

Bulgarian Solitaire

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How to play Bulgarian Solitaire:

1. Place any number of beans placed in any number of different piles.
2. Each turn, take one bean from each pile and form a new pile with them. (For example, a pile of 2 and a pile of 3 would become a pile of 1, a pile of 2, and a new pile of 2).
3. Continue playing until bored.

Try out some of these Bulgarian Solitaire starting positions:

A. Four beans in piles of 1, 1, and 2

B. Five beans in piles of 2 and 3

C. Six beans in piles of 2, 2, and 2

D. Seven beans in piles of 1, 2, and 4

E. Eight beans in piles of 4 and 4

F. Nine beans in piles of 4 and 5

G. Ten beans in piles of 5 and 5

Question 1: Are A - G sinks or cycles?

Question 2: Does getting a sink or a cycle depend on the total number of beans you start with, or on the number of piles you start with, or on the way you organized the beans into piles to start with, or.....?

Let's Investigate!

H. Six beans in piles of 3 and 3 or in piles of 2 and 4. How do these games differ from six beans in piles of 2, 2, and 2?

I. Eight beans in piles of 2, 2, and 4 or in piles of 1, 2, 2, and 3. How do these games differ from eight beans in piles of 4 and 4?

Question 3 (sort of): Make a conjecture about what determines if we get a sink or a cycle.

Question 4: Can we expand our previous graphs to include these new results for 6 and 8 beans?

Question 5: Draw graphs that shows all possible Bulgarian Solitaire games with 1, 2, 3, 4, and 5 beans (separate graph for each number of beans). **Hint:** First determine what possible starting positions there are for each number of beans.

Question 6 (sort of): Make a prediction about when a game of Bulgarian Solitaire will result in a sink or a cycle.