$A \to C \to G$

QUESTION 2: STATE SPACE

1) Number of tiles in a (m,n,k) puzzle =

Total number of squares in a (m,n,k) puzzle — Number of empty squares

$$\left.\begin{array}{l}\text{No. of tiles in a}\\ \text{(m,n,k) puzzle}\end{array}\right\} = m*n-k$$

2) Number of distinct states in the state space:

Total number of distinct states = Number of (placing) arrangements of the $m*n$ tiles & empty squares

$$\left.\begin{array}{l}\text{No. of ways in which tiles and}\\ \text{empty squares can fill up the}\\ m*n \text{ slots}\end{array}\right\} = (m*n)!$$

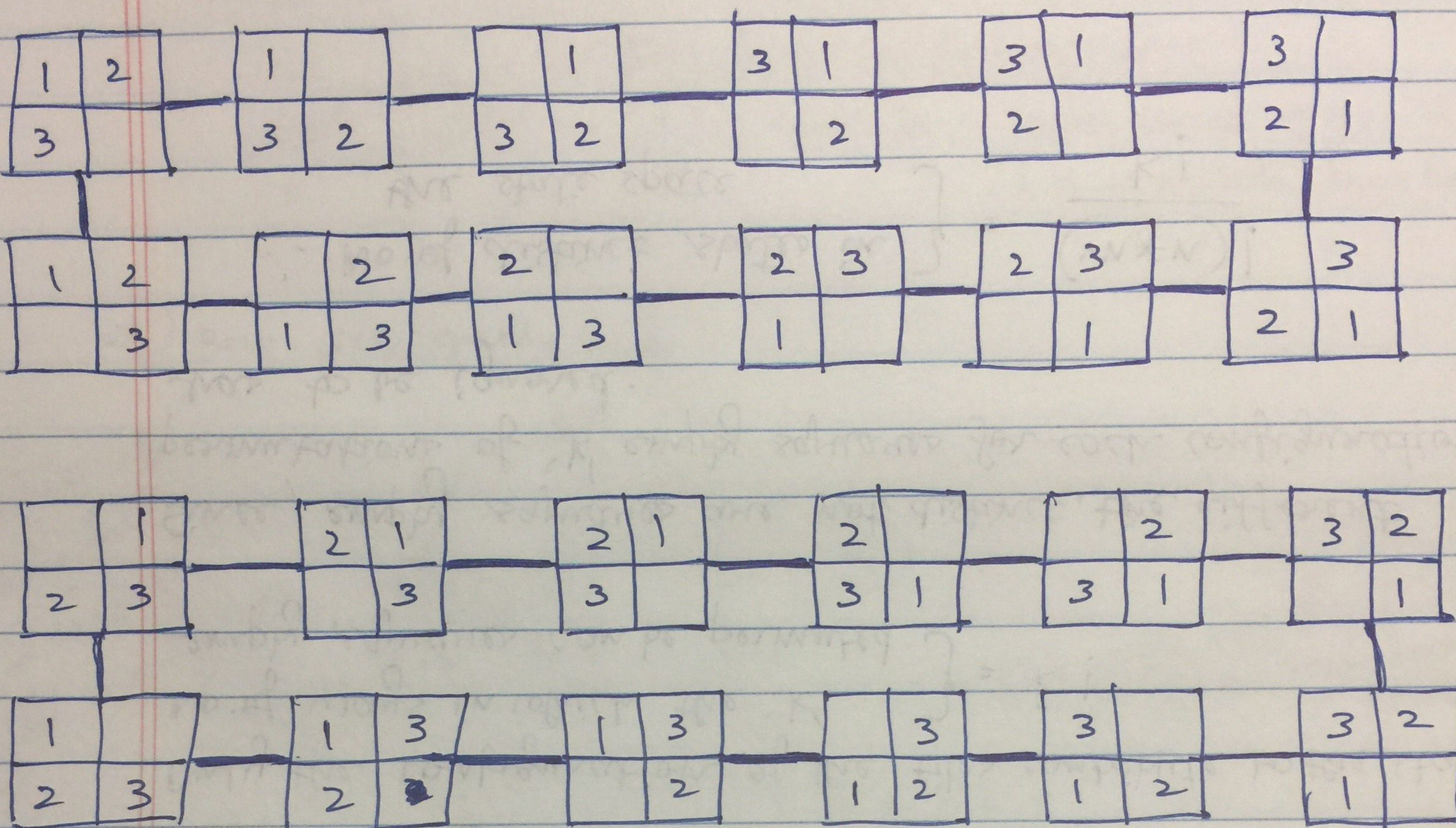
Only the configuration of the tiles contribute to the state.

$$\left.\begin{array}{l}\text{No. of ways in which the `k'}\\ \text{empty squares can be permuted}\end{array}\right\} = k!$$

Since, empty squares are not distinct, the different permutations of 'k' empty squares for each configuration has to be ignored.

$$\therefore \left.\begin{array}{l}\text{No. of distinct states in}\\ \text{the state space}\end{array}\right\} = \frac{(m*n)!}{k!}$$

3) STATE SPACE OF (2,2,1) PUZZLE



The graph corresponding to the state space of (2,2,1) puzzle is an undirected graph (if left move is taken, right move can be taken to reverse it, so are up and down moves) consisting of 24 states (distinct) $[(\,(mn)!/k!\,) = 4!/1! = 24]$

The graph is split into two disconnected components each with 12 states.