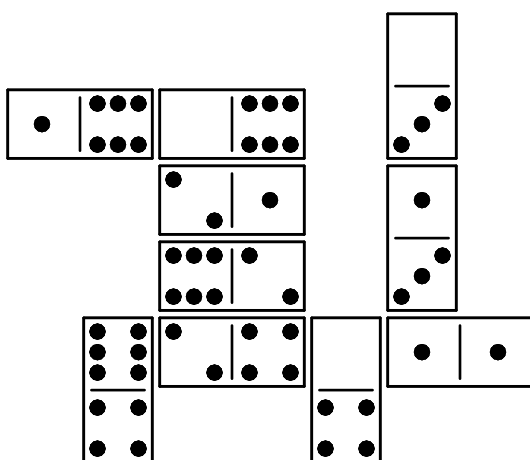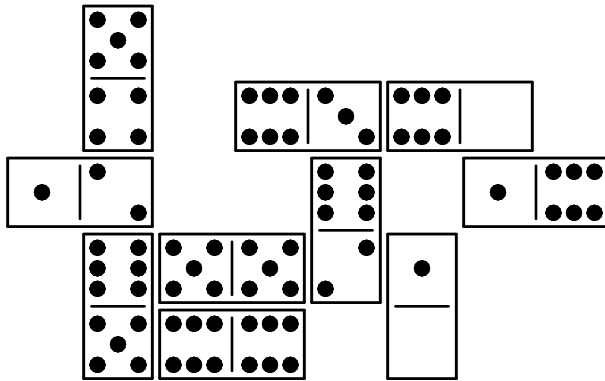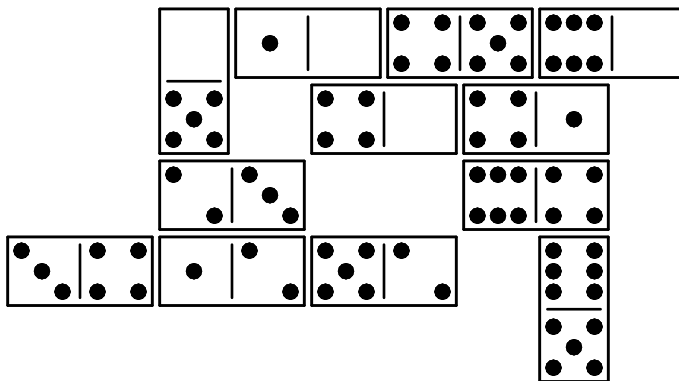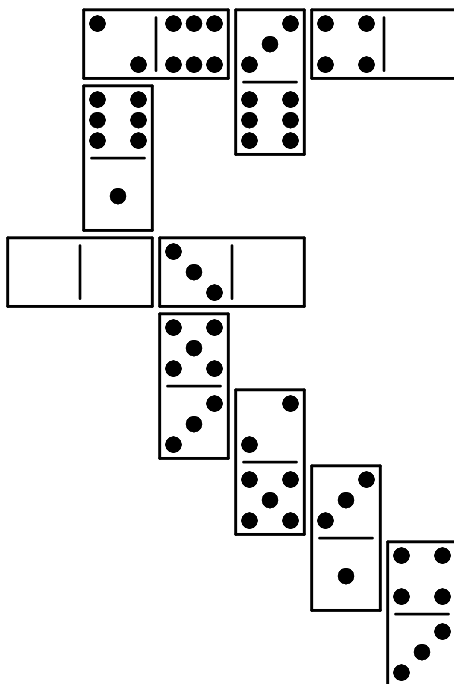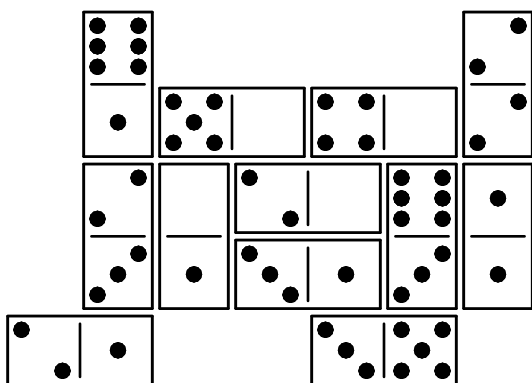
Problem 12

Problem 13

Problem 14

Problem 15

Problem 16

Problem 17

Problem 18

Problem 19
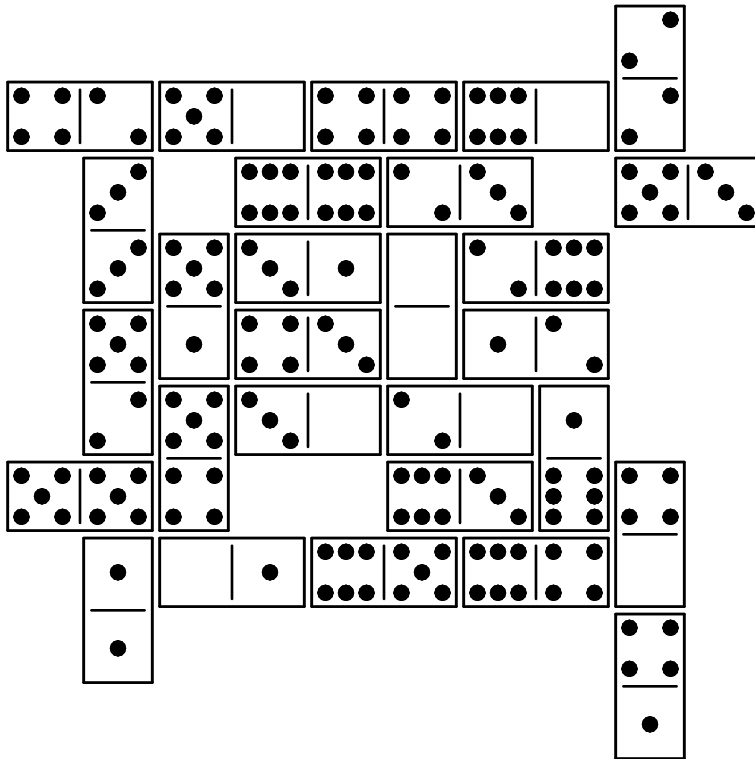
The Capturing Puzzle's Goal

The goal is to collect all the dominoes by sliding matching numbers next to each other.

Moves

There are only two ways a domino can move.

Matching

Move a domino one space along its long axis so that it ends up with at least one of its numbers matching an adjacent number on a neighbouring domino. Then collect the domino you moved and any dominoes that match it, by removing them from the pattern. In this example, the threes match, so you collect both dominoes: solution found!
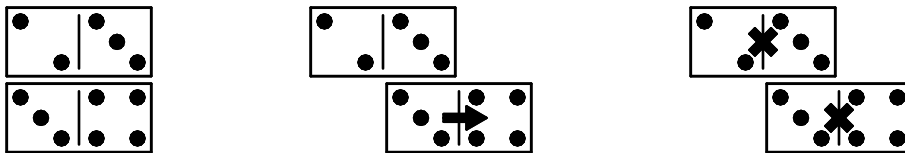
Adding

Move a domino one space along its long axis so that it ends up with at least one of its numbers next to an adjacent number that adds up to six. With an adding move, no dominoes are removed. In this example, the two adds up with the four above it to make six.
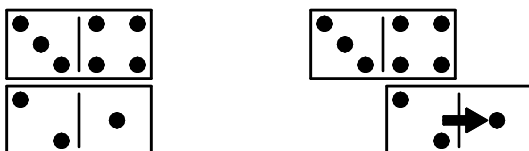
Sometimes, you can collect more than two dominoes at once. In the first example, the two matches twos on both of the other dominoes, and you collect all three dominoes. In the second example, the two matches the two to the left, and the four matches the four above it. You collect all three dominoes.
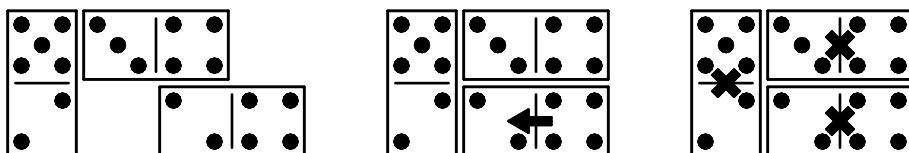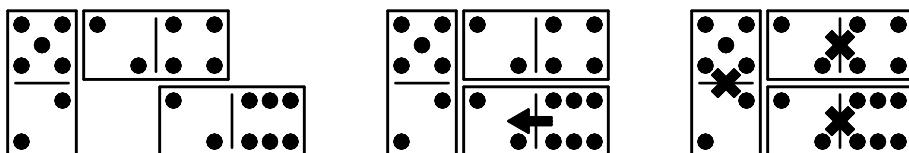
Stay Connected

All the dominoes must stay in one connected group, you can't split the group after moving or after removing the matching dominoes.

Capturing Donimoes Problems

Here are the starting positions for several Capturing Donimoes problems. The solutions are listed at the end.
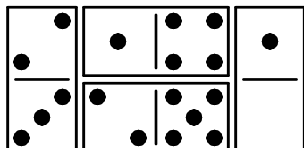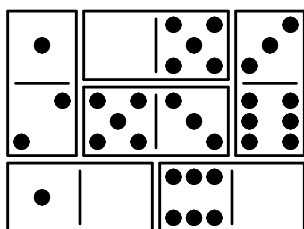
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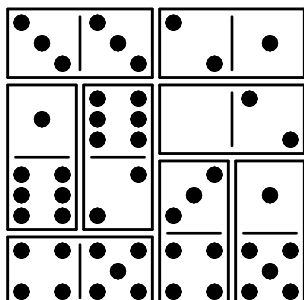
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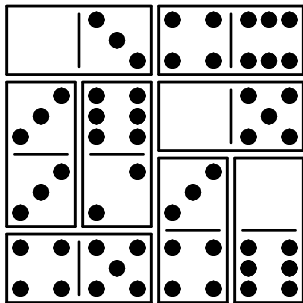
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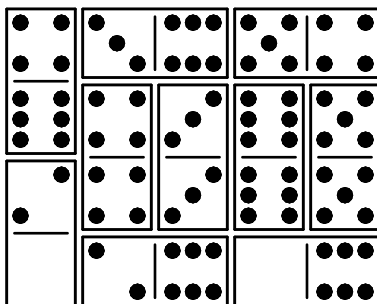
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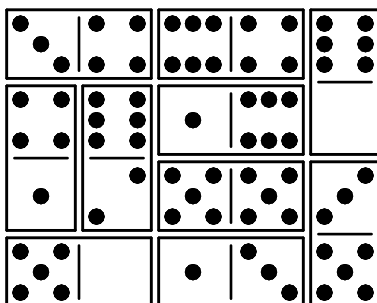
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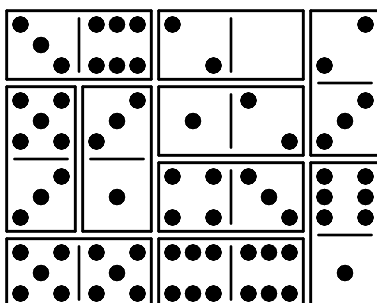
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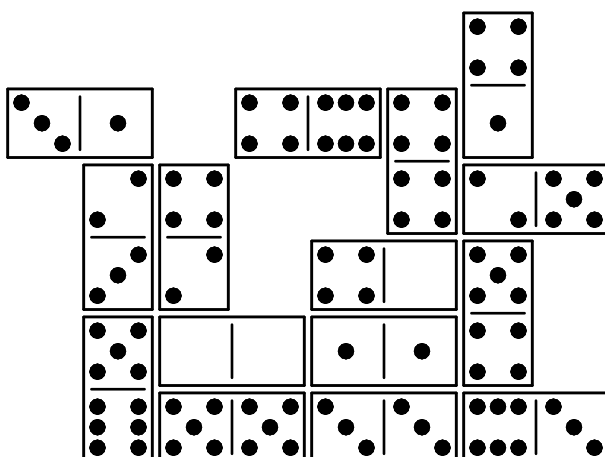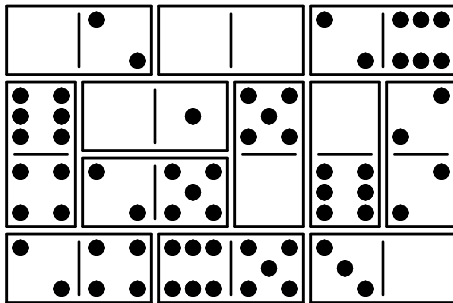
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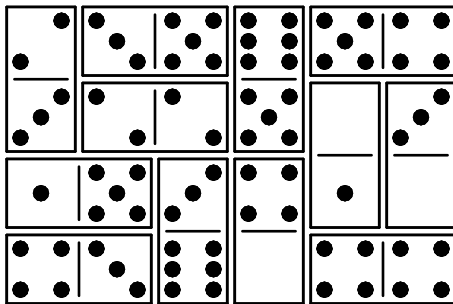
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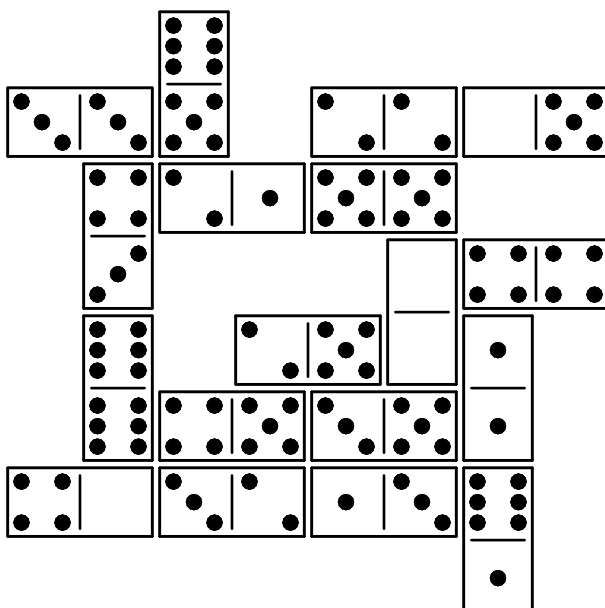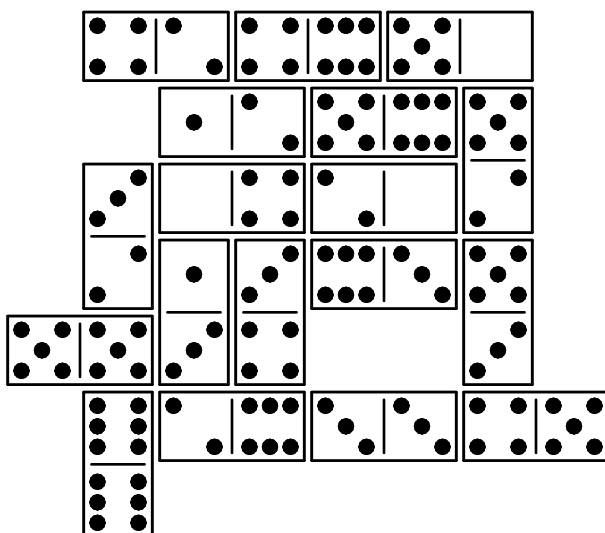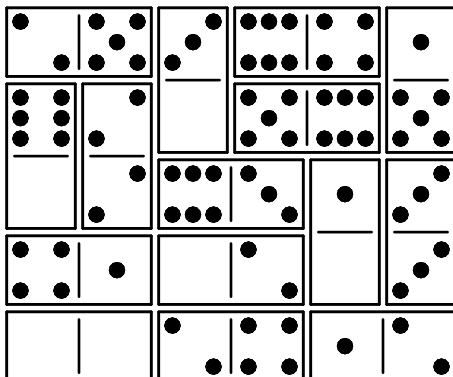
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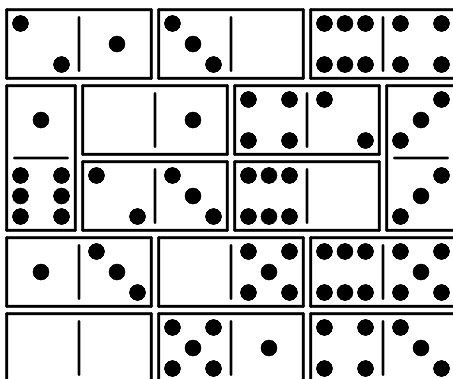
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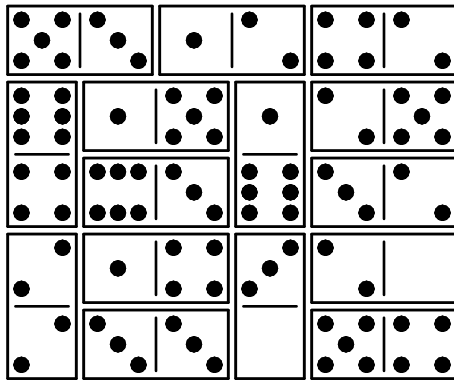
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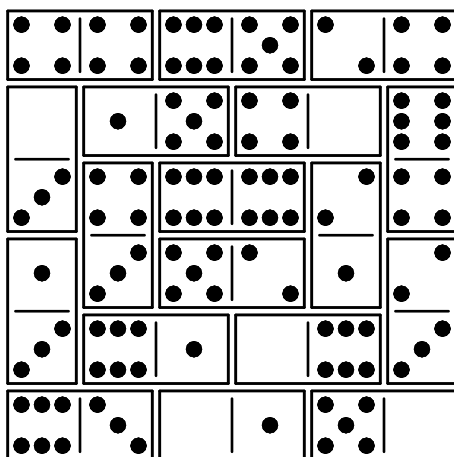
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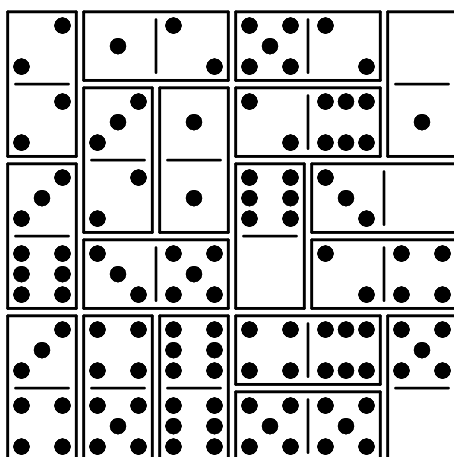
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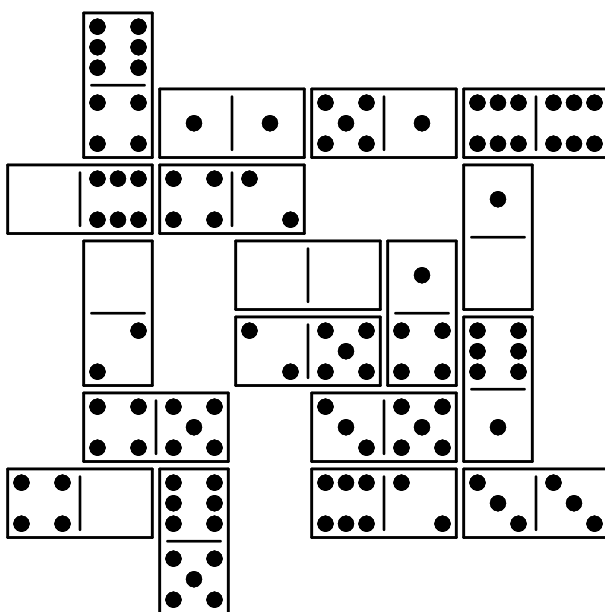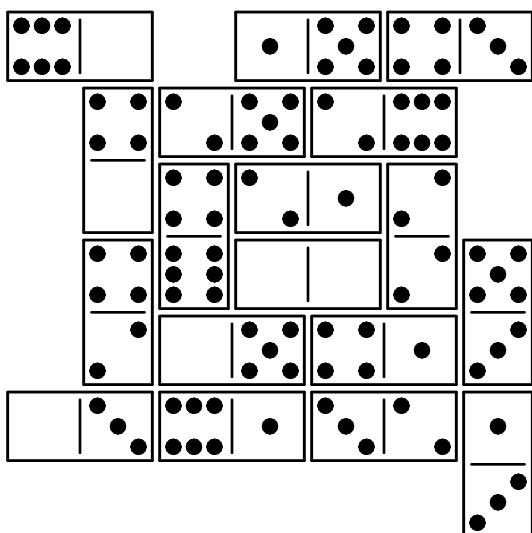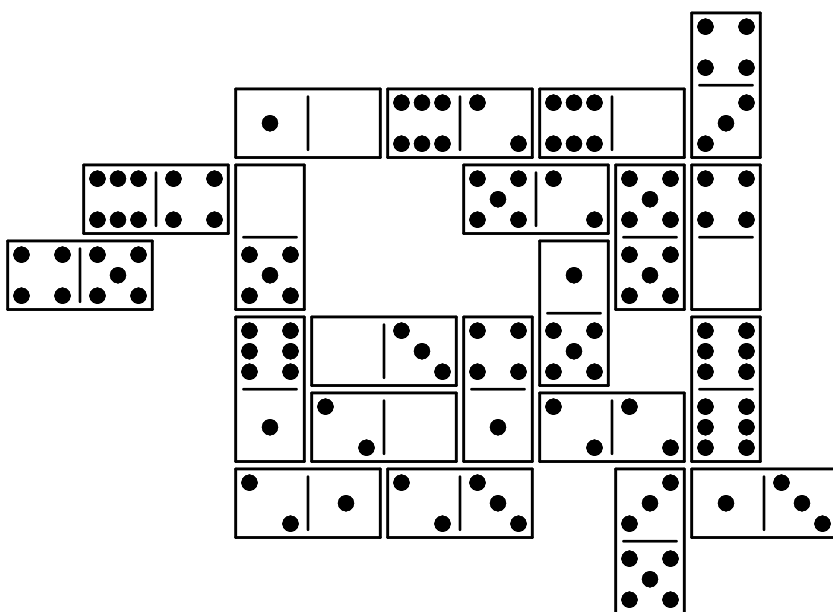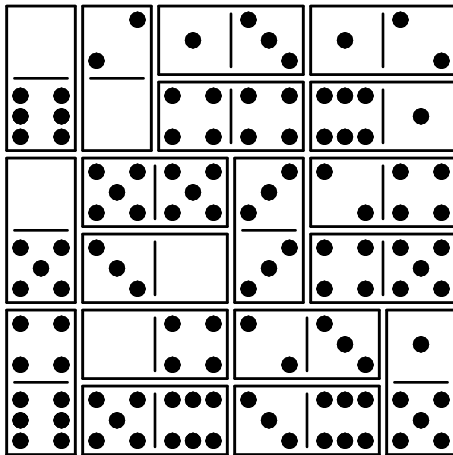
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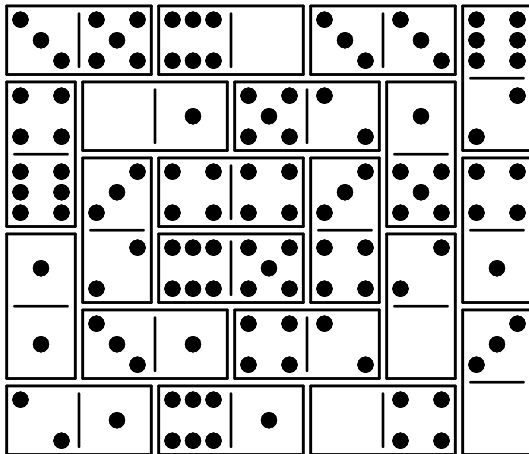
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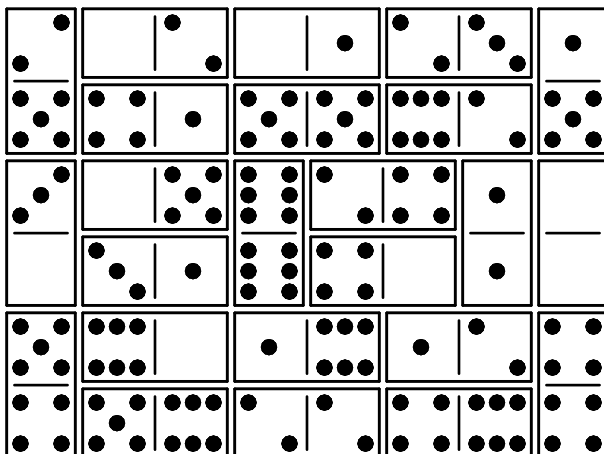
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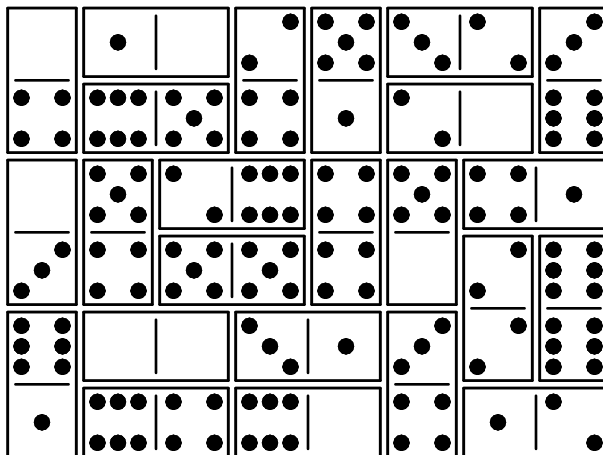
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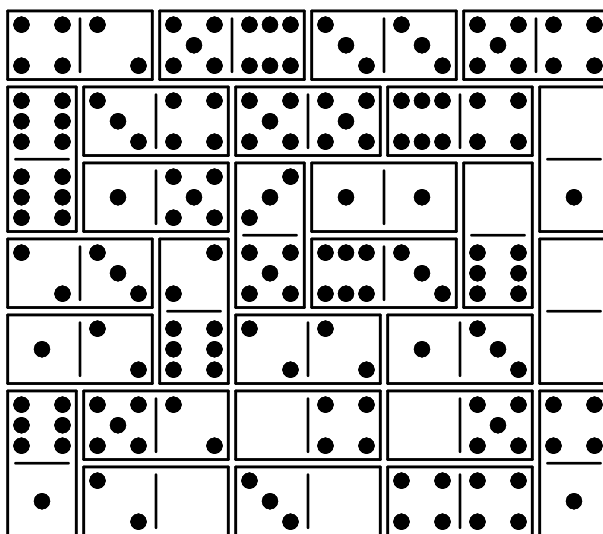
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Problem 20
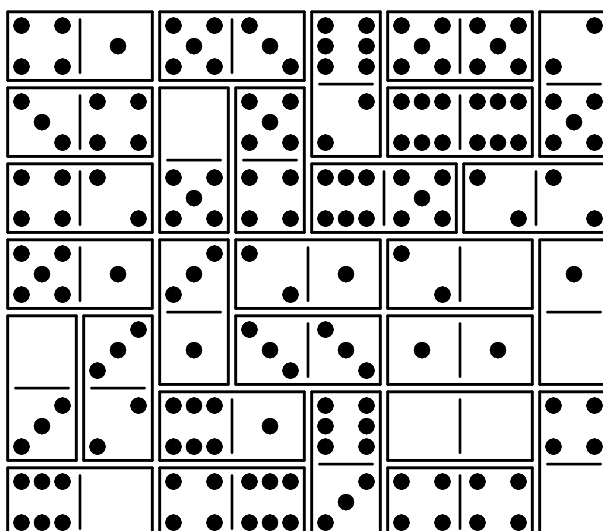
Domino Puzzles By Other Designers

Dominosa

The domino puzzle I often see is called either Dominosa or Domino Solitaire. You start with a grid of numbers, and you have to lay the dominoes on them. It was invented by O.S. Adler in 1874. There's an interesting proof that this puzzle is NP-hard.

Reiner Knizia published some puzzles called Domino Knobelspass that are very similar to Dominosa.

Mountains and Valleys

Sid Sackson included this in his Beyond Solitaire book, and I adapted it from paper, pencil, and dice to use dominoes.

To start, shuffle a set of double-six dominoes face down, then turn 18 of them face up. The remaining 10 aren't used. Then arrange the dominoes into a 6x6 square of numbers that represents a map of mountains and valleys, where blanks are at sea level, and sixes are the highest peaks. The goal is to make a map where you can walk to every square. You can walk from one square to its neighbour if the two heights are the same or differ by one. (You can't climb cliffs.)

For example, this set of 18 dominoes:
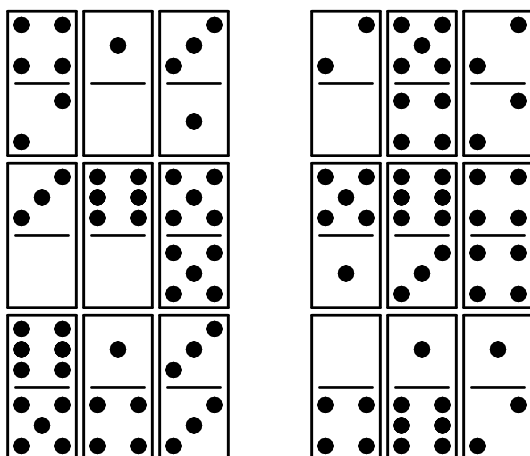
Can be arranged into this solution:
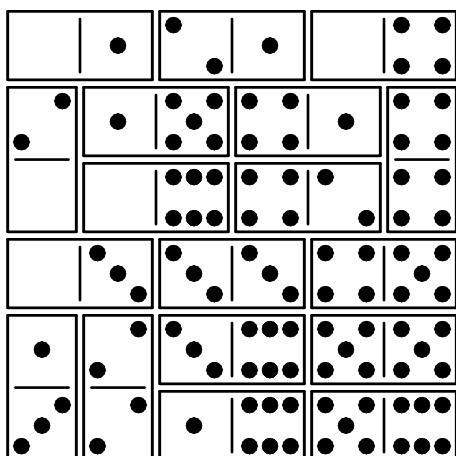
I like this solitaire, because it can almost always be solved, though finding a solution can be very difficult. There's usually more than one solution. For example, you can flip the 56 domino, above. There is a trivially unsolvable situation whenever one of the numbers from 1 to 5 is completely missing, but that can be quickly checked, and I haven't found any other unsolvable combinations.

Cooperative Version

You can play Mountains and Valleys cooperatively with other players. Shuffle the dominoes face down, then draw 9, 6, or 5 dominoes each when there are 2, 3, or 4 players, respectively. Keep your dominoes hidden from the other players.

Randomly choose a player to go first. That player chooses one of their dominoes and passes it to the player on their left. The player receiving the domino plays it on the table, then chooses one of their dominoes and passes it to the player on their left. Play continues in the same pattern until a 6x6 square is complete. After the first domino, all dominoes must be played so they have at least one neighbour, and they can't be moved after they are added.

When the 6x6 square is complete, see if the whole map is connected as described in the solitaire game. If you need a step of more than one level to get from one section of the map to another, you get a penalty of the number of levels. For example, if a map is completely connected except that you need to go from a 3 to a 5, then you would have a 2 point penalty. A perfect game is zero, and anything under 5 is a good game.

With four players, the last two players will each have an extra domino left at the end of the game.

For a harder solitaire version, draw 18 dominoes, but only turn five of them face up. Each time you play a domino, turn another one face up, until you've turned up all 18. Then play the last five. Use the same placement and scoring rules as the cooperative version.

Fujisan

James Droscha designed this for the piecepack game system, and then adapted it for dominoes and pawns in a paper on using entangled components in solitaire games.

Four Shinto Priests have traveled from their various prefectures in pilgrimage to the top of Mount Fuji. You must find pathways for them to move up and down the mountain until they can all achieve the peak. Often, this will require you to guide them into positions from which they can assist each other.

Setup

Remove all dominoes with the number six and all doubles from a standard set of double-six dominoes. Shuffle the remaining 15 dominoes face down, then place twelve face-up dominoes side by side. Leave the three remaining dominoes face down, and use them to lift up the two middle dominoes as the peak of Mount Fuji. Here's an example layout:
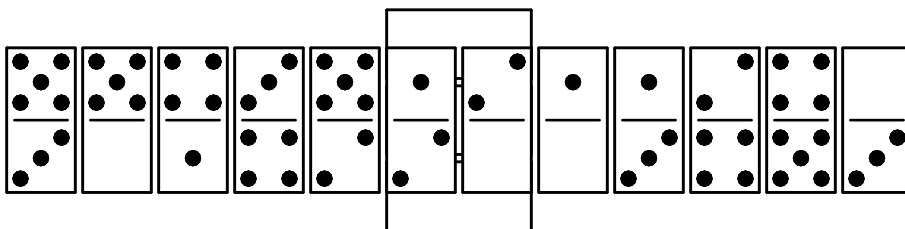
Place a Priest (pawn) beside each number at both ends of the mountain.

Moving a Priest

1. A Priest may move onto a space if the number matches the number of unoccupied spaces the Priest must move in a straight line to get there (including the destination space itself, but not including the space the Priest's starting space). For example, a Priest may move onto a space containing a value 4 coin if there are 3 unoccupied spaces between it and the Priest.
2. Occupied spaces (containing intervening Priests) are not counted when determining if a Priest may move onto a particular space. For example, a Priest may move onto a space containing a value 2 coin if there are 3 occupied spaces and one unoccupied space between it and the Priest.
3. A Priest may move freely between the two spaces on a domino. This is the only manner in which a Priest may move onto a blank space.

4. Once a Priest lands on the peak of the mountain, he will refuse to leave it, but he can move back and forth (in the same domino) or to and fro (between the two dominoes). Clarification: A Priest may pass over the peak dominoes as part of a move.
5. A Priest must enter the mountain from his own starting row; that is, he cannot move back or forth while he remains on the ground.

Goal

The Priests will be content when they all reach the top of the mountain.

Variant

Country Road: Once all four Priests have reached the peak, move the dominoes at the peak to the Priests' original setup positions at the two ends of the mountain and continue until all four Priests have left the mountain.

Treat the spaces at the peak as blanks. Once a Priest leaves the mountain, he will not step back on.

Fujisan Problems

Shuffling the dominoes generates a nice set of problems. In 1000 randomly generated problems, 92% were solvable. Of those, the median solution length was 14, with half of them between 12 and 16. Here are some more challenging problems for you to try. The solutions are listed at the end.
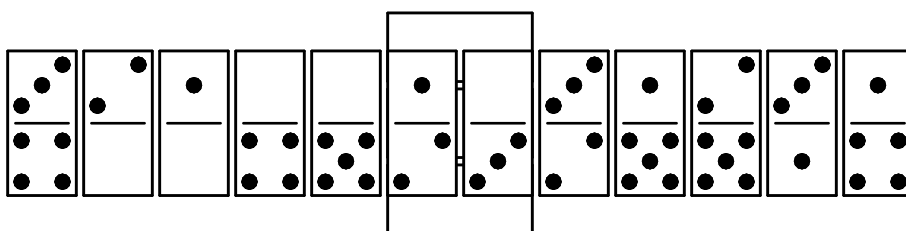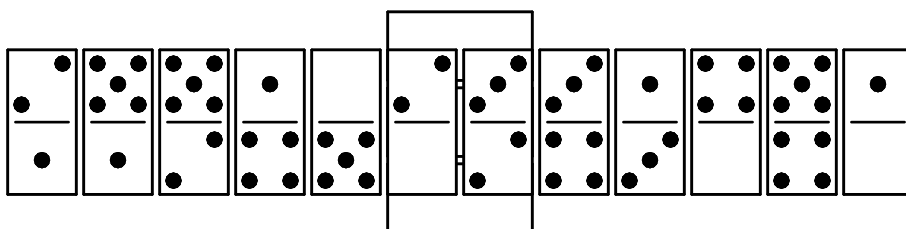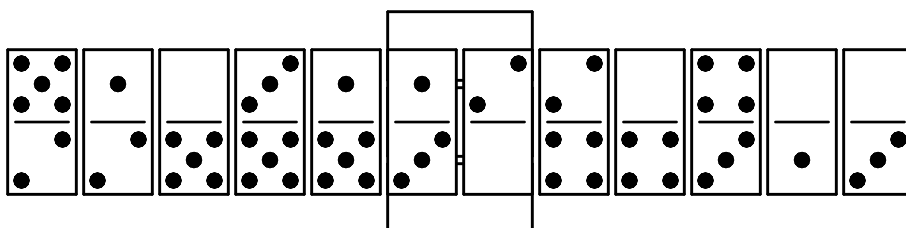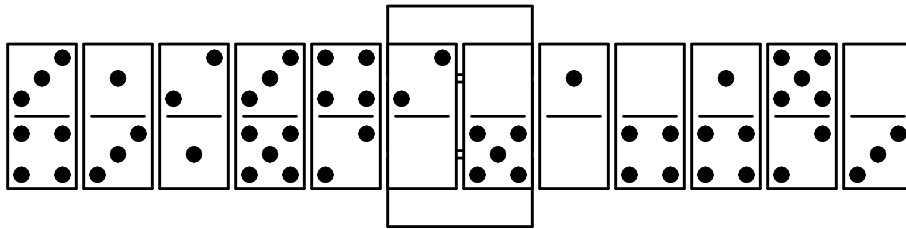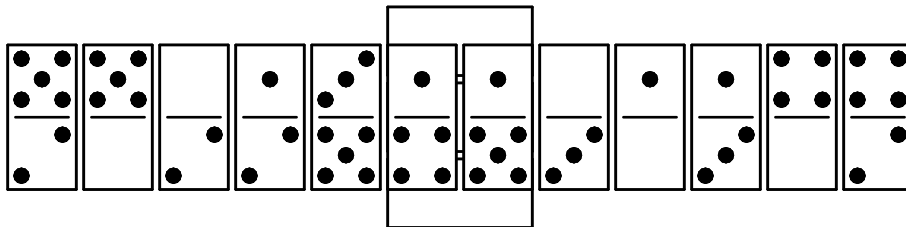
Problem 1

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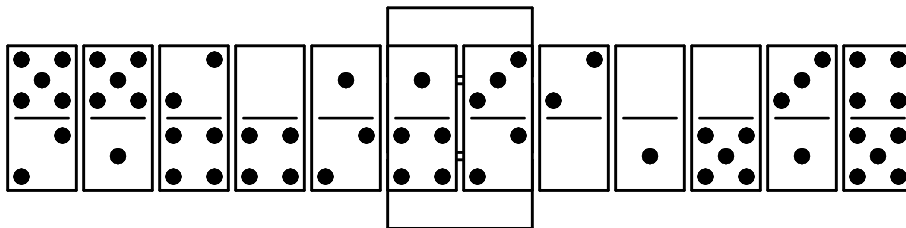
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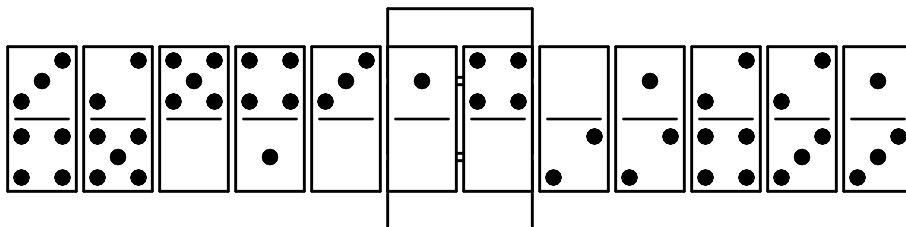
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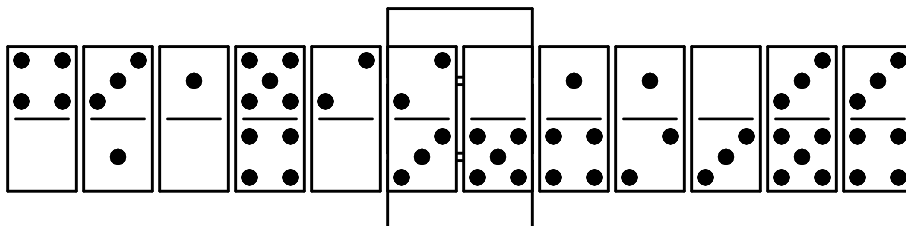
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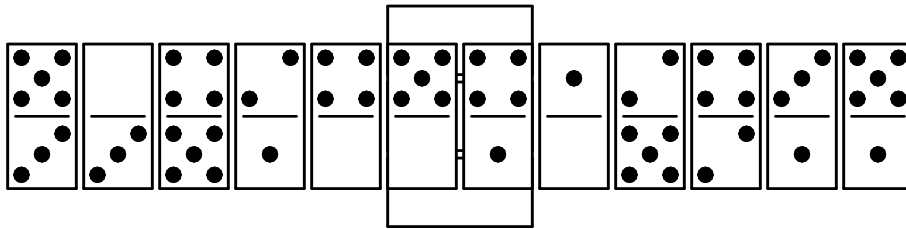
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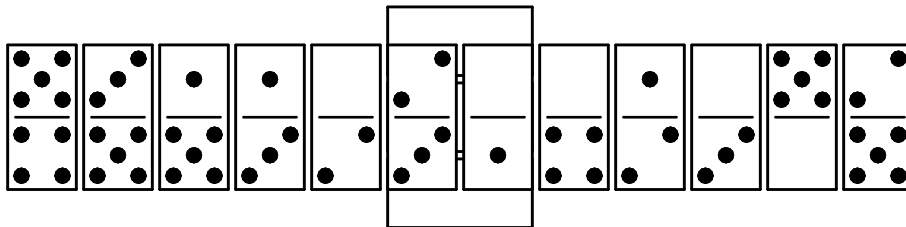
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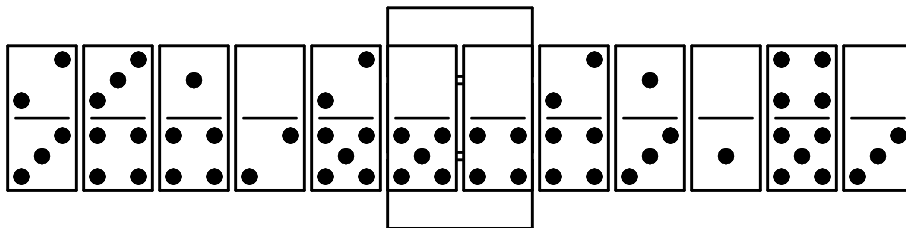
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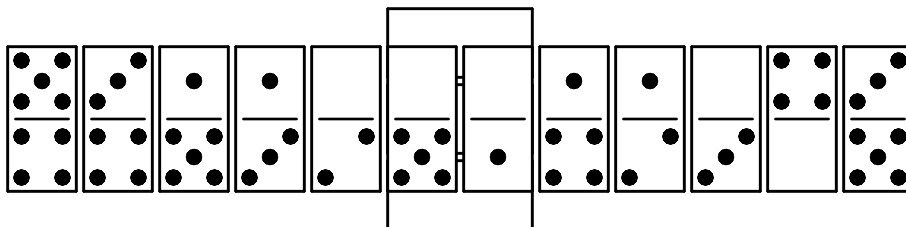
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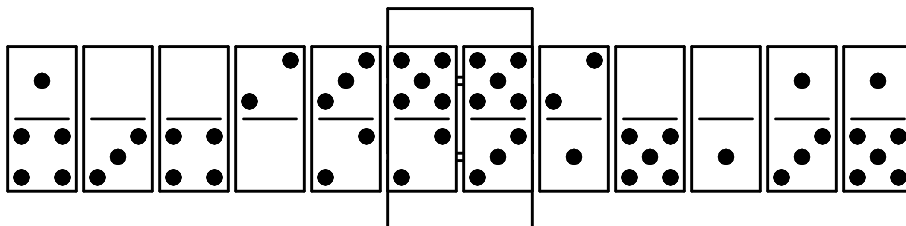
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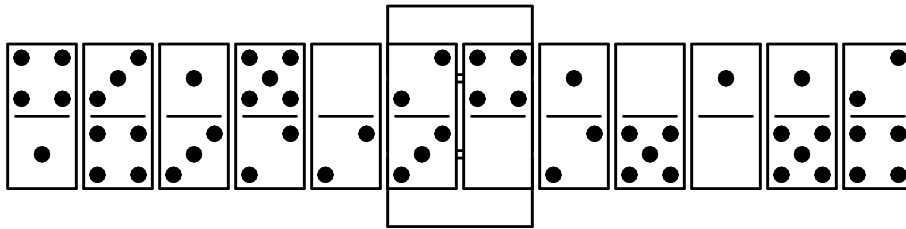
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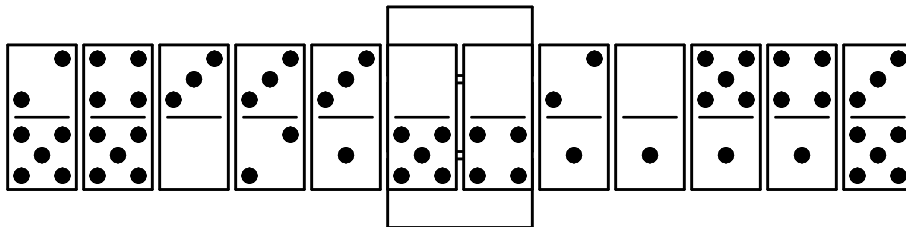
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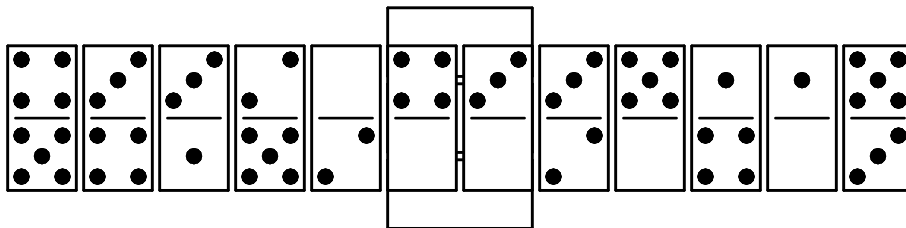
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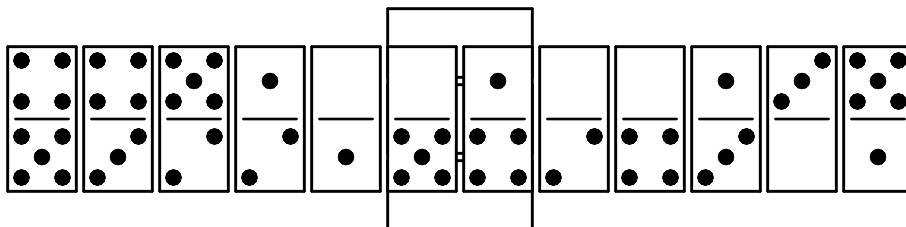
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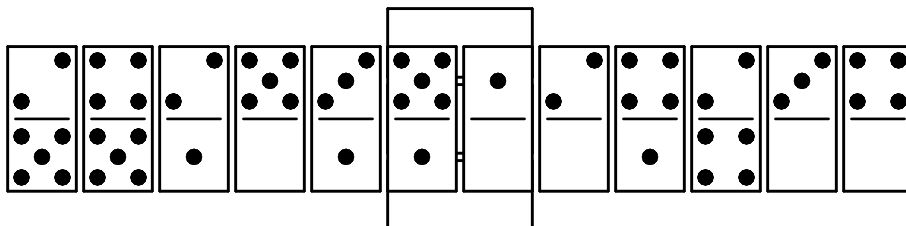
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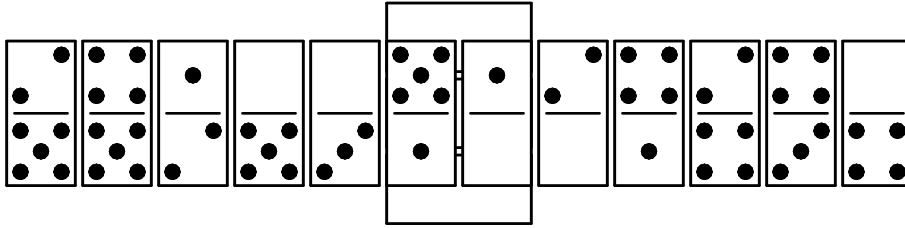
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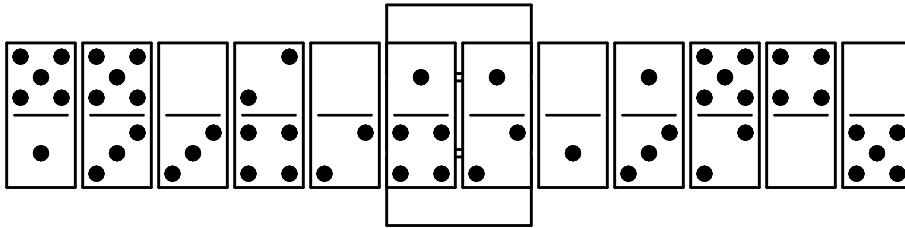
Problem 20

Solutions

Blocking Donimoes Solutions

Here are the solutions to the Blocking Donimoes problems. For each step, move the listed domino left, right, up, or down.

1. 24R, 24R, 23D
2. 24U, 02L, 02L, 02L, 24D, 46D
3. 53L, 53L, 63D, 24L, 34D, 24L, 24L, 24L, 34U, 63U, 30L, 53L
4. 20L, 63L, 62L, 54U, 20L, 63L, 62L, 05U, 20L, 20L, 20L, 05D, 54D, 63L, 62L
5. 65L, 65L, 52D, 14D, 53D, 34D, 04R, 04R, 60U, 10U
6. 04D, 04D, 43R, 43R, 43R, 04U, 50U, 06L, 51U, 02L, 00U
7. 06L, 54L, 06L, 06L, 06L, 06L, 43U, 46L, 43U, 54L, 46L, 46L, 16U, 54L, 54L, 43D
8. 22R, 22R, 22R, 22R, 34D, 50D, 54L, 25D, 50U, 54L, 54L, 34D, 46R, 54R, 54R, 50D, 46R, 46R, 34U
9. 21L, 06R, 16R, 21R, 62R, 64U, 64U, 24L, 62L, 04U, 04U, 11L, 11L, 13D, 03D
10. 43U, 31U, 43U, 31U, 43U, 31U, 43U, 31U, 43U, 25U, 30R, 53U, 30R, 25U, 53U, 53U, 00R, 25U
11. 23L, 52R, 12R, 34R, 23R, 23R, 05D, 10L, 40L, 45L, 60L, 41L, 64L, 65U, 65U, 52R, 12R, 34R
12. 12R, 66R, 10D, 16L, 63L, 12R, 54D, 63R, 16R, 10U, 66L, 62D, 10D, 16L, 12R, 63L, 60L, 12L, 16L, 10U
13. 11D, 22D, 11D, 22D, 40R, 40R, 63U, 63U, 20R, 50R, 01U, 21R, 21R, 01D, 50L, 23D, 61D, 20L, 63D, 63D, 40L, 40L, 22U, 11U
14. 31R, 40L, 44D, 46R, 31R, 23U, 56U, 55L, 55L, 33L, 33L, 63L, 63L, 54D, 54D, 11R, 11R, 44D, 25L, 25L, 41D, 25L, 44U, 11L, 11L, 54U, 54U, 63R, 33R, 55R
15. 55R, 21R, 65D, 65D, 33R, 33R, 43U, 66U, 45L, 25L, 35L, 00D, 44L, 44L, 44L, 11U, 61U, 00U, 35R, 25R, 45R, 66D, 65D, 21L, 55L, 11U, 61U, 13R, 32R, 40R, 43D, 33L, 22L, 05L
16. 32U, 42L, 46L, 32D, 12L, 56L, 50L, 52U, 52U, 20R, 20R, 04R, 04R, 34U, 13U, 55R, 55R, 66U, 55R, 13D, 55R, 34D, 04L, 20L, 52D, 04L, 20L, 52D, 50R, 56R, 12R, 32U, 66U, 26L, 33L, 45L, 46R, 42R
17. 45R, 42R, 02D, 42R, 06R, 06R, 64D, 64D, 11L, 51L, 66L, 11L, 51L, 66L, 10U, 10U, 42R, 42R, 61U, 14U, 35R, 25R, 45R, 65U, 65U, 65U, 40R, 45L, 25L, 14D, 35L, 42L, 61D, 42L, 62L, 33L, 10D, 10D, 66R, 51R, 11R
18. 60R, 53U, 53U, 43R, 15R, 60R, 40U, 40U, 25L, 25L, 46U, 42U, 05L, 41L, 13U, 13U, 41R, 05R, 42D, 46D, 32R, 61R, 03R, 25R, 25R, 40D, 40D, 60L, 15L, 43L
19. 41U, 22L, 35U, 35U, 13L, 13L, 66D, 40D, 43D, 66D, 40D, 43D, 60R, 60R, 55U, 55U, 52R, 62R, 10R, 05U, 45R, 61U, 05U, 64R, 61D, 45R, 64R, 64R, 45R, 05D, 45R, 05D, 10L, 62L, 52L, 55D,

55D, 60L, 60L, 43U, 40U, 66U
20. 53L, 66L, 23L, 53L, 22D, 22D, 60R, 44R, 50R, 60R, 42R, 44R, 50R, 42R, 33U, 33U, 66L, 66L,
    51U, 52U, 54U, 55R, 55R, 11U, 11U, 01L, 65L, 63L, 64L, 16D, 20R, 16D, 40U, 41U, 16U, 20L,
    40U, 41U, 16U, 64R, 63R, 65R, 55R, 54D, 01R, 11D, 52D, 51D, 66R, 66R, 33D, 33D, 42L, 50L,
    44L, 60L

Capturing Donimoes Solutions

Here are the solutions to the Capturing Donimoes problems. For each step, move the listed domino left,
right, up, or down. Then make captures for any matching numbers.

1. 10D, 14R, 23D, 14R
2. 60R, 10R, 12D, 12D, 53R
3. 21R, 34U, 45R, 34U, 16U
4. 03L, 46L, 05R, 34U, 45R, 46L, 45R
5. 54R, 20D, 46D, 06L, 36R
6. 34L, 64L, 55L, 35D, 50R, 60D
7. 61D, 43R, 55R, 53D, 53D, 20R, 36R
8. 26R, 24L, 65L, 01L, 30L, 06U, 30L
9. 40D, 65D, 54L, 01D, 36D, 15R, 23D
10. 30U, 56L, 30D, 10U, 10U, 63R, 30D, 41R, 60D, 25R, 41R, 41R
11. 21L, 23L, 60L, 05L, 65L, 33D, 42R, 42R, 01R, 30L, 60R
12. 30D, 54L, 20L, 54L, 54L, 20L, 20L, 64D, 25R, 15L, 15L, 12R
13. 63L, 01L, 50L, 50L, 21D, 66R, 64D, 40R, 40R, 15R, 43U
14. 50D, 45D, 36D, 22D, 66U, 46R, 46R, 60D, 30L, 01D, 01D, 26R, 12R
15. 12R, 44R, 44R, 33U, 20U, 05U, 46U, 56L, 56L, 30L, 45L, 15U, 36R, 15U
16. 21L, 61L, 04L, 04L, 20D, 15D, 52R, 01R, 32U, 46D, 65L, 41U, 34U, 01R, 35R
17. 54D, 60L, 60L, 25D, 02L, 02L, 01L, 01L, 55L, 62L, 11U, 11U, 40R, 44U, 46R, 22R, 46R, 22R, 16L
18. 61D, 60L, 60L, 31L, 31L, 03D, 04D, 10L, 54D, 26L, 10L, 26L, 24D, 51D, 51D, 41L, 36D, 41R, 34U,
    34U, 12L, 20R, 34U
19. 41D, 30R, 12L, 61U, 61U, 20R, 26D, 13L, 34L, 06D, 34L, 55L, 35U, 35U, 11R, 64R
20. 25U, 40D, 10D, 63D, 60R, 60R, 32D, 20R, 31D, 65R, 62D, 21R, 51R, 34L, 53R, 51R

Fujisan Solutions

Here are the solutions to the Fujisan problems. To distinguish the four different pawns, the top left is
labelled as a (P)awn, the bottom is a k(N)ight, the top right is a (B)ishop, and the bottom right is a
(R)ook.

1. NR4, NR2, PR2, PR1, PD, PR3(+1), BL1, BL2, BD, RL5(+3), RU, RR1, PU, BL3
2. NR1, NU, BL1, BD, BL3, RL4(+1), RU, BU, BL5(+1), RL5(+1), PR1(+3), NR2(+3), ND, PR2,
   RR3(+2), RD, BR3(+1)
3. NR5, NR4, RL4(+1), NL5(+1), NU, PR3(+1), NR1(+1), PD, PR4(+1), RR3(+1), RU, PU, NR4(+1),
   BL2(+3), RL2(+3), PL1(+2), PD, RD, NL2(+1), BL1(+1)
4. RL4, RL5, RU, PR4(+1), PD, RD, NR5(+2), NU, RR4(+1), RR3, RU, PU, PR5(+1), BL1(+2),
   PL4(+2), PD, PR4, PU, BL2(+2), BD, PL2(+1), RD, RL5
5. NR5, NL2, NL2, NU, RL3, RL5, RU, RL1, PR3(+2), PD, PR3, PU, NR3(+1), RR1(+1), NR4(+2),
   ND, PR4, NU, BL1(+2), NL1(+1), NL3(+1), NR1(+1), BD, BL4, PD, PL5
6. NR4, NU, NR1, NL2, ND, NL1, NU, PR2(+1), PD, ND, NR2(+1), NR5, NU, NL2, NR4, ND, PR2,
   PR5, PU, PL2, RL1(+1), RU, NU, BL3(+3), BD, NL3(+2), PL1(+1), RD, RL4(+1)
7. BL1, BL2, BD, BL2, PR2, PR3, PD, PR4(+1), BR3(+1), RL2(+2), BL2(+2), BU, BL3, RU, RL5(+1),
   BL3(+1), BD, RD, PL2, PL5(+1), NR1(+3), RU, PU, PR4(+1), PD, RR4, NU, BU, BR3(+1),
   NR1(+1), ND, BR1
8. RL3, RU, RL1, RL5, RL1, RR2, RL4, RD, NR1(+1), NU, RU, PR1(+2), RR2(+2), RD, NR2(+1), PD,
   PR4(+1), RR5(+1), RL2, ND, NR3(+2), RU, RR3, PU, PR3, NU, BL1(+3), PL1(+2), PL2, PR,
   NL2(+2), ND, BL2(+1), RD, RL5
9. RL1, RL1, RU, RL2, RL4, RD, RL1, RU, PR4(+1), RD, RR5, RU, PR4(+1), PD, RL1, RR3, PU,
   BL2(+2), PL1(+1), RL4(+2), BL4(+2), PL5(+2), PD, RD, RL3, BD, NR1(+3), PU, PR5, PD, BU, RU,

RR4(+1), RD, BR4, NL3, NU, NR5

10. RL3, RU, RR2, RD, RL4, RL5, NR3(+1), NR4, NL5(+1), NU, RR2, RL4, RU, PR1(+2), PD, ND, RD, RR2(+2), NR4(+2), NU, NR1, ND, PR4(+1), RR3(+2), RU, NU, NR2(+1), PL5, PR2, PU, PR5(+1), BL1(+3), ND, NL4, NL1, RD, PD, PL3(+2), PU, PR, BL2(+1), RL3(+1)

11. NR5, NU, NL3, ND, NR2, NR4, NU, NR1, ND, NR1, RL4(+1), RR3(+1), NL5, RL4, RL4(+1), RU, RL2, NU, NL3, PR1(+2), RR2(+2), RD, NR2(+1), PD, PR4(+1), RR3(+1), PR1(+1), PU, RU, NR4(+2), BL2(+3), ND, NL4, BD, RD, PD, PL4(+3), NU, BR3(+1), BL5(+1), BU, PR4, RR3, RL5(+1)

12. RL3, RU, RL1, RL1, RD, RL5, RR2, RL4, NR3(+1), NR4, NL5, NR2, NU, NL3, RU, PR1(+2), PD, ND, RD, RR2(+2), NR4(+2), NU, NR1, ND, PR4(+1), RR3(+2), RU, NL5(+1), PU, NR2, NU, NR4(+2), ND, PR3(+1), NU, BL1(+3), ND, PD, PL5(+1), PU, NL5, RL1(+1), RD, BD, BL1(+1), BU, RL1

13. BL1, BL1, BD, BL1, BU, BL2, BL3, BD, BL3, BU, PR1, PR2(+1), PD, PR5, PL1, PR3, PU, PR1, PD, BR2, BD, BR5, BL1, BR3, RL1(+2), RU, BU, PU, PL2(+2), PL3, PD, PL4, BL2(+1), BL3, BD, RL2, RD, RL4(+1), RU, BL3, RD, NR2(+3), PR2(+3), PU, BR3(+2), RR2(+1), NL4, NU, NR5(+1)

14. NR3, NR2, NU, NL3, ND, NR2, NR5, NU, NR1, NR2, BL1(+1), NL1(+1), ND, NL2, NU, BL1, BL5(+1), BL1, BD, BR2, BU, ND, NR4, NU, NL1, NL1, NL5(+1), NL1, ND, NR2, BL4, NU, NL3, PR1(+2), PD, ND, BD, BR2(+2), NR5(+2), NU, PR5(+1), BR5(+1), NR1, ND, RL2(+3), RU, RL2, PL3, PR, NL3(+1), BU, BL4

15. PR3, PL2, PR3, PD, PR1, PU, PR5, PD, PL1, PU, PR3, PD, RL1(+1), PL1(+1), PL1, PU, RU, RL2(+1), PL3(+1), RL3(+1), RD, PR5, PL2, PD, PL5(+1), PU, RU, RL2(+1), RD, PD, NR2(+2), PU, PR3, PR5, PD, PL1, NU, RU, RR3(+1), NR5(+1), PU, RR4(+2), BL2(+3), ND, NR1, NL4, NU, RD, RL5, BD, PD, PL5(+2), PR4(+1), BL5(+2), RU, BR5

16. PR3, PD, PR2, PU, PL3, PR2, PR5, PD, PR3, PU, BL1(+1), PL1(+1), PD, BL3, BD, PL5(+1), PU, PR5, BU, BR1(+1), PD, BD, BL5(+1), BL1, BR2, BU, BL4, BD, PL5, PL1, PR2, PU, PL3, PD, NR1(+2), PR2(+1), NU, BU, BR2(+1), NR5(+1), ND, NR3, BR5, BD, PR4(+1), RL2(+3), PU, PL3, PD, BU, RU, RR1(+1), NU, NL4(+2), ND, BR1(+1), BL4(+1), RL3

17. RL3, RL2, RU, RL5, RR1, RD, RR1, RL3, NR2(+1), NU, RR2, ND, NR1(+1), NR4, NU, NR1, ND, NL2, RR4(+1), NU, NR3, ND, RU, RR1, RD, RR1(+1), RU, NU, BL1(+2), BD, ND, RD, RL2(+2), RU, RL5, RR1, RD, NL2(+1), NU, NL5, ND, BL2, BL5(+2), BU, NU, RR1, RL3, RU, PR1(+3), PD, PR1, PU, ND, NR4, NL, NU, PR1(+1), BD, BR5, RD, RR4(+1)

18. BL4, BL5, BD, BL1, BU, BL2, PR2(+1), BR3(+1), BR4, BL5, PL2, PR3(+1), BR4(+1), BD, PD, PR4(+1), PU, PL2, PD, BU, BL5, BD, PL5(+1), BL1, BU, BL2, BD, NR1(+2), PU, BU, BR3(+1), BR4, BD, PR3, PD, PR4(+1), PU, PL2, PD, BU, BL5, BD, NR1(+1), BR4(+2), BU, BL2, BR3, BD, NR4(+1), PU, PR4, PD, RL1(+3), RU, PU, PL5(+1), BU, BL2(+1), NU, NL1(+2), ND, RL1(+1), BD, BL1(+1)

19. BL4, BD, BL5, BU, BL1, BL2, BD, NR2(+1), BR3(+1), BU, BR4, BD, BL5, NU, NL2, ND, NR3(+1), NU, BU, BR4(+1), BD, ND, NR4(+1), NU, NL2, BL5, ND, NL5(+1), NU, BU, BL2(+1), PR1(+2), ND, BD, BR3(+1), BU, BR4, BD, PL2, PD, PR3(+1), PU, NR3, NR4(+1), NU, NL2, ND, BL3(+1), BR4(+1), BU, NU, PR4(+2), ND, NR4, PD, BD, RL1(+3), BU, NU, NL5(+1), BL2, BL1, BD, RL3(+1), PL5(+2), PR1(+1), RU, RR1(+1)

20. NR3, NR2, NU, NR5, ND, RL3(+1), NL1(+1), RL4(+1), RU, NU, NL5(+1), ND, RD, NR2(+1), NU, RU, RR5(+1), RL1, RD, RL1, RU, RL5(+1), ND, NL3, NL1, NU, PR2(+2), PD, NR2(+1), RD, RR2(+1), RU, NR5(+1), NL1, ND, PU, PR5(+1), PL1, NL1, NU, RR4(+2), RD, PD, PL1, PL4, PU, NL5(+1), PD, ND, NR2(+1), NU, PU, PR5(+1), PD, ND, NR5(+2), NU, PU, RU, BL1(+3), BD, PD, PL2(+1), PU, BL2, RD, ND, NL4(+2), NU, RL4(+1)

Contributing

Found some interesting problems to solve? Ideas to share? Get in touch at donkirkby.github.com/donimoes.

Capturing and Blocking Donimoes are original puzzles designed by Don Kirkby.