1 | **Fifteen Square Puzzle**

From the definition of the problem, we have the state (A, B):

- A is a list $(a_1 \ldots a_{15})$ with all the values skipping the empty square

- B is a tuple (X, Y) containing the coordinates of the empty square

We also define "out of order" as pairs of not-necessarily-continuous values that are not strictly increasing, and "parity" as $mod\ 2$ of the number of out-of-order pairs plus the row number of the empty square.

1.1 | **Defining Transitions**

For every single case, there is four possible transitions to make

1. Move empty square up

2. Move empty square down

3. Move empty square left

4. Move empty square right

1.2 | **Proving Invariant**

We will show that the base state has a