The cannibals and the missionaries - solution

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Let us construct a graph with each node labeled by a triple (a, b, c), where $a = \overline{0, n}$, $b = \overline{0, m}$ and $c = \overline{0, 1}$. We can give a node the following meaning: we have a cannibals on one side of the river, b missionaries on the same side, and the boat is on the side denoted by c. It is clear, that we do not need to store the number of cannibals and missionaries on both sides of the river, because their sum is always the same, so the number on one side clearly determines the number on the other side.

Let us connect two nodes (a_1, b_1, c_1) and (a_2, b_2, c_2) with a directed edge, if we can get in one "turn" from (a_1, b_1, c_1) to (a_2, b_2, c_2). After this transformation, it should be clear, that the problem asks for the minimal length path between nodes $(n, m, 0)$ and $(0, 0, 1)$. Because every edge has cost equal to 1, the most efficient method is a simple breadth first search.

The only difficulty of the problem was the large number of test cases, but this could be easily solved by precalculating the solution for every $n, m \leq 50$ (this should run in less than 10 minutes), and running the breadth first search only for those 0.01% of big cases.