

Rotate the die up to 31 game

Rules.

A regular 6-sided die, in which the sum of the numbers on any two opposite faces is 7, is rolled. The game begins with the number on the top face. Two players take turns turning the die to the side and adding the number on the new top face to the previous sum. Note: the die must be rotated at each move, but only by 90 degrees (it cannot be turned over). The player who first obtains a sum larger than 31 loses.

Strategy.

Make a table of possible positions. Note that a position in this game is a pair (current sum, number on top face). Working backwards, determine all good and bad positions. In the table below, a plus indicates a good position (that is, a position to which it is good to go on our move), and a minus indicates a bad position (one that we do not want to go to on our move).

Sum	1	2	3	4	5	6
31	+	+	+	+	+	+
30	+	-	-	-	-	+
29	-	-	-	-	-	-
28	-	-	+	+	-	-
27	-	-	+	+	-	-
26	-	+	-	-	+	-
25	-	-	-	-	-	-
24	-	-	-	-	-	-
23	-	-	+	+	-	-
22	+	+	+	+	+	+
21	-	-	-	-	-	-
20	-	-	-	-	-	-
19	-	-	+	+	-	-
18	-	-	+	+	-	-
17	-	+	-	-	+	-

16	-	-	-	-	-	-
15	-	-	-	-	-	-
14	-	-	+	+	-	-
13	+	+	+	+	+	+
12	-	-	-	-	-	-
11	-	-	-	-	-	-
10	-	-	+	+	-	-
9	-	-	+	+	-	-
8	-	+	-	-	+	-
7	-	-	-	-	-	-
6	-	-	-	-	-	-
5	-	-	+	+	-	-
4	+	+	+	+	+	+
3	-	-	-	-	-	-
2	-	-	-	-	-	-
1	-	-	+	+	-	-