As usual, we should name the states in this diagram.

This automaton “guesses” which 0 will be the “special” 0 that will be followed by another 0 with 4k letters in between (k, an integer >= 0). It then counts the number of letters following the “special” 0 and checks for a 0 at each multiple of four letters, accepting if it finds one. In other words, it “checks” its guess by verifying there is a 0 after the first with the appropriate spacing.

Some people made the mistake of omitting the 0, 1 loop from the start state back to the start state. This is (almost always) incorrect because it assumes the first 0 must be the “special” zero, which is not the case — it could be any 0 (except the last, but this machine is designed to reject the last 0). (However, by adding other transitions elsewhere, you could avoid this loop — some people successfully designed their machines this way.)

Some people thought you could only have 1’s between the two 0’s; this is not a restriction given in the problem specification. Thus, the transitions around the loop must be 0, 1 except for the first one, labelled 1 in the diagram; it can be either 0, 1 or 1.

You can have all sorts of different but equivalent versions of this diagram, such as having two final states depending on if the string contains “00” (with nothing between the zeros) or not. There was another, slightly different way to design the loop, too.