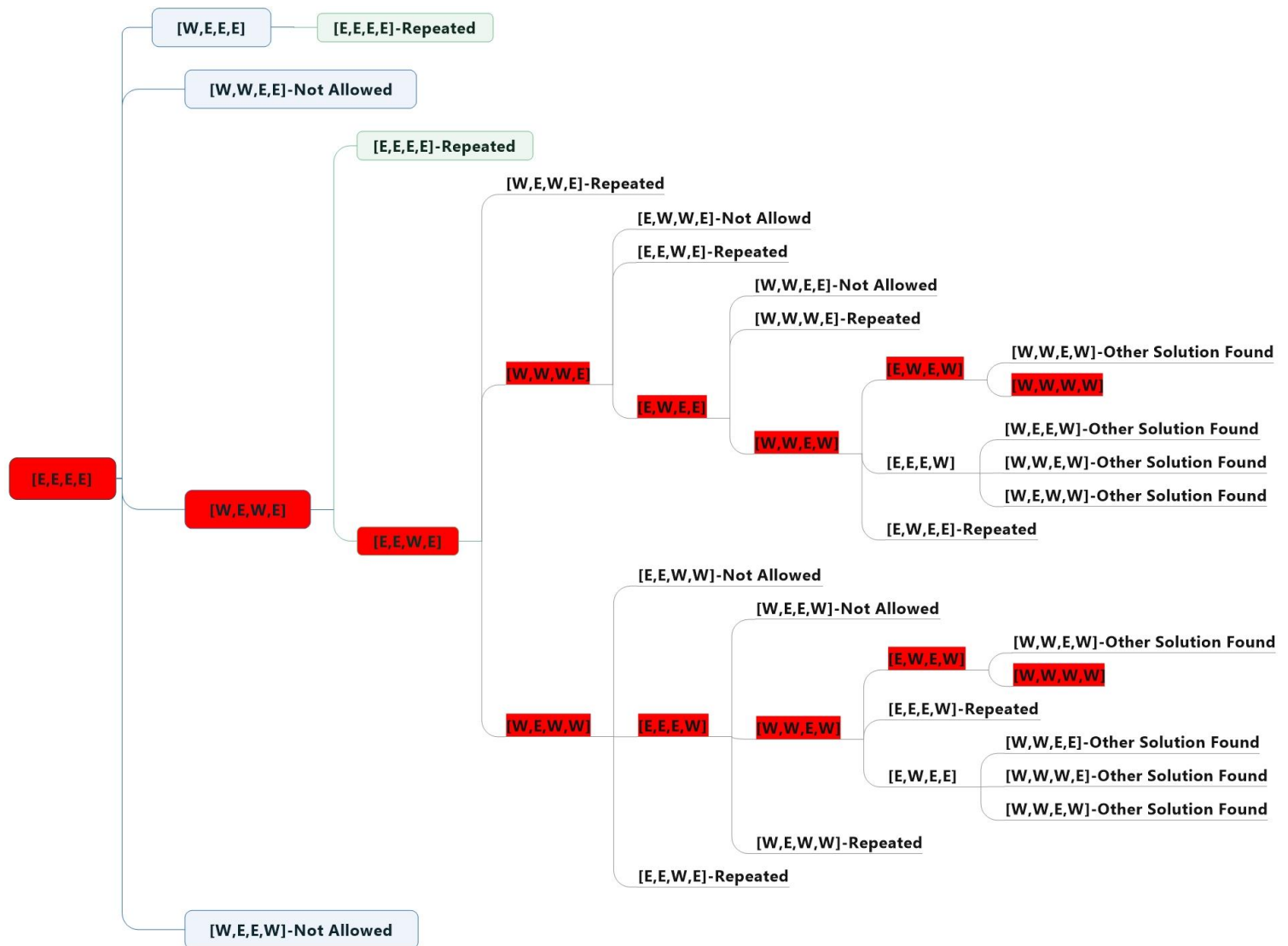


1. (The Man, Cabbage, Goat and Wolf problem) In our class we have discussed this problem as an illustration what computation is. In particular, we abstract the problem as finding a shortest way from $[E, E, E, E]$ to $[W, W, W, W]$. In each step, the first item must change its value (i.e., $E \leftrightarrow W$ or $W \leftrightarrow E$). Moreover, for the other three values, 0 or 1 of them can change its value too. However, some states are not allowed, and they are $[E, W, W, *]$, $[E, *, W, W]$, $[W, E, E, *]$, $[W, *, E, E]$, where $*$ indicates that it can be E or W. Draw a diagram starting from $[E, E, E, E]$ to find all possible solutions.

Solution:



There are 2 possible shortest ways as shown in the diagram in red.

Examination:

The searching process is actually a **breadth-first search with pruning algorithm**. There are 3 pruning conditions:

1. The state is **NOT ALLOWED**.
2. The state **REPEATS** previous state. Hence current state will certainly not lead to shortest way.
3. The current step, current state is not [W,W,W,W] while in other paths [W,W,W,W] **HAS BEEN FOUND**. Hence current state will certainly not lead to shortest way.

The search stops in any of those 3 pruning condition.