CPSC 322
Introduction to Artificial Intelligence

October 6, 2004

Things to look for

Midterm exam is being marked

Solutions posted later this week

Your results available next week

Highlights from a couple of weeks ago

We're moving forward under some assumptions:

Whatever intelligence is, it results from some kind of computation and it's platform independent. It's not unique to brains.

Symbol manipulation is a type of computation that is sufficient to give rise to intelligent behavior.

Any symbol manipulation can be carried out on a Turing machine (and, by the way, computers are TMs).

But keep in mind that these assumptions may be wrong.

Search

A physical symbol system exercises its intelligence in problem solving by search -- that is, by generating and progressively modifying symbol structures until it produces a solution structure.

Allen Newell and Herbert A. Simon, “Computer Science as Empirical Inquiry: Symbols and Search”

Search

In order to cope, an organism must either armor itself (like a tree or a clam) and “hope for the best,” or else develop methods for getting out of harm’s way and into the better neighborhoods of the vicinity. If you follow this later course, you are confronted with the primordial problem that every agent must continually solve: Now what do I do?

Daniel C. Dennett, “Consciousness Explained”

The Cracker Barrel


1
12
14
11
2
15
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10
3
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7
6
13
8
5

8-Tile Puzzle

8-Tile Puzzle

8-Tile Puzzle

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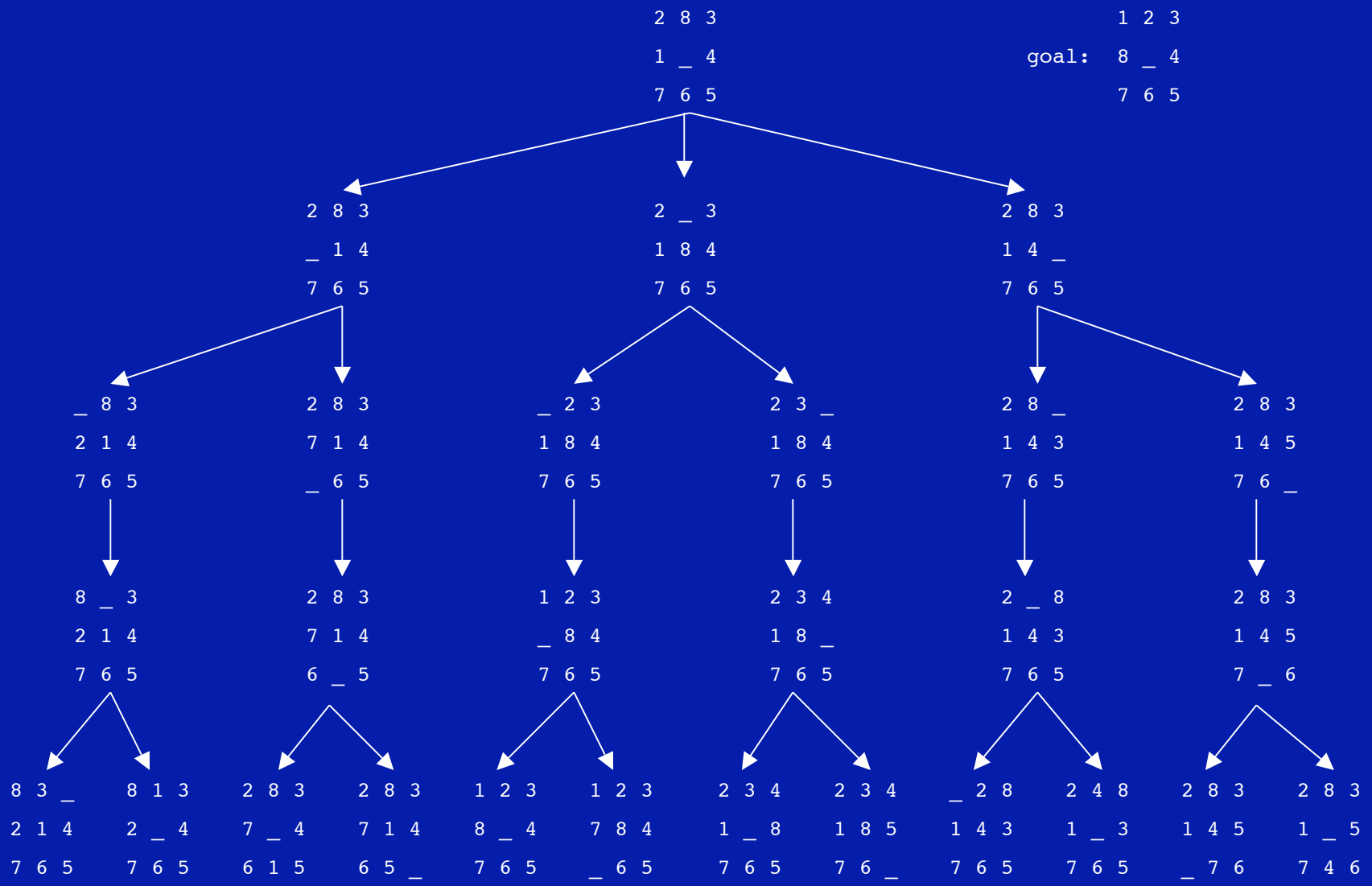
8-Tile Puzzle

What do I do now?

You're AI students, so the obvious answer is search! More specifically, graph search:

Many (why not all?) problem-solving tasks can be mapped onto the problem of finding a path in a graph

8-Tile Puzzle (just a little bit of it)



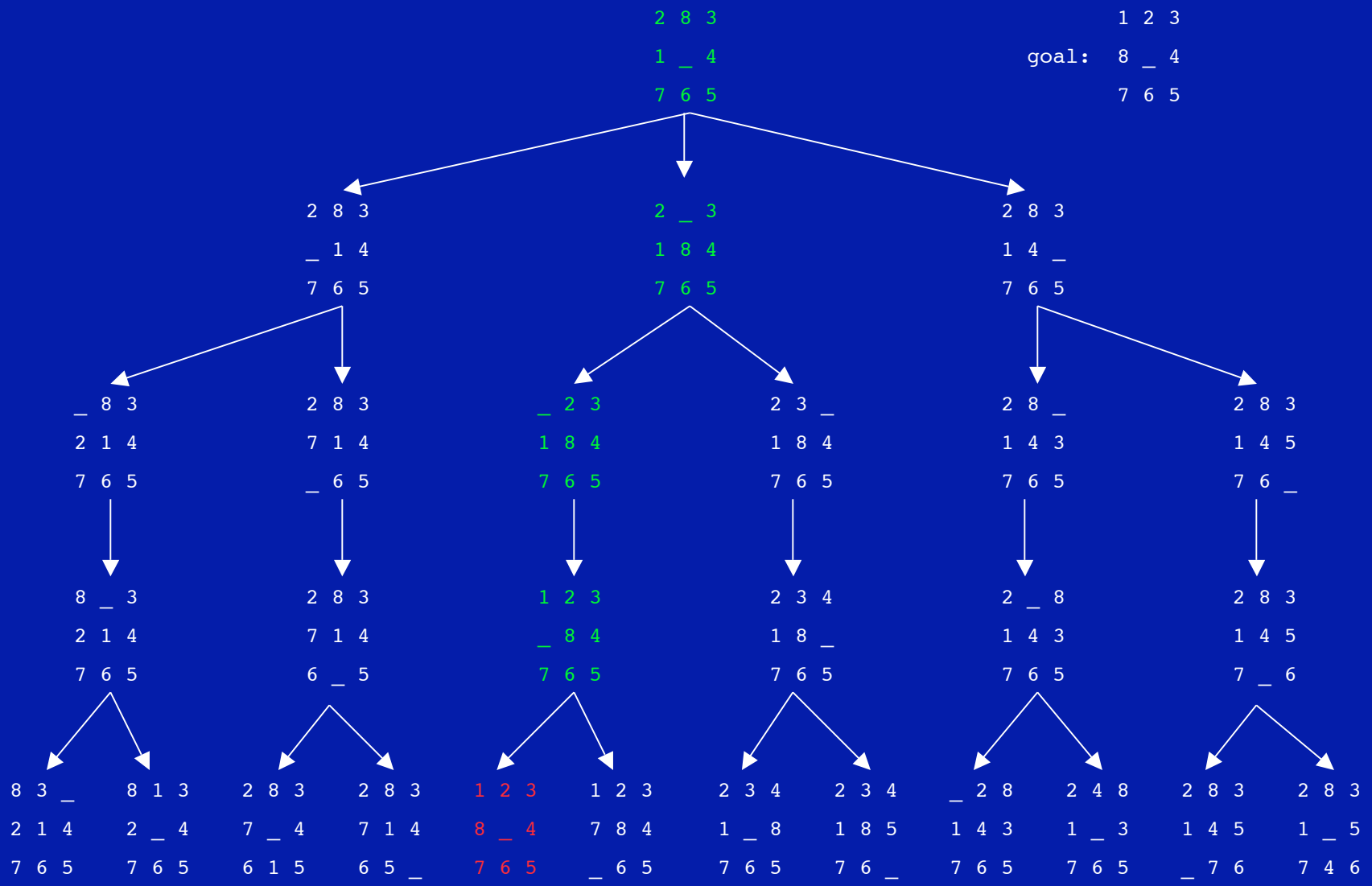
What do I do now?

You're AI students, so the obvious answer is search! More specifically, graph search:

Many (why not all?) problem-solving tasks can be mapped onto the problem of finding a path in a graph

- nodes represent partial solutions
- arcs represent transformations from one partial solution to another
- try to find path along arcs from a start node to a goal node

8-Tile Puzzle



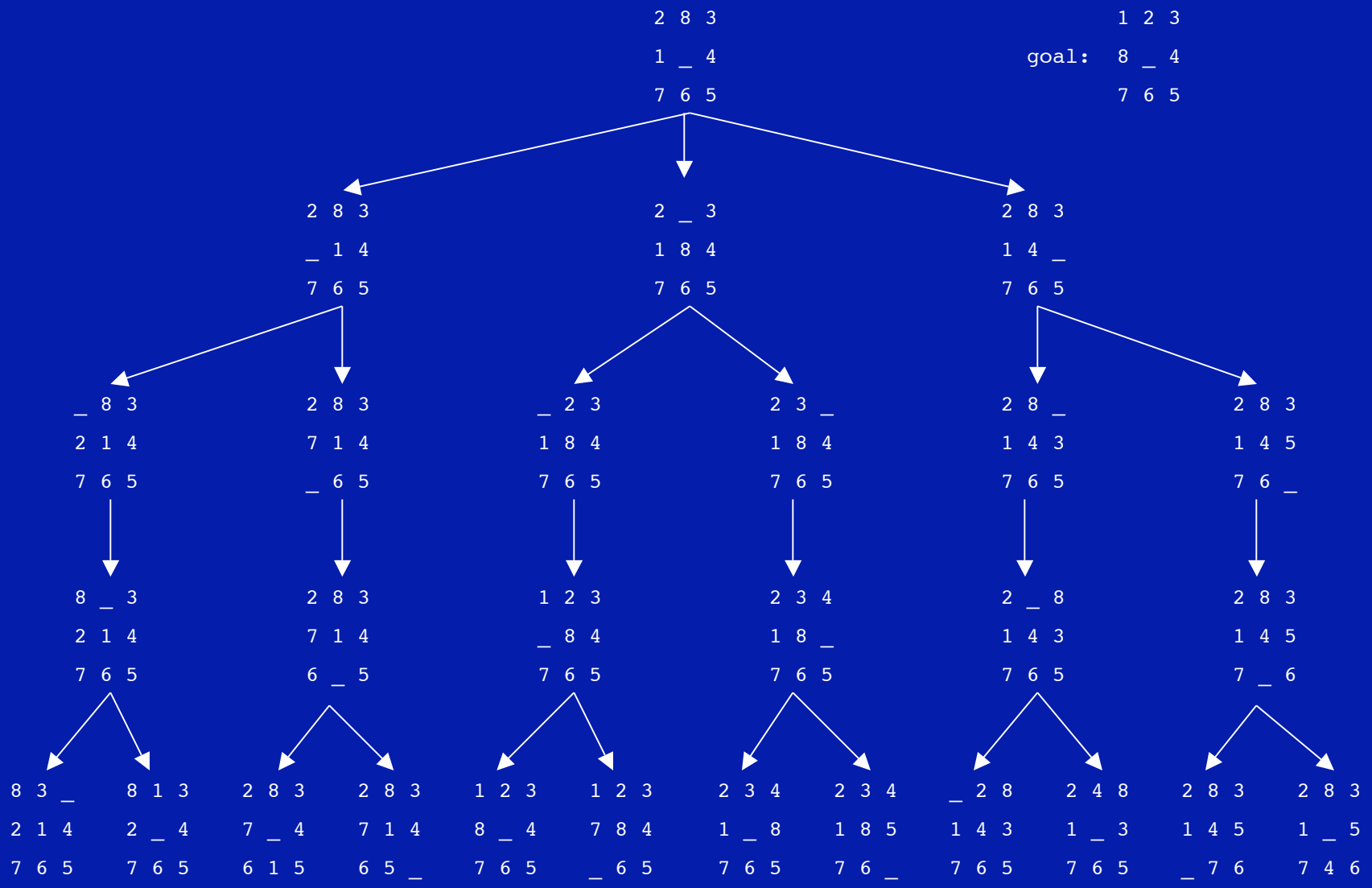
How do I do this graph search stuff?

Given a set of start nodes, a set of goal nodes,
and a graph:

make a “list” of the start nodes - let’s call it the “frontier”

repeat
  if no nodes on the frontier then terminate with failure
  choose one node from the frontier and remove it
  if the chosen node matches the goal node
    then terminate with success
    else put next nodes (neighbours) on frontier
end repeat

8-Tile Puzzle



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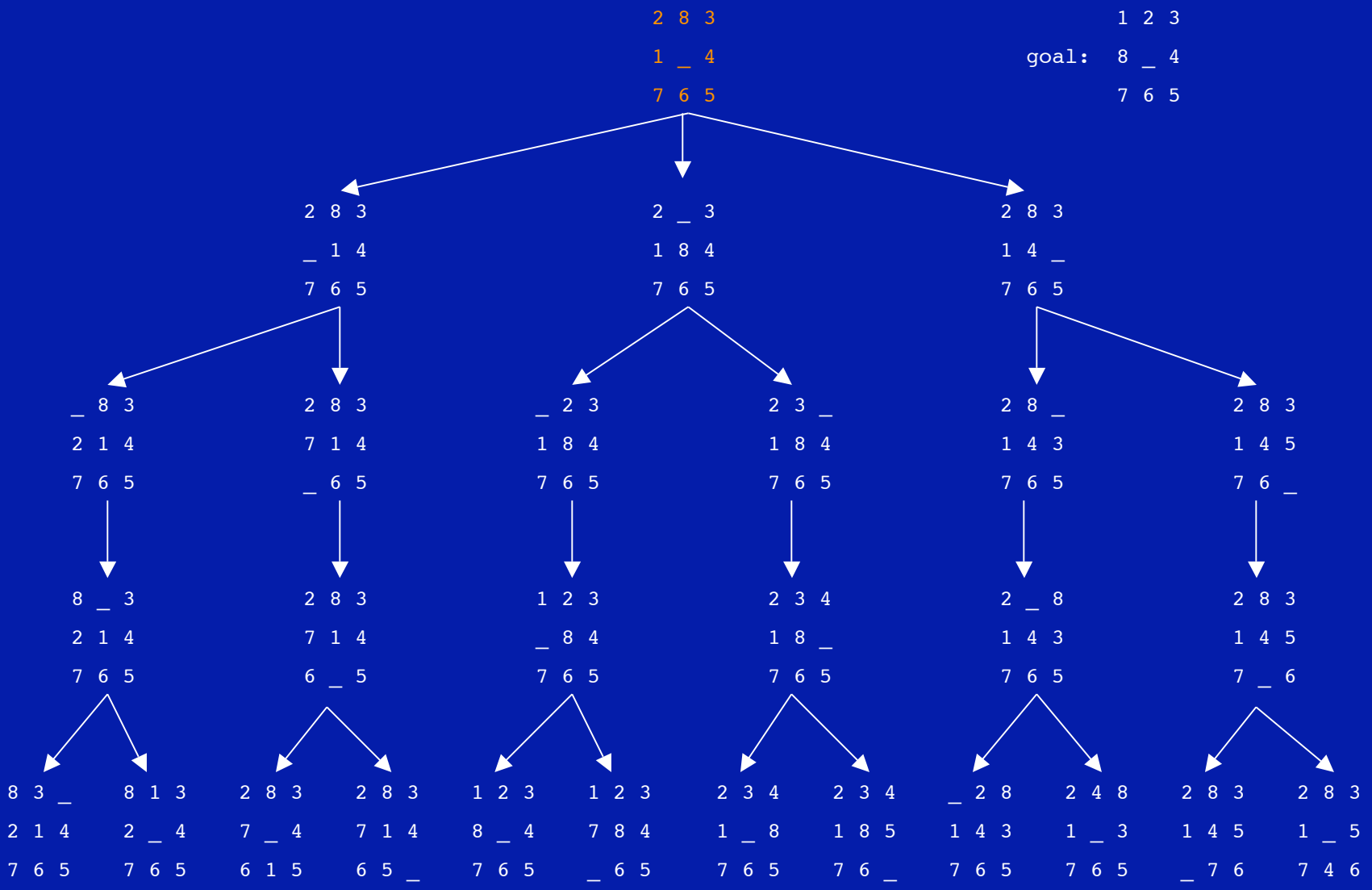

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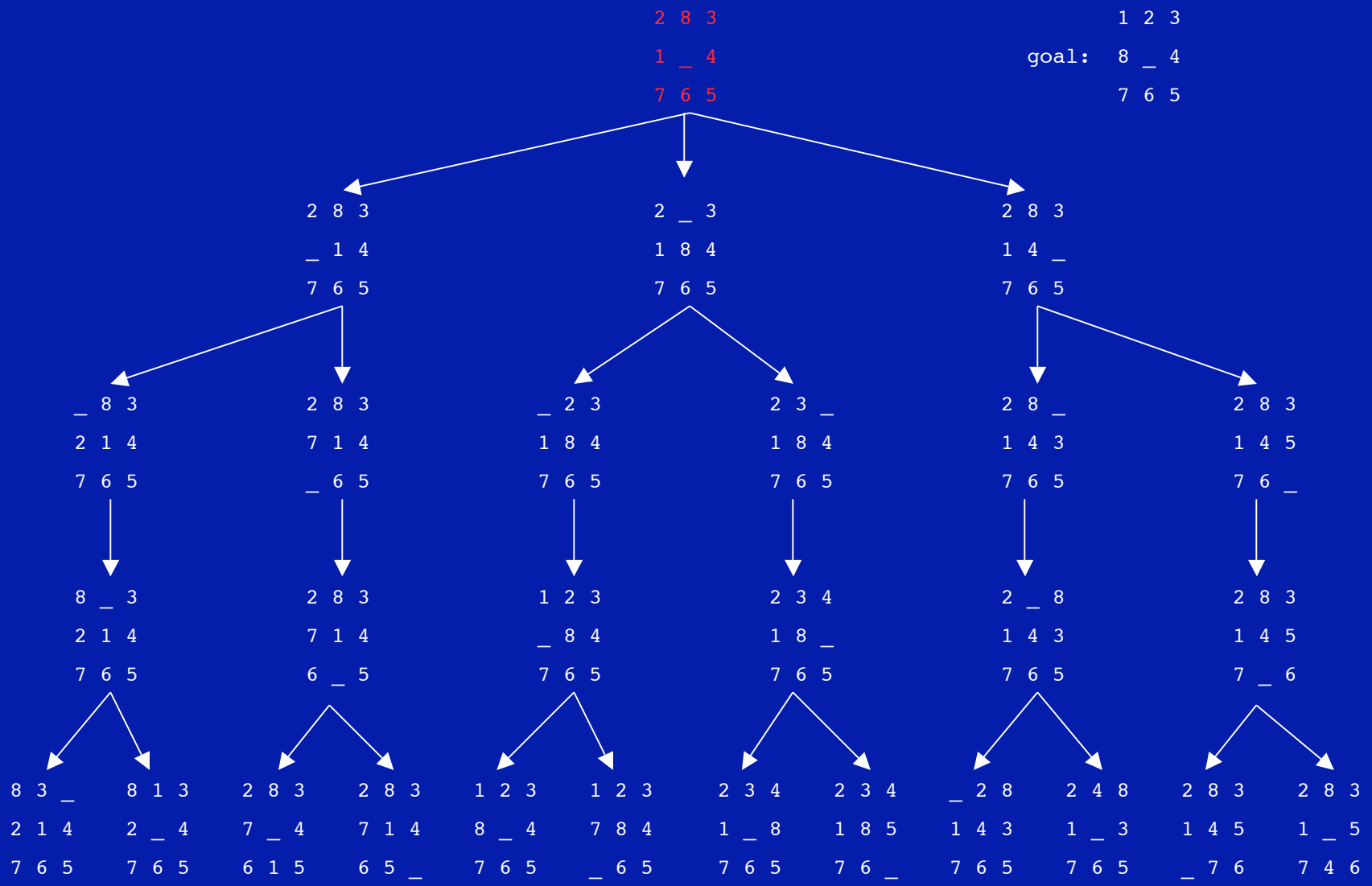

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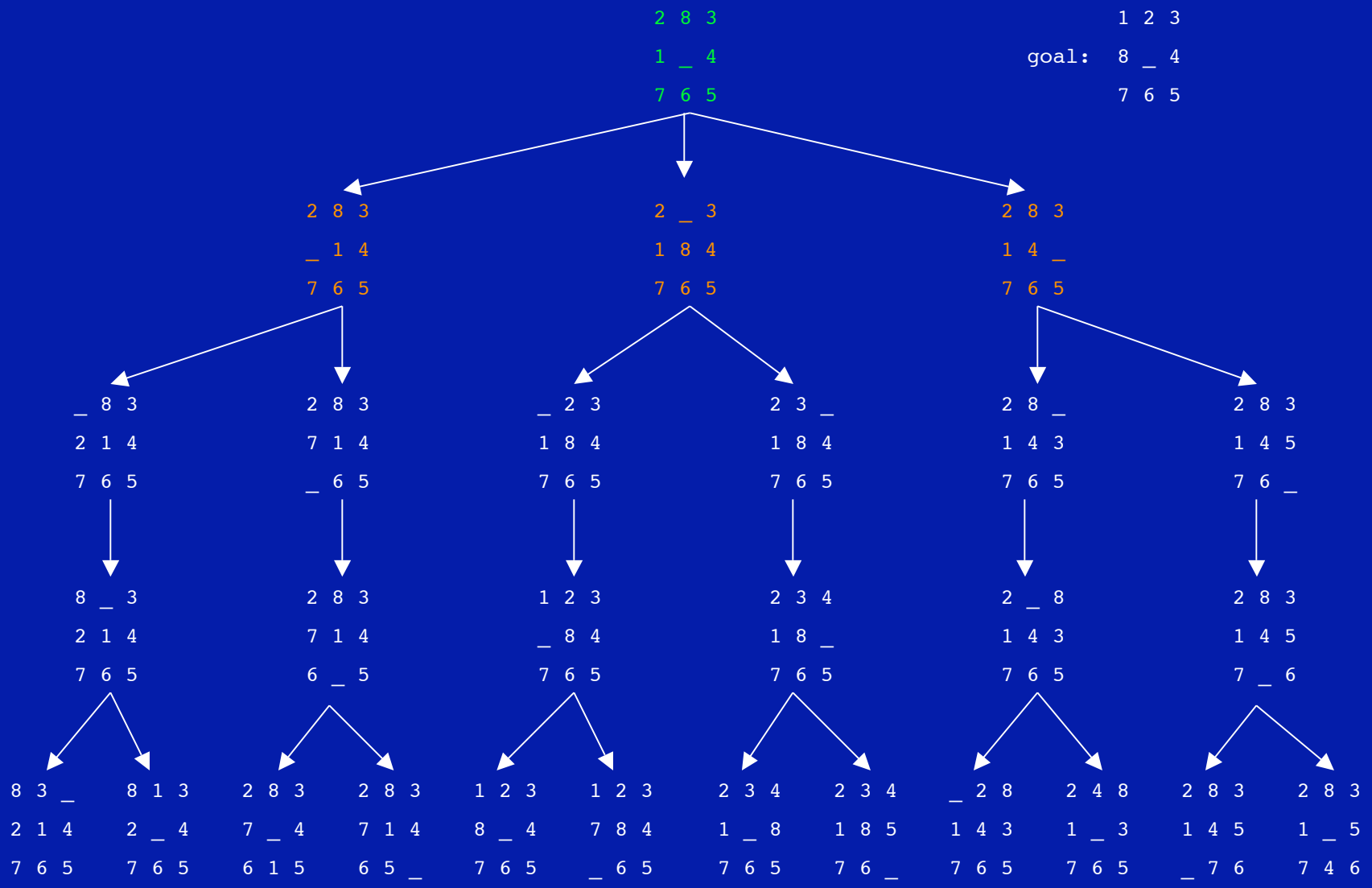

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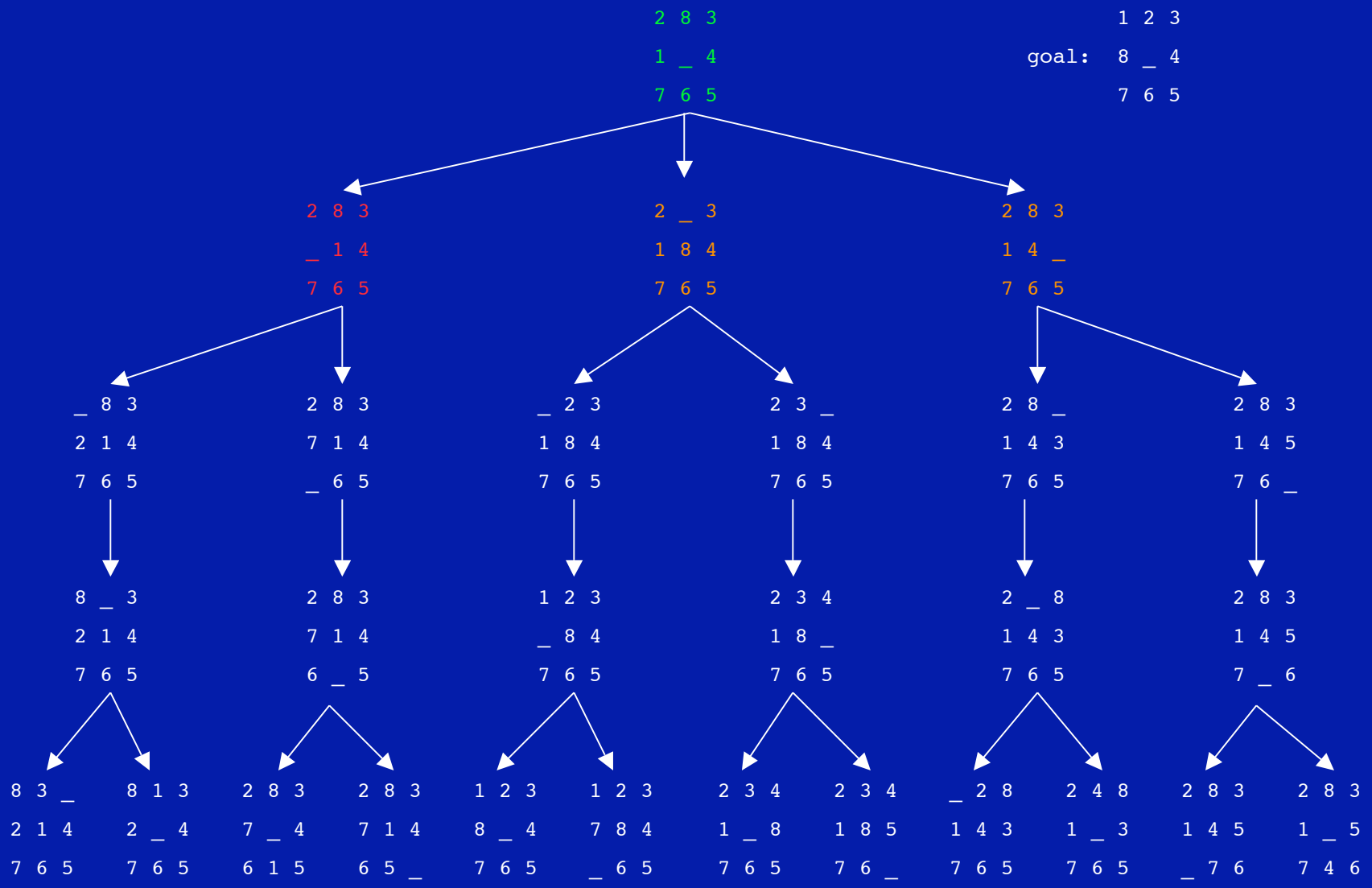

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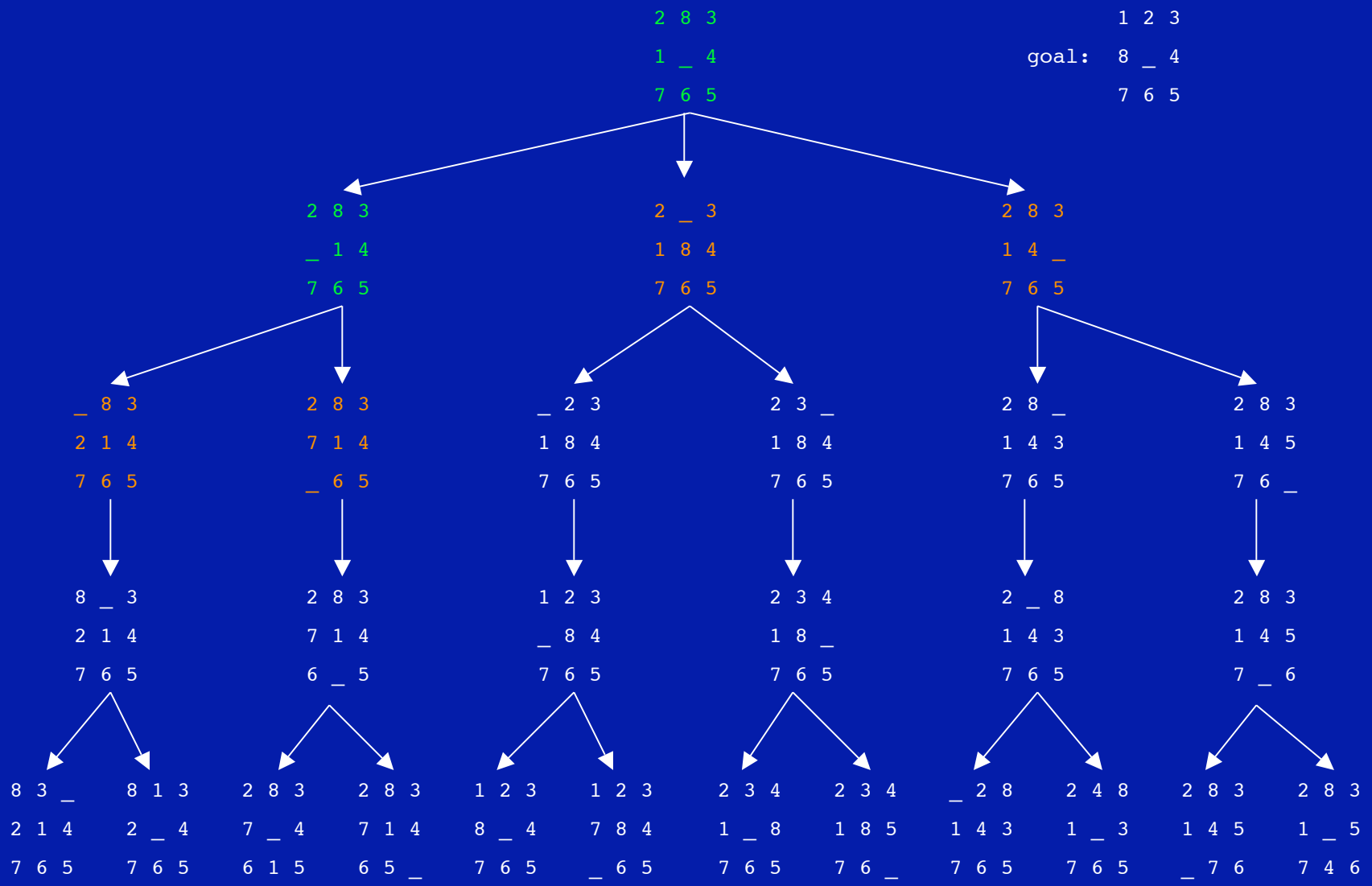

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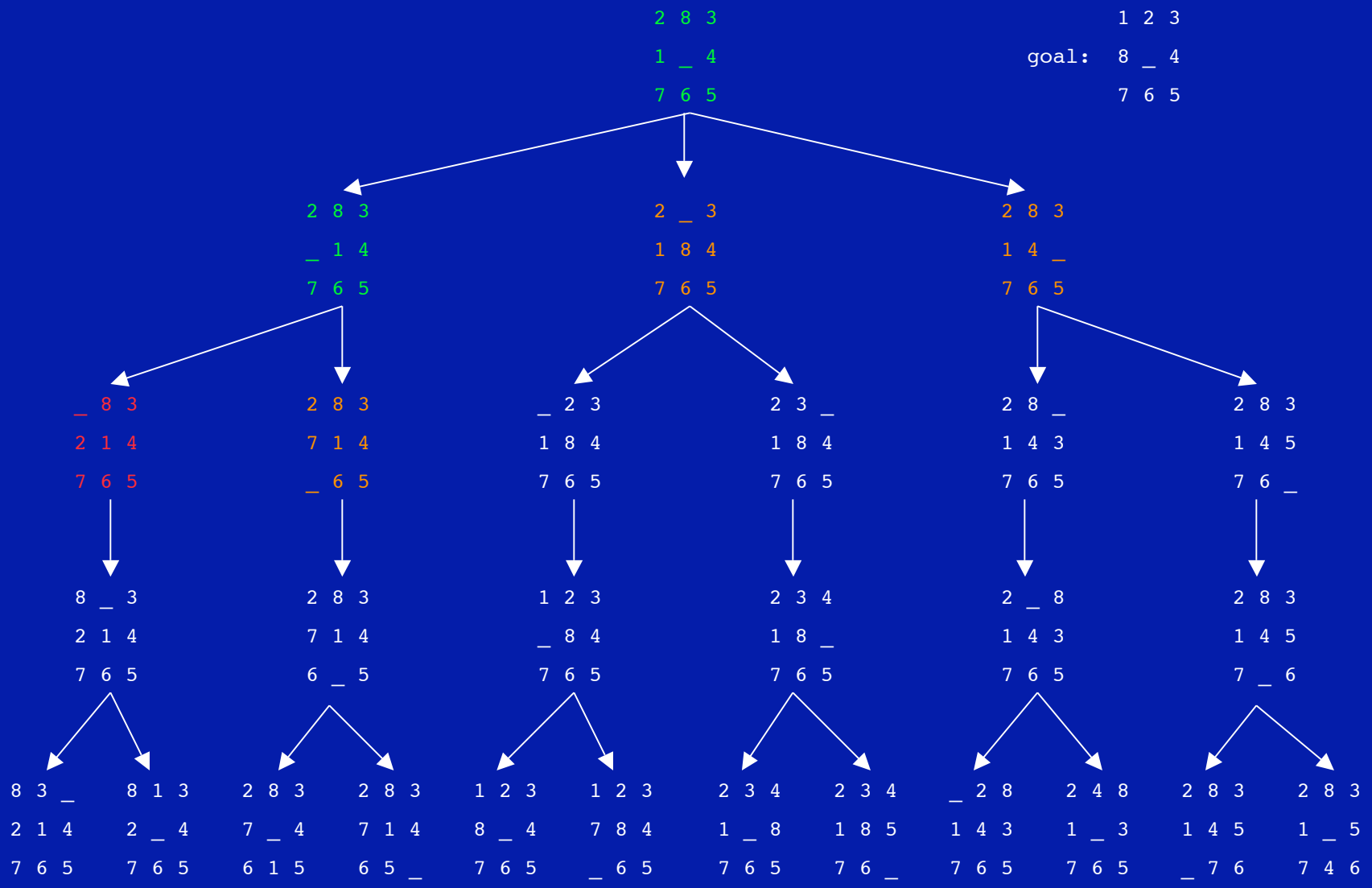

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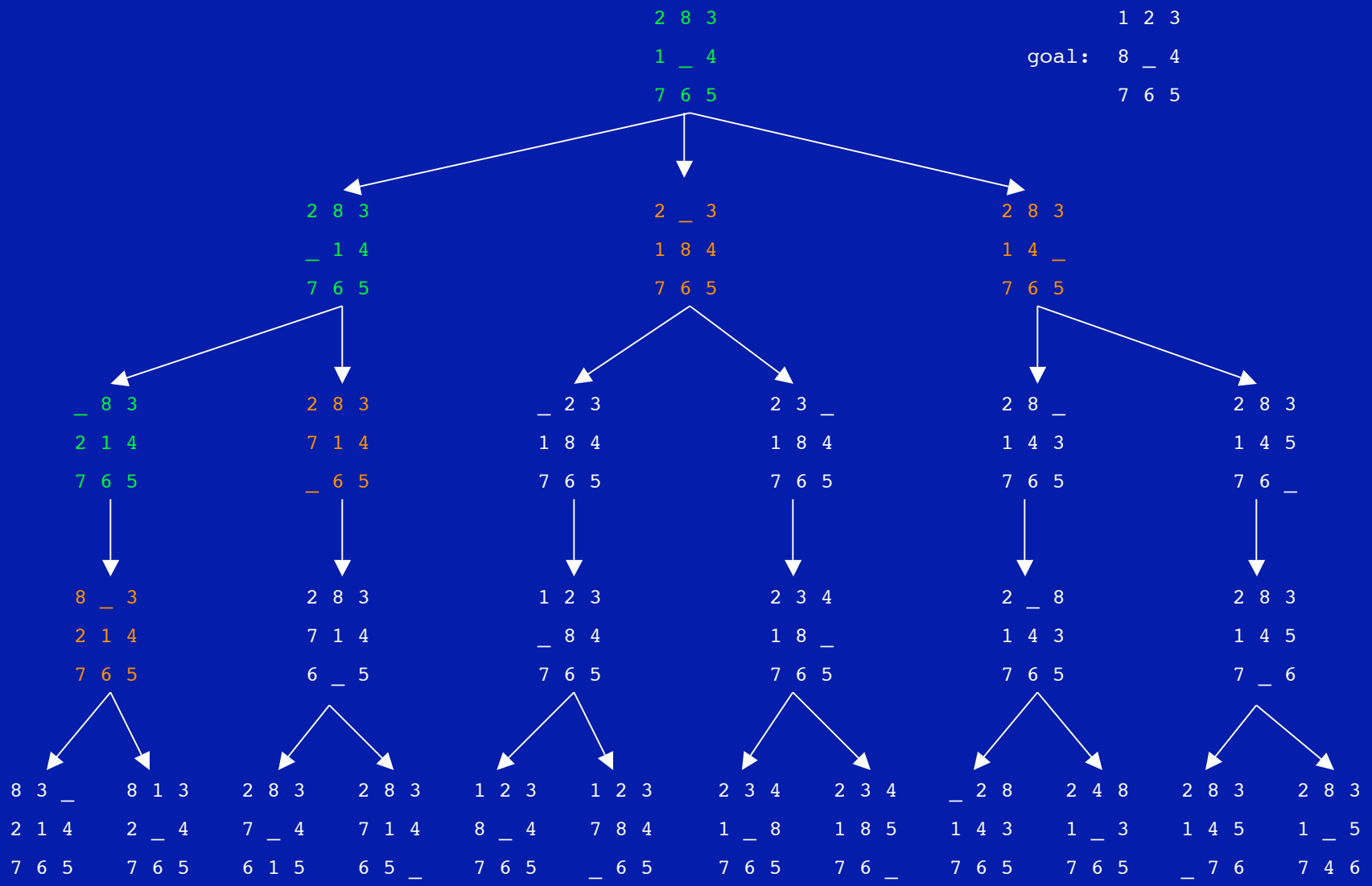

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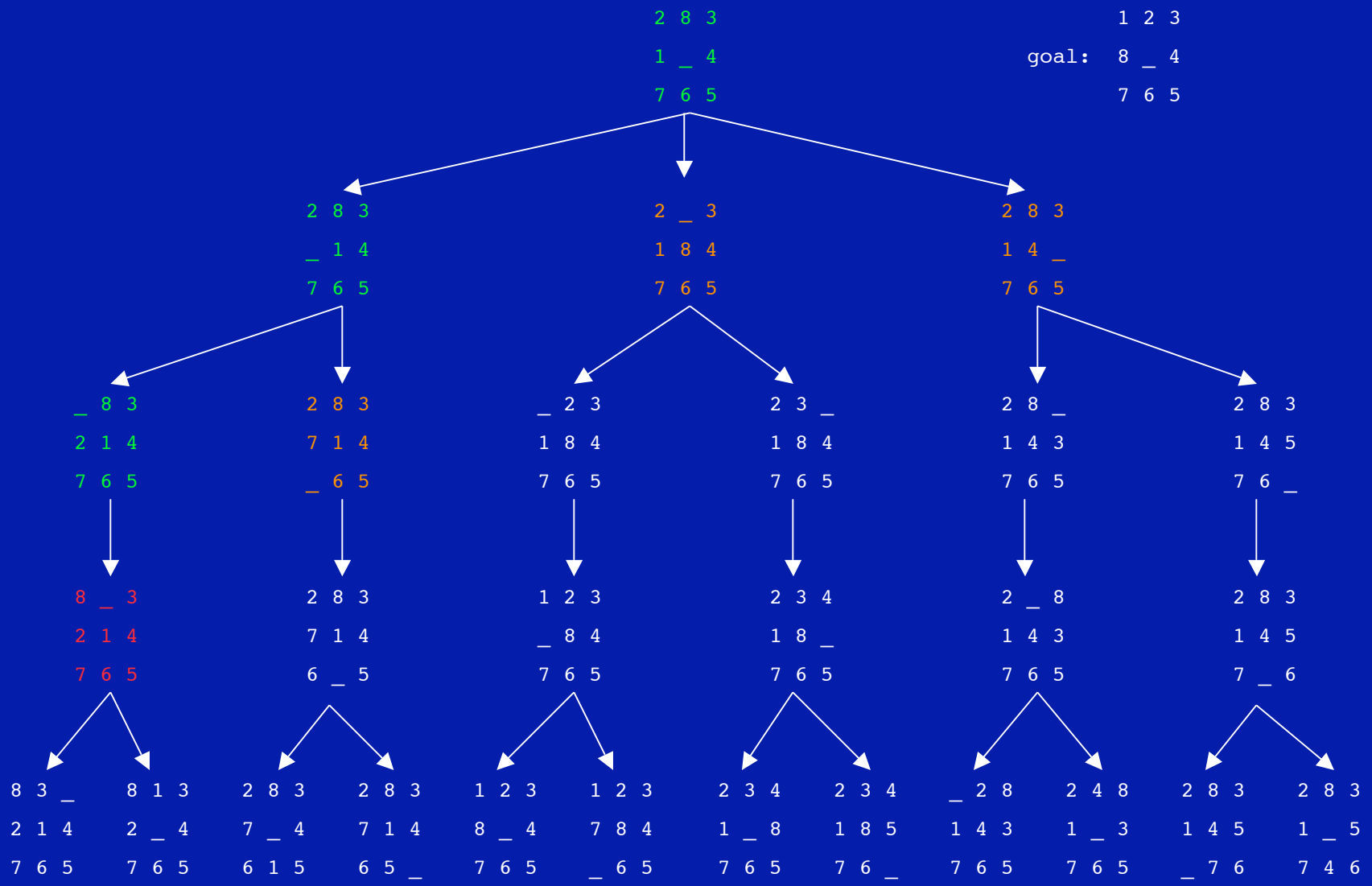

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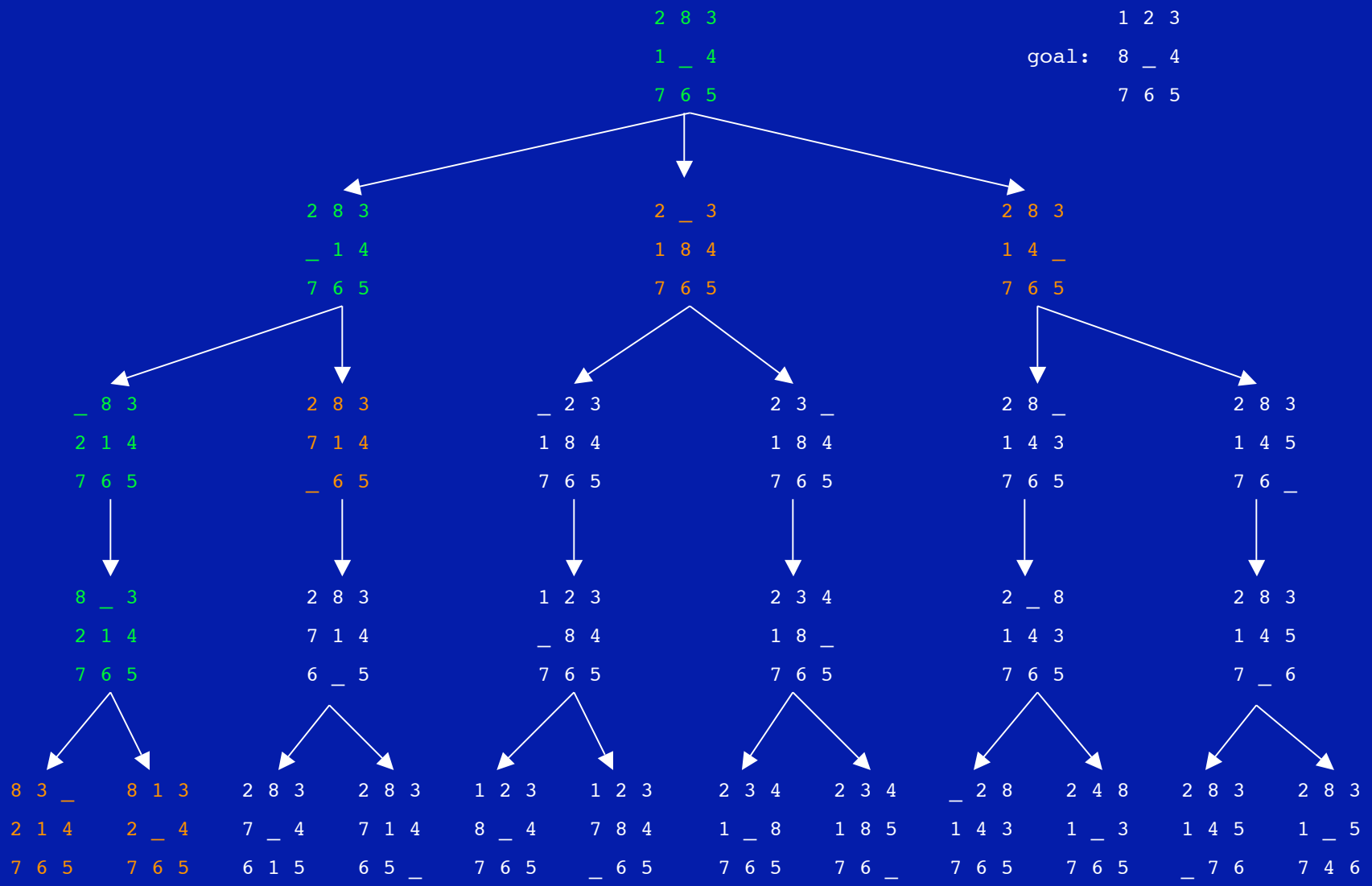

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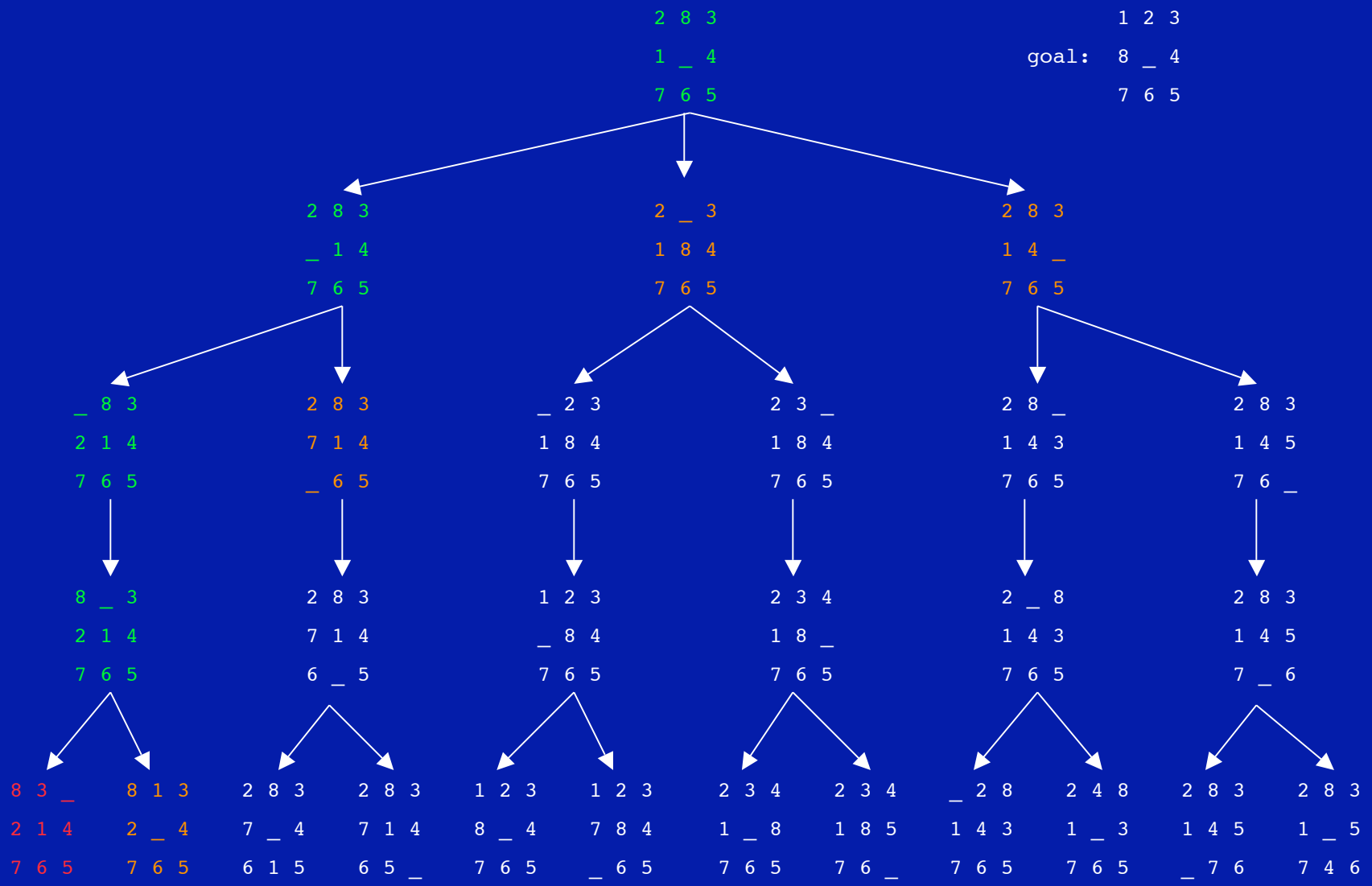

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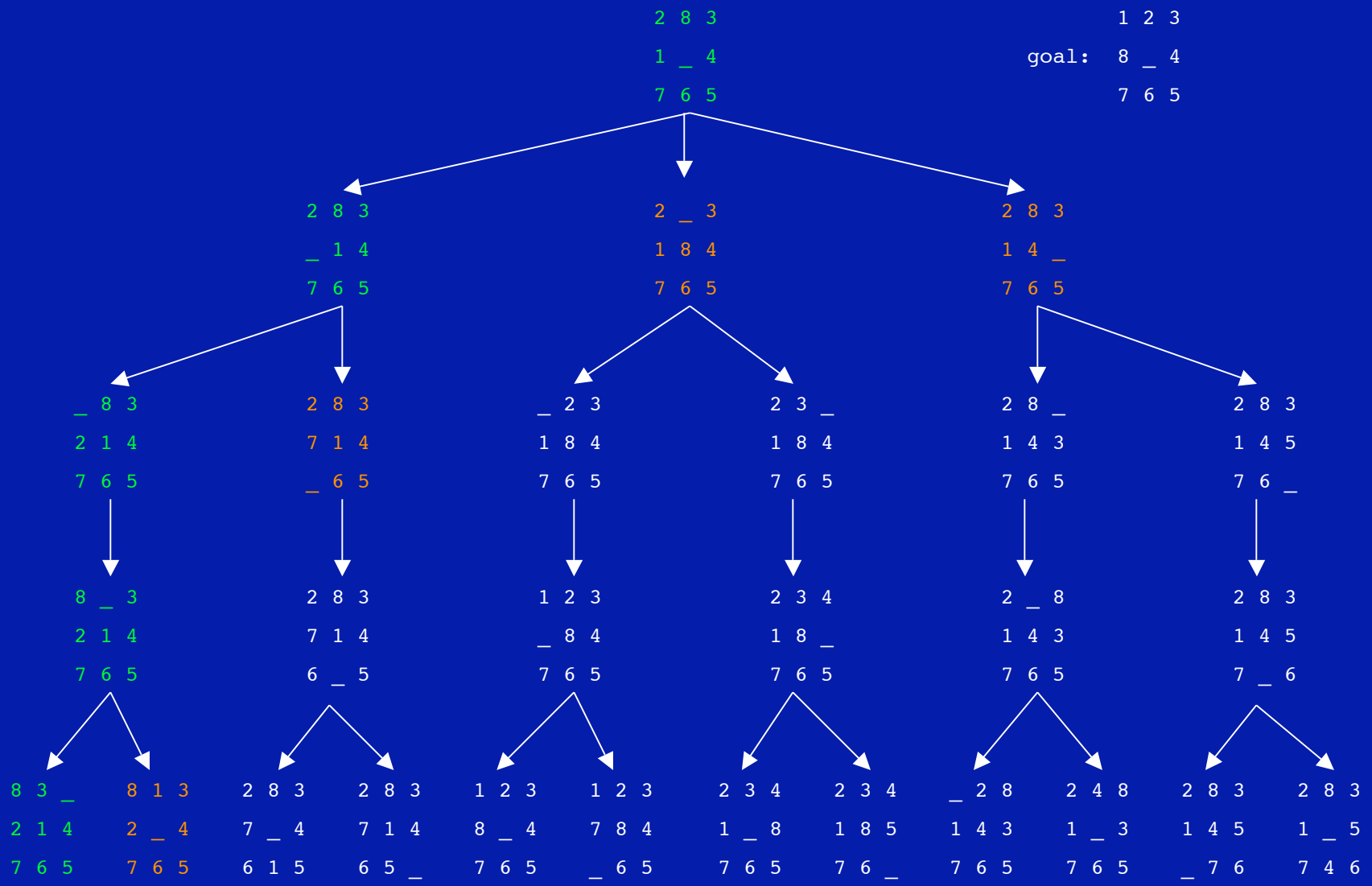

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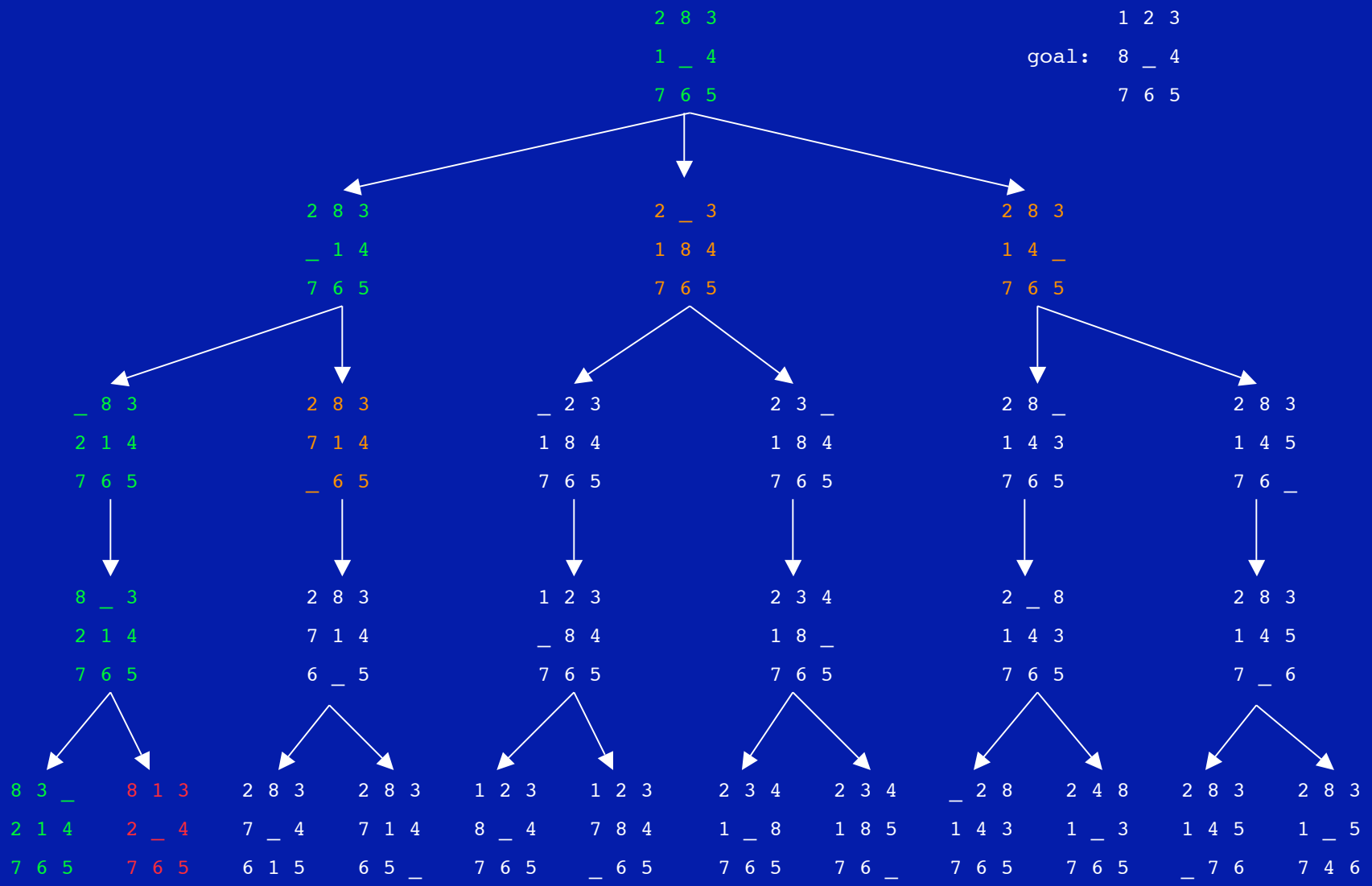

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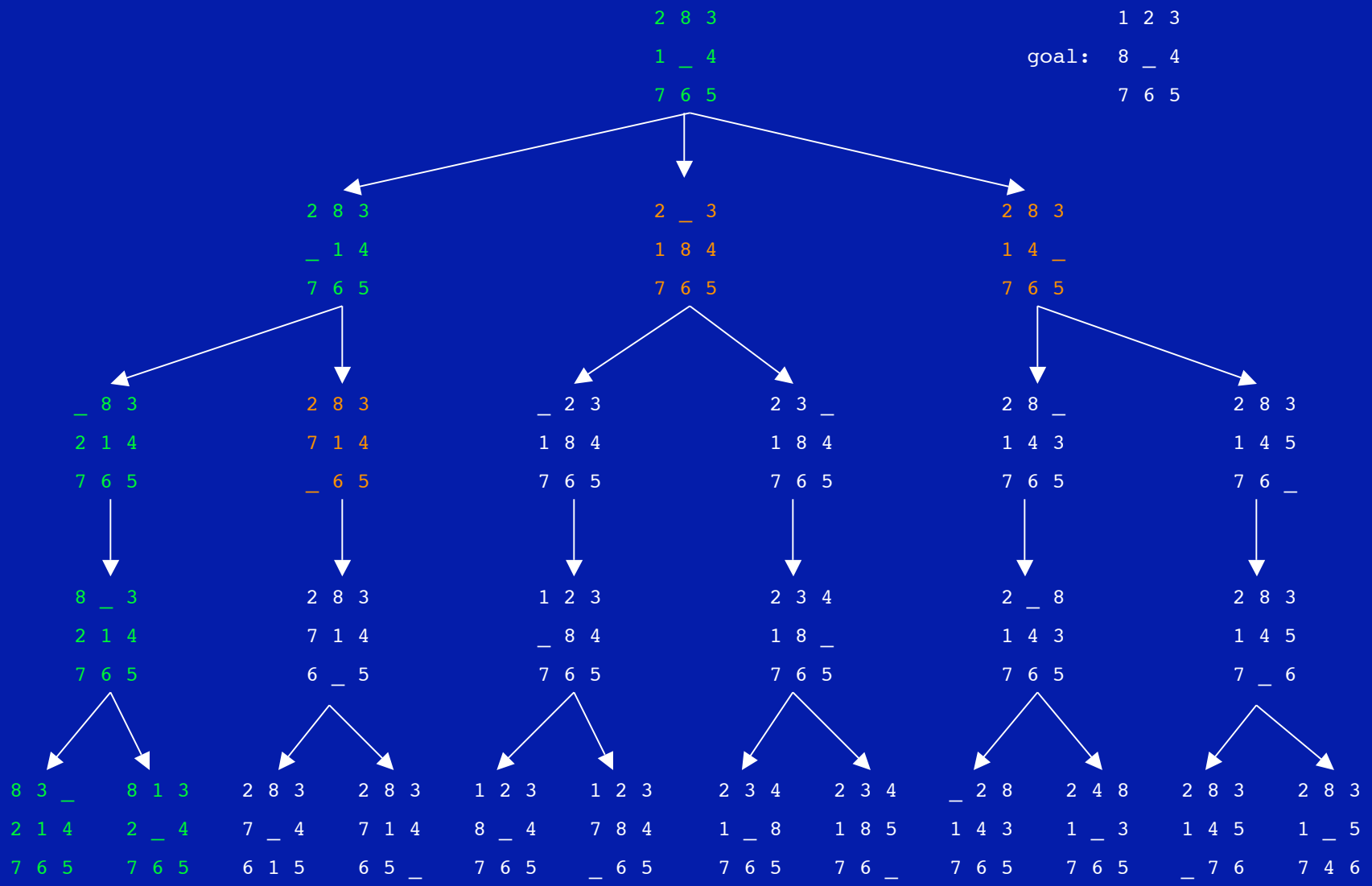

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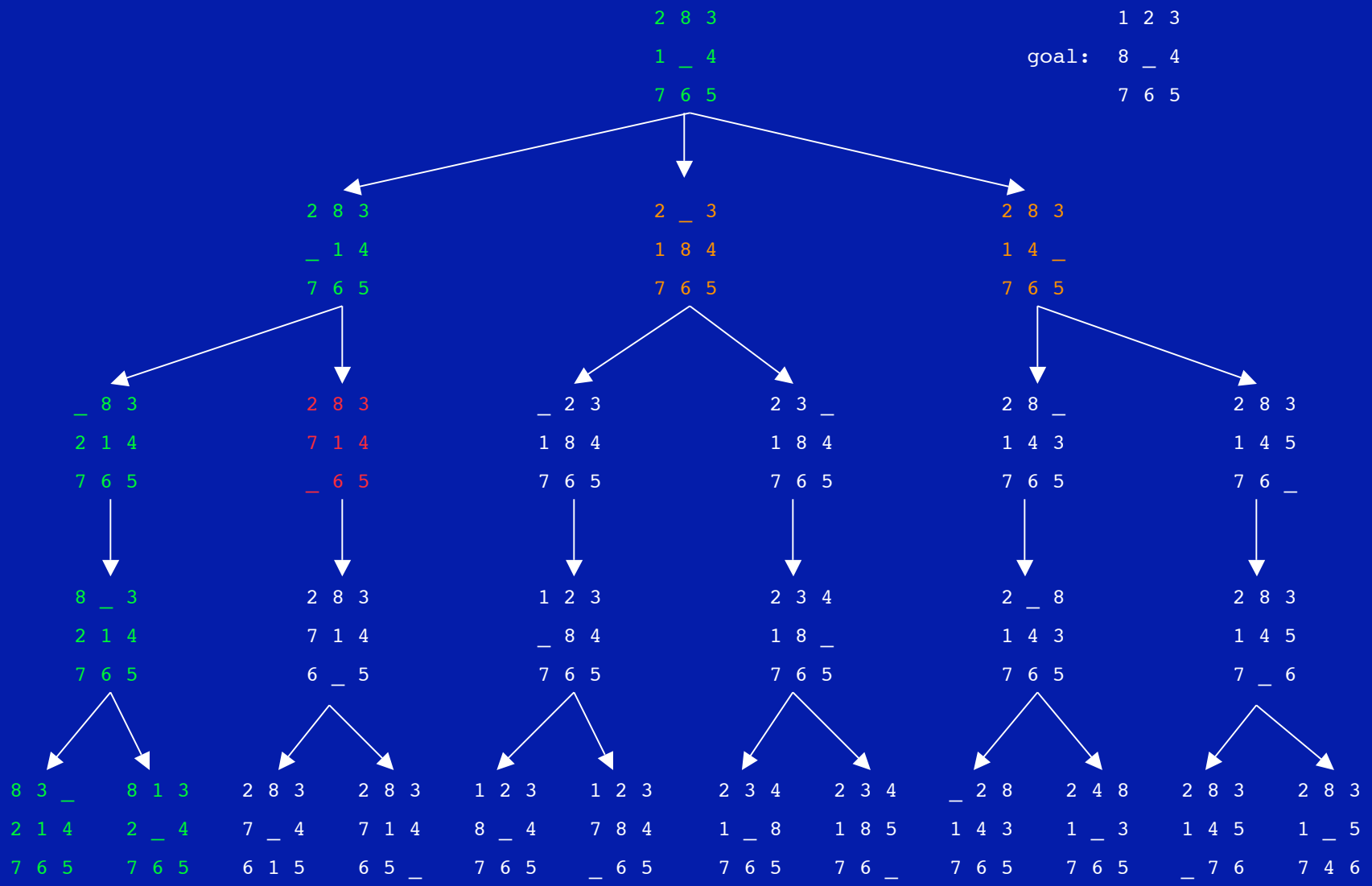

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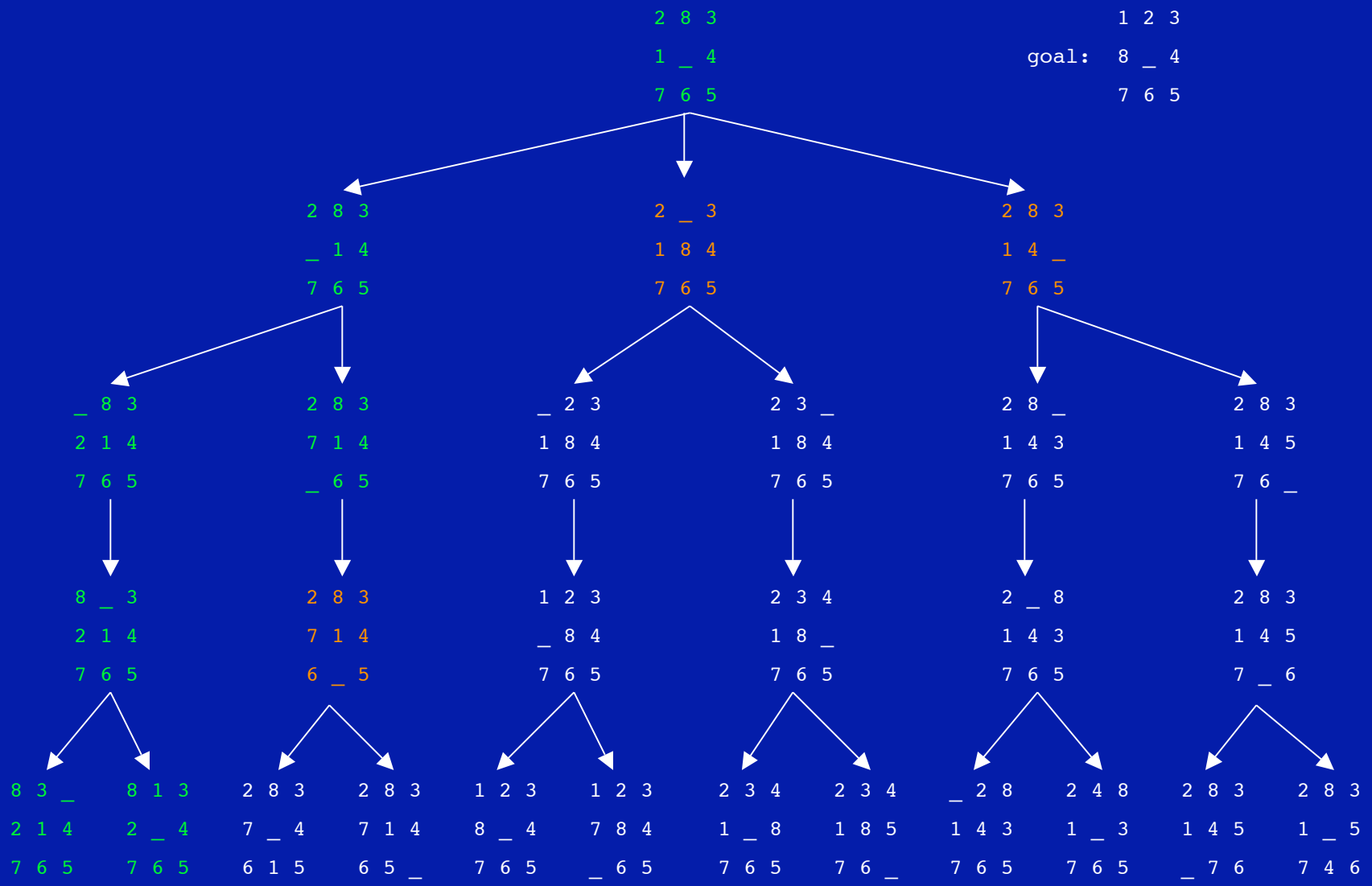

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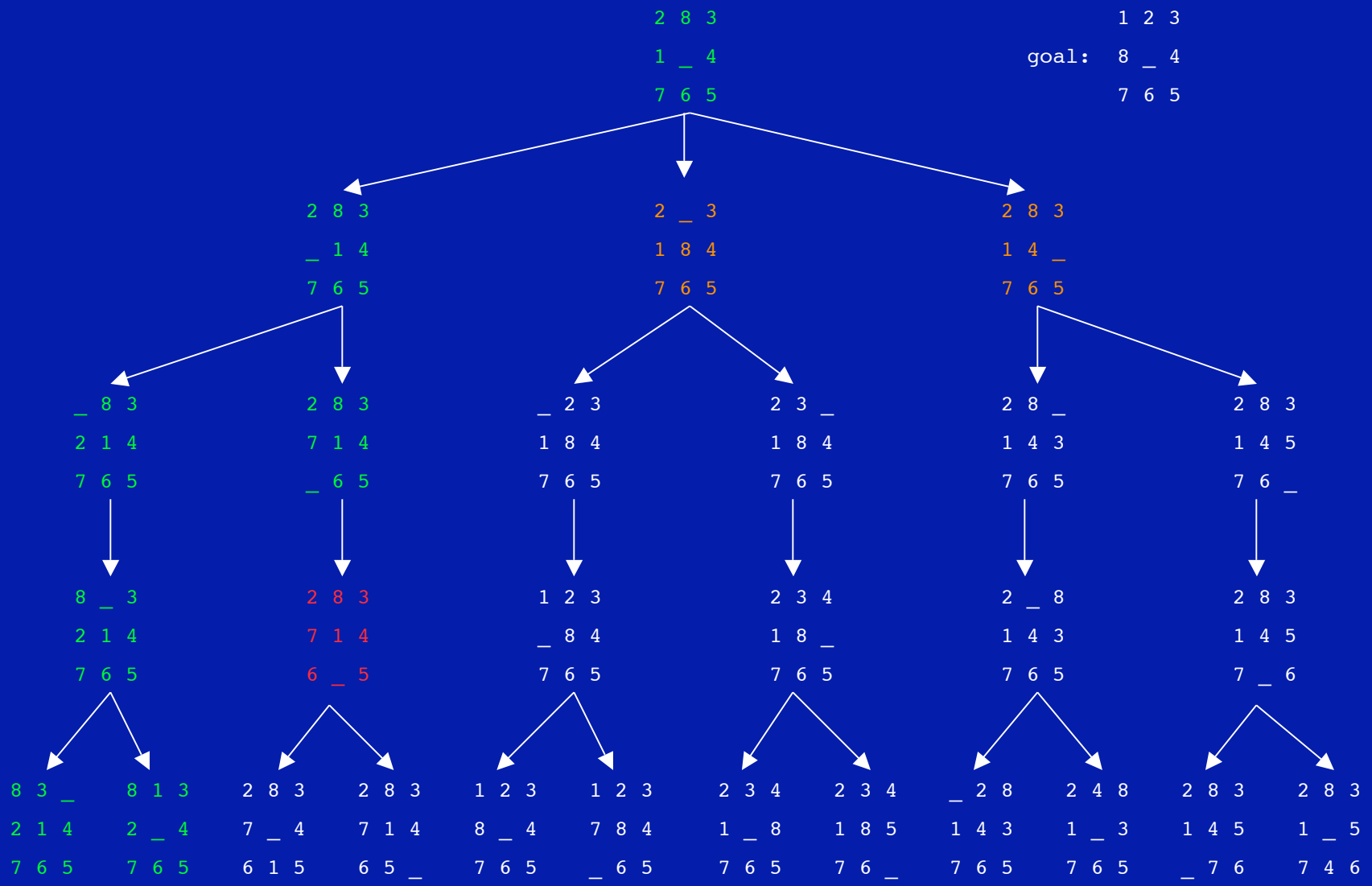

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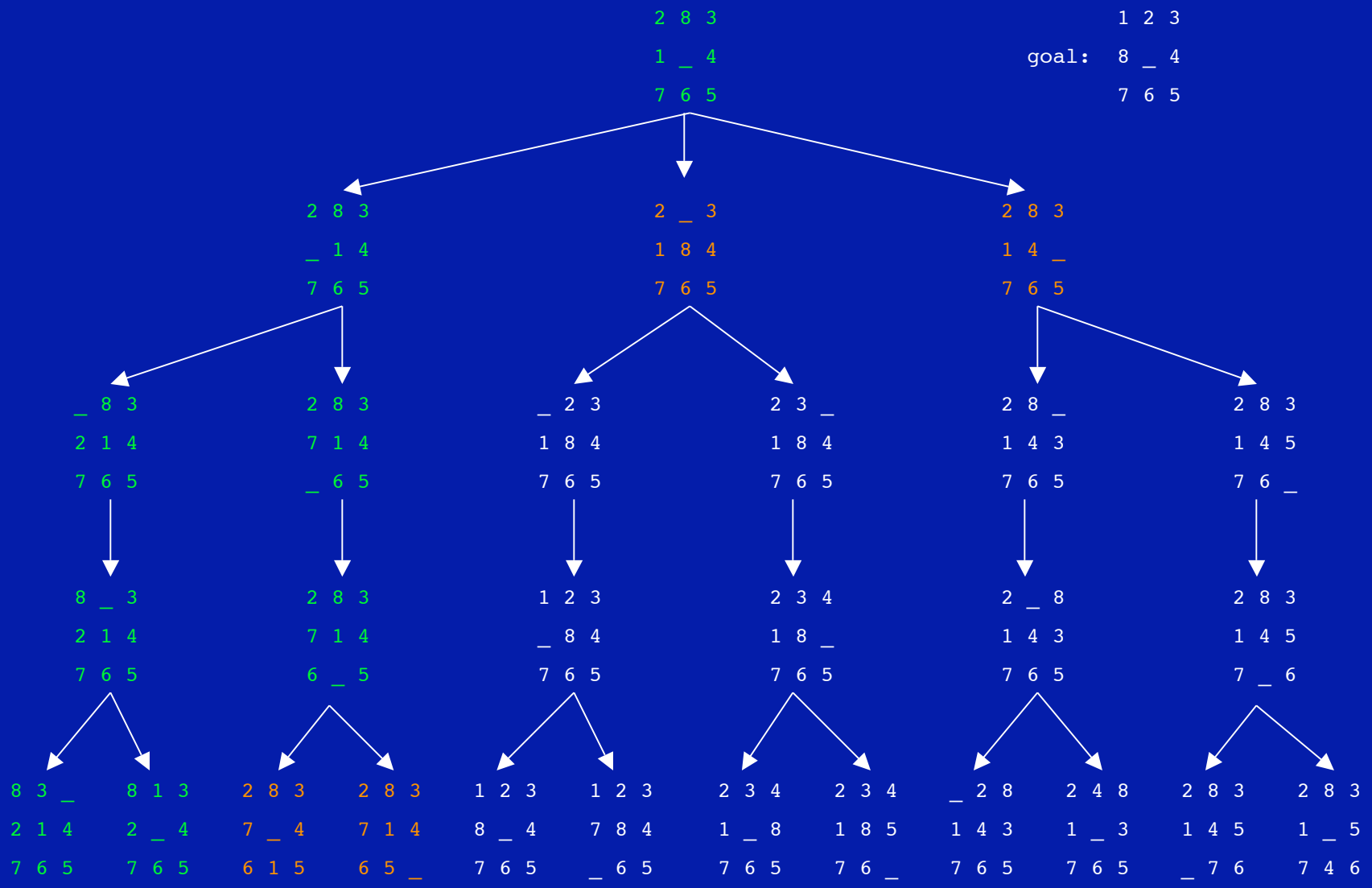

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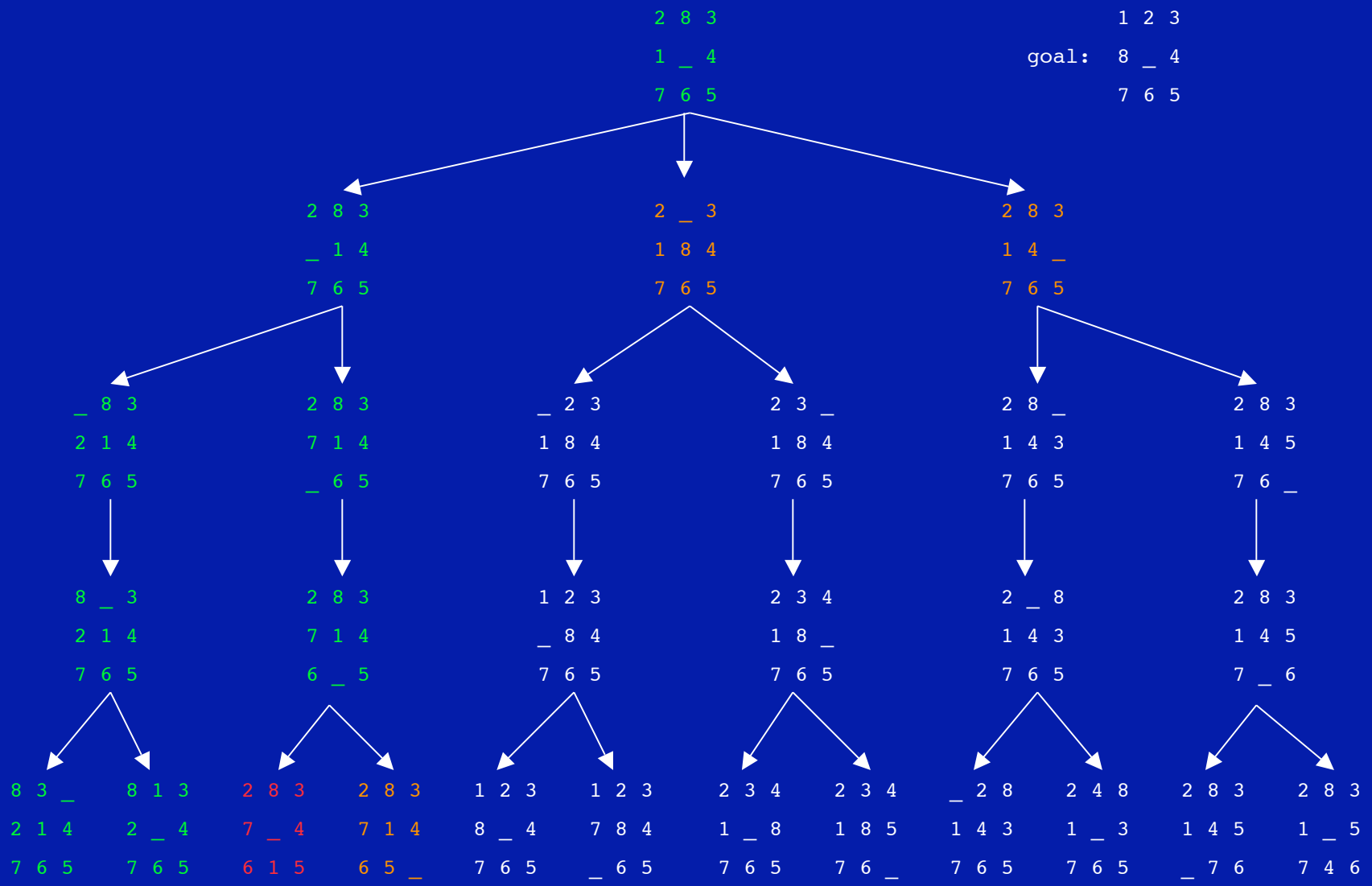

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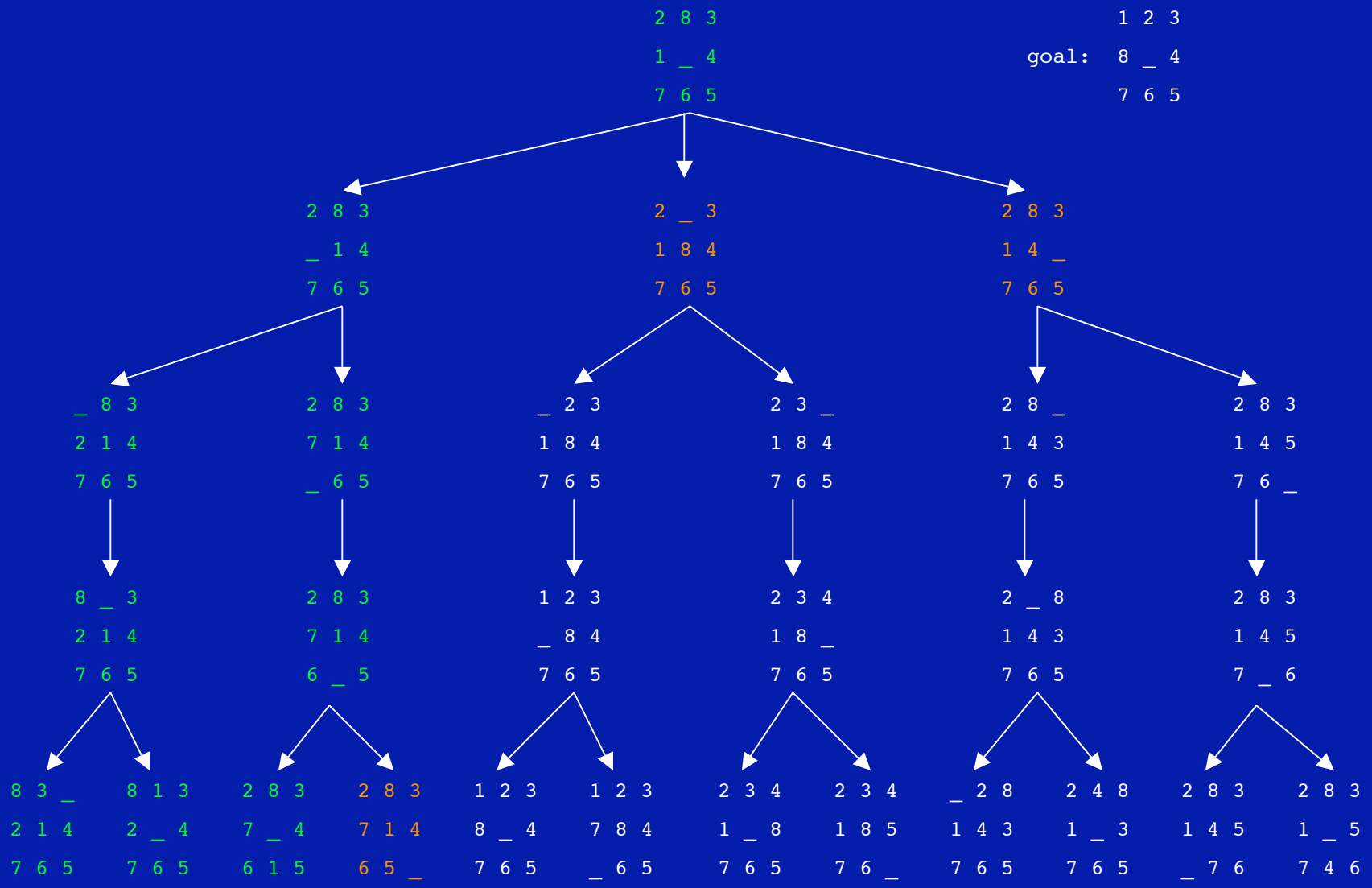

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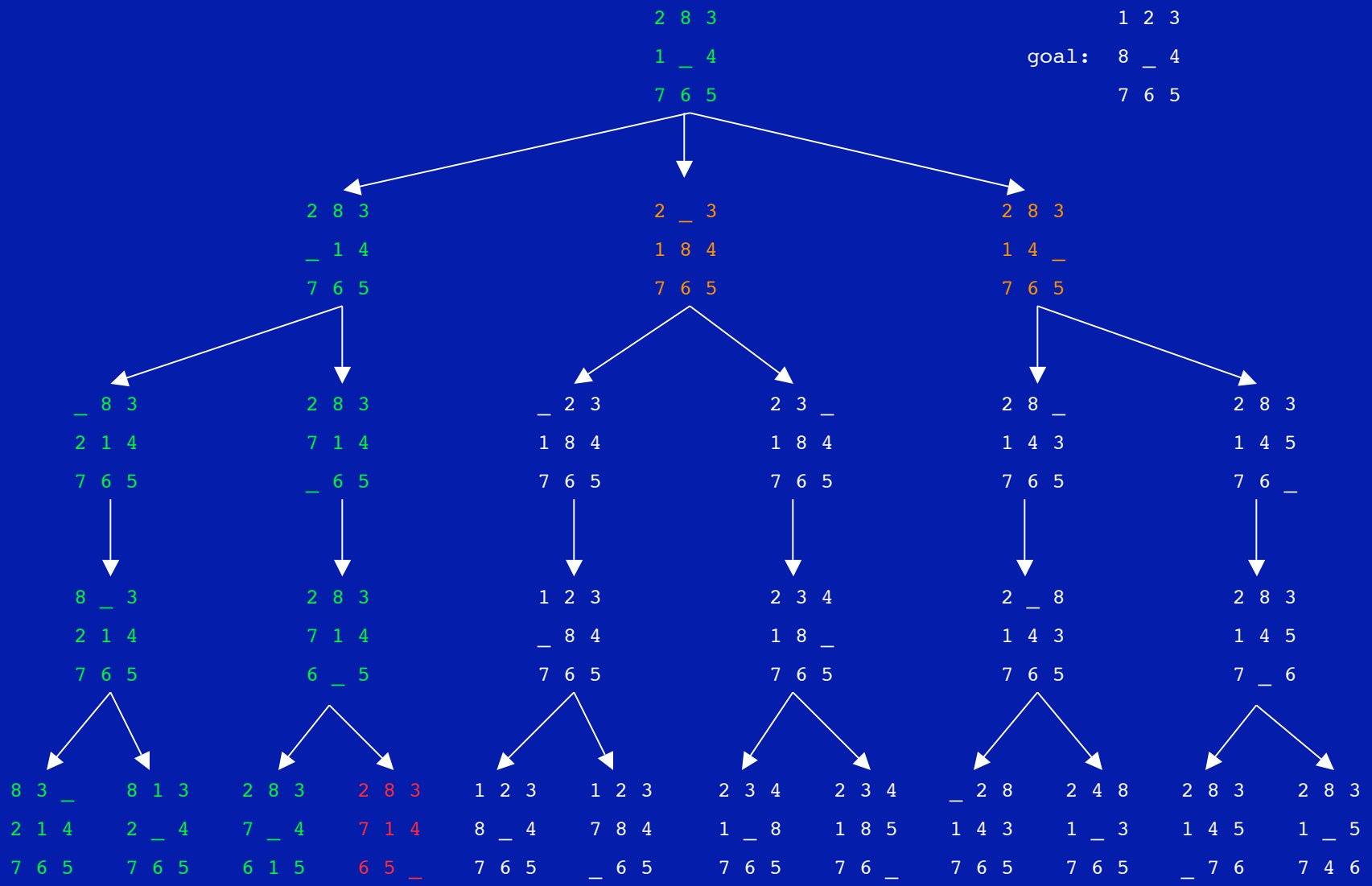

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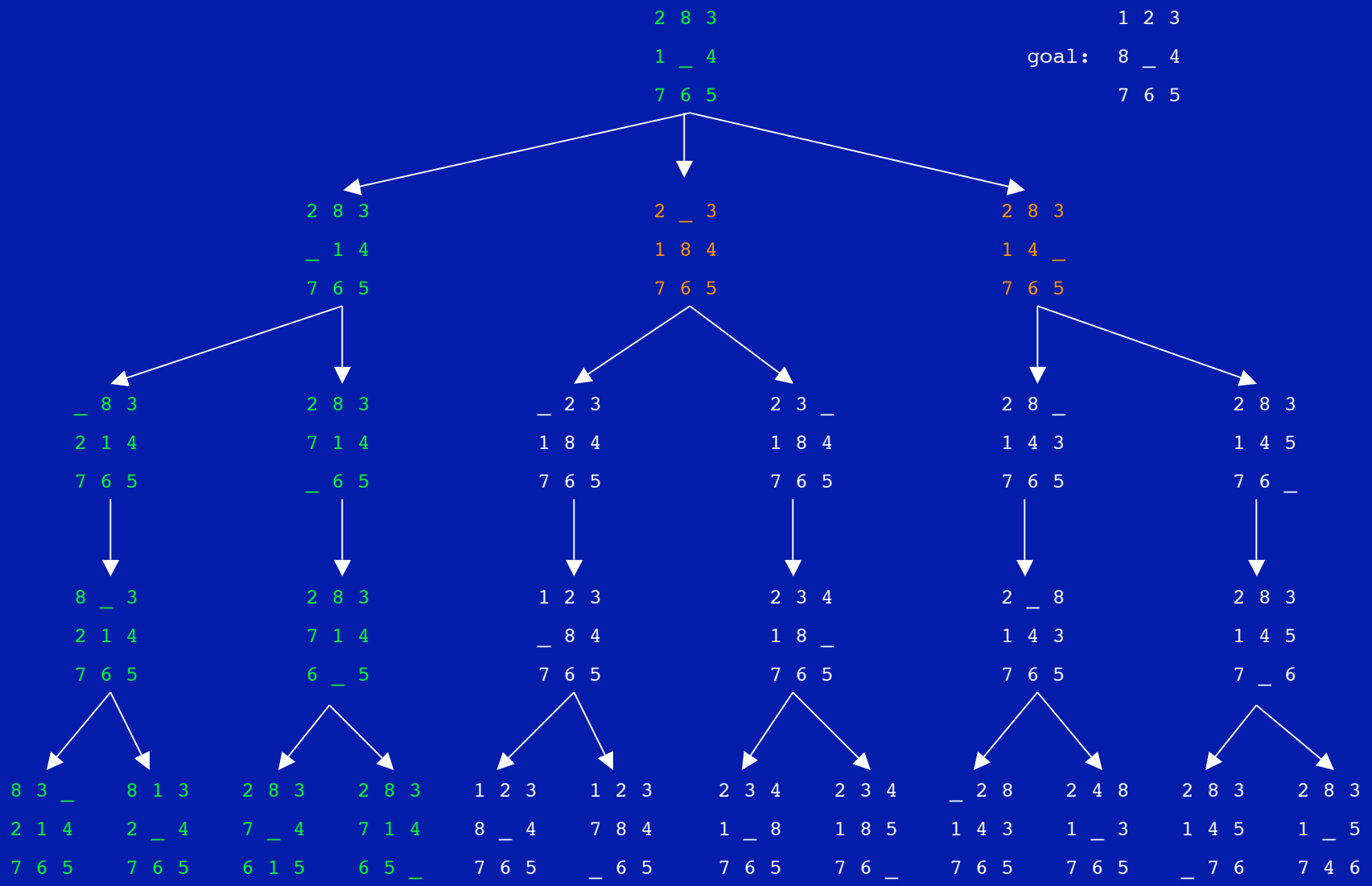

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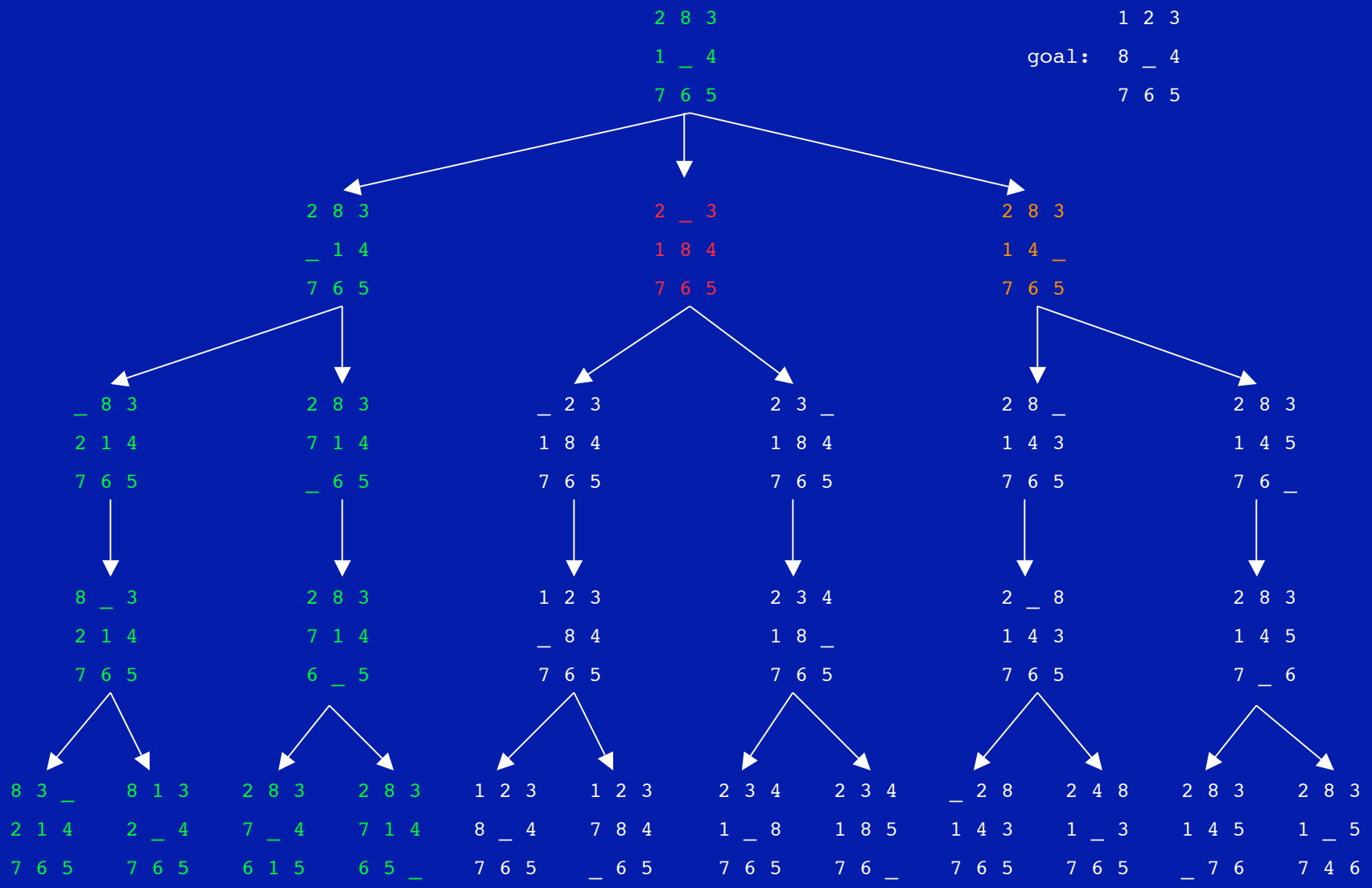

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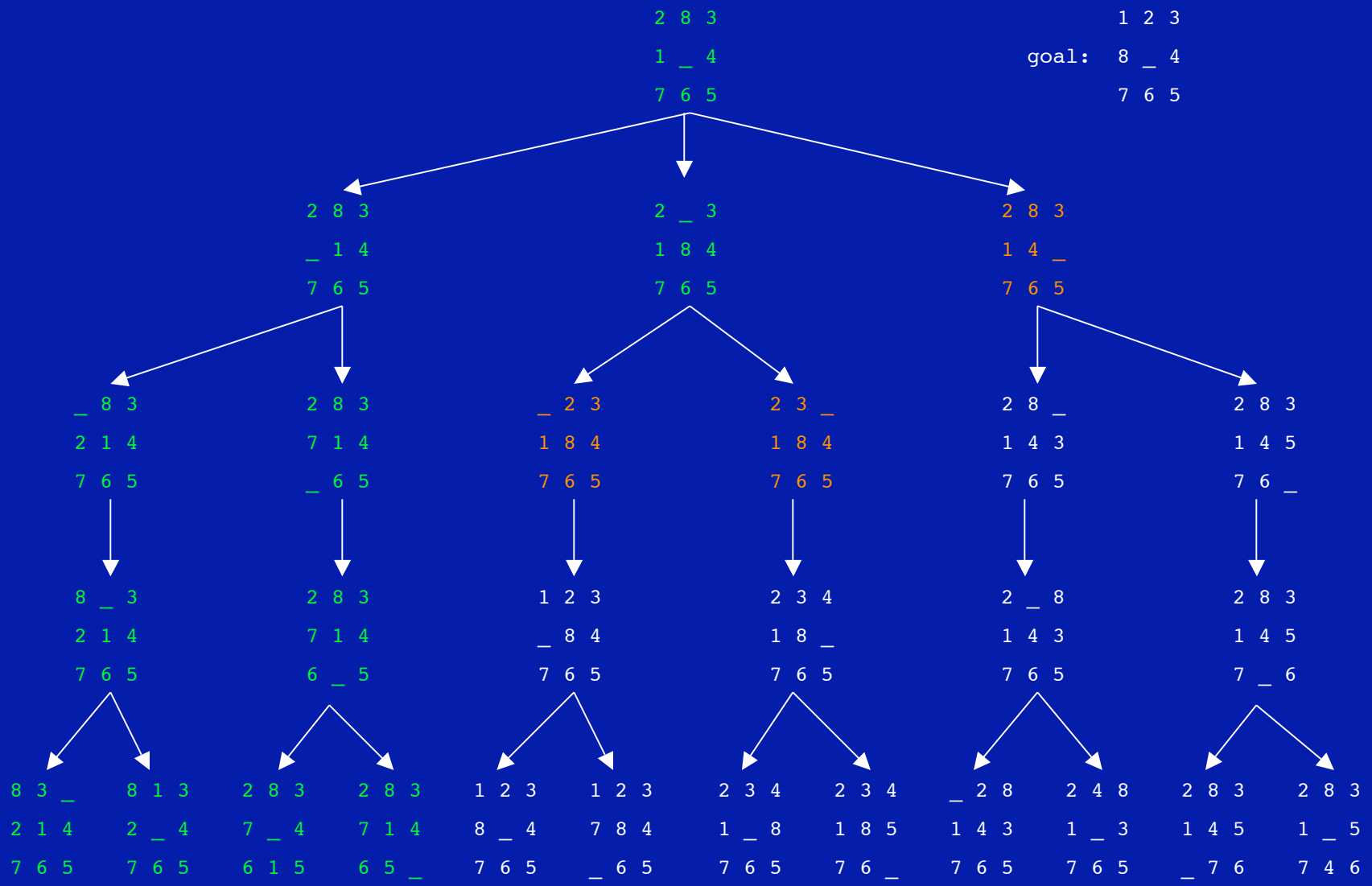

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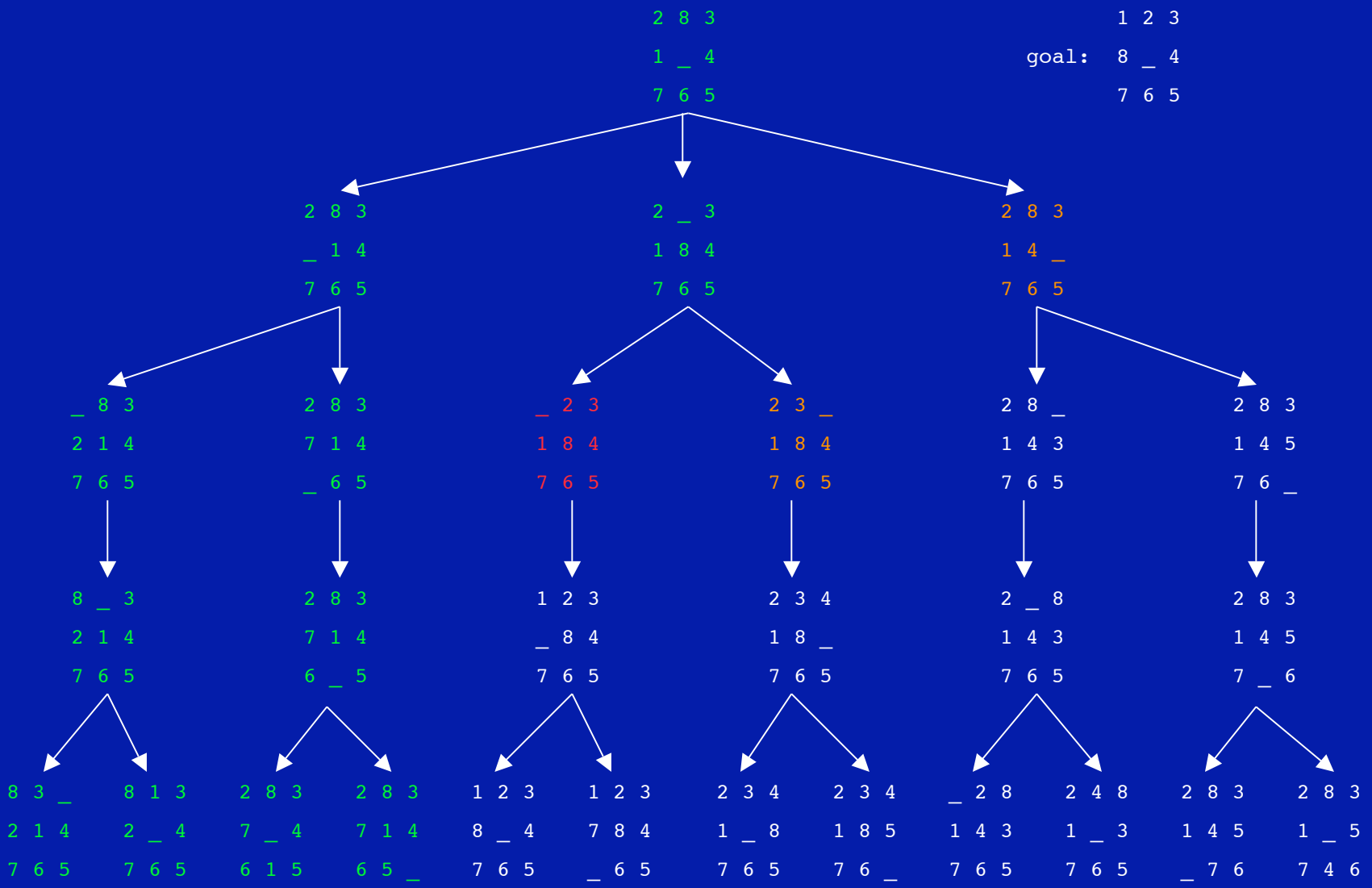

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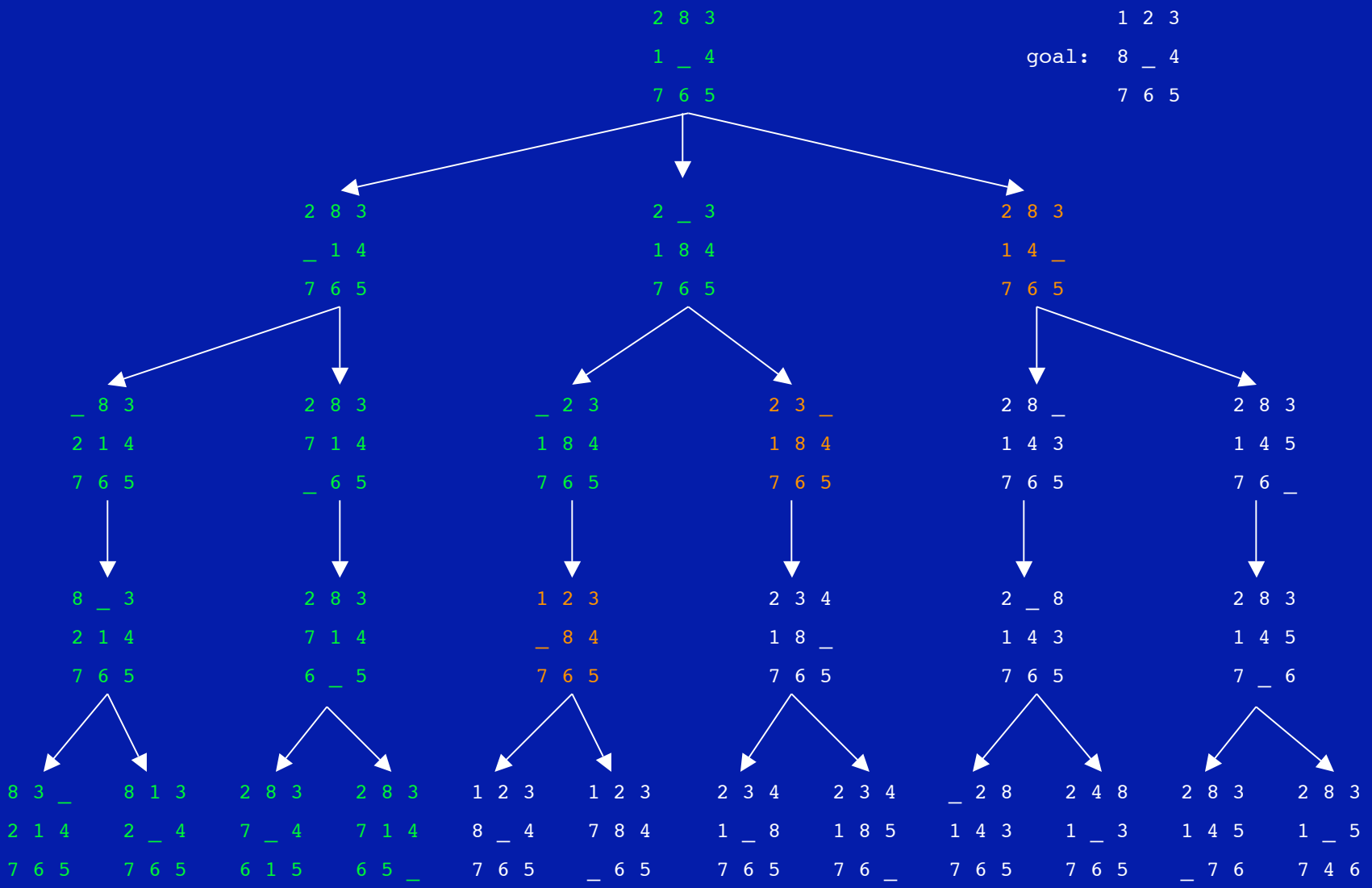

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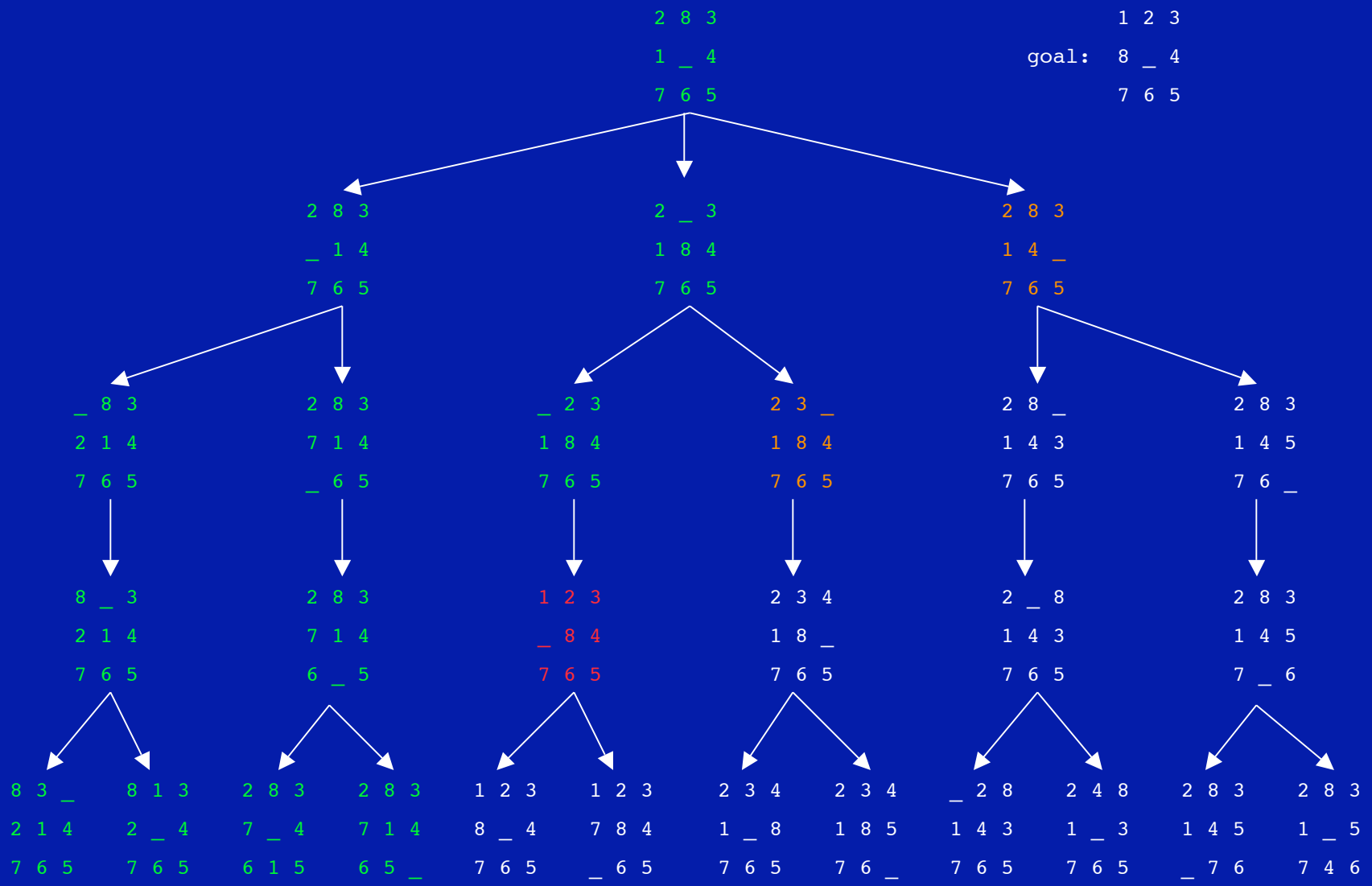

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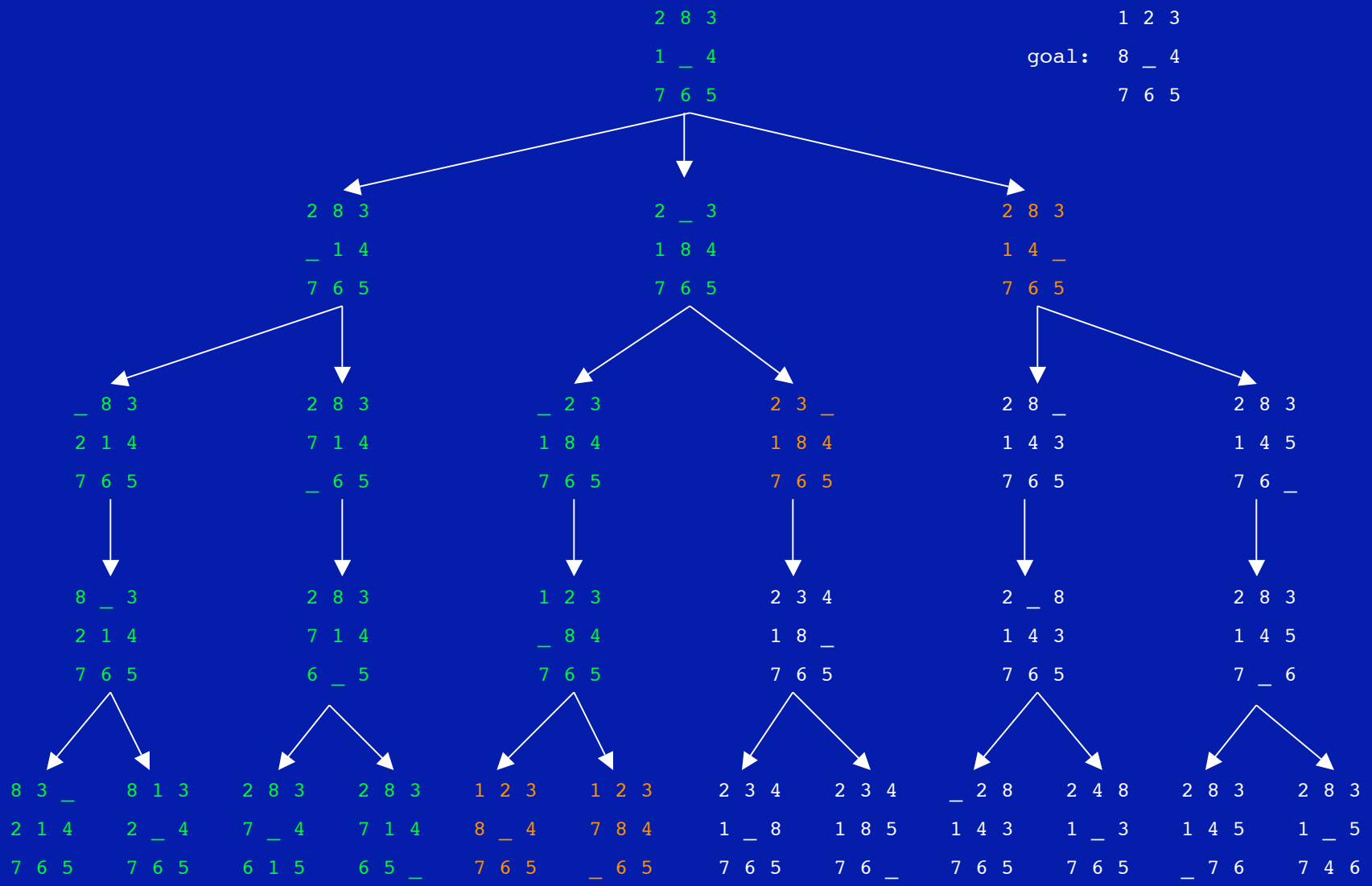

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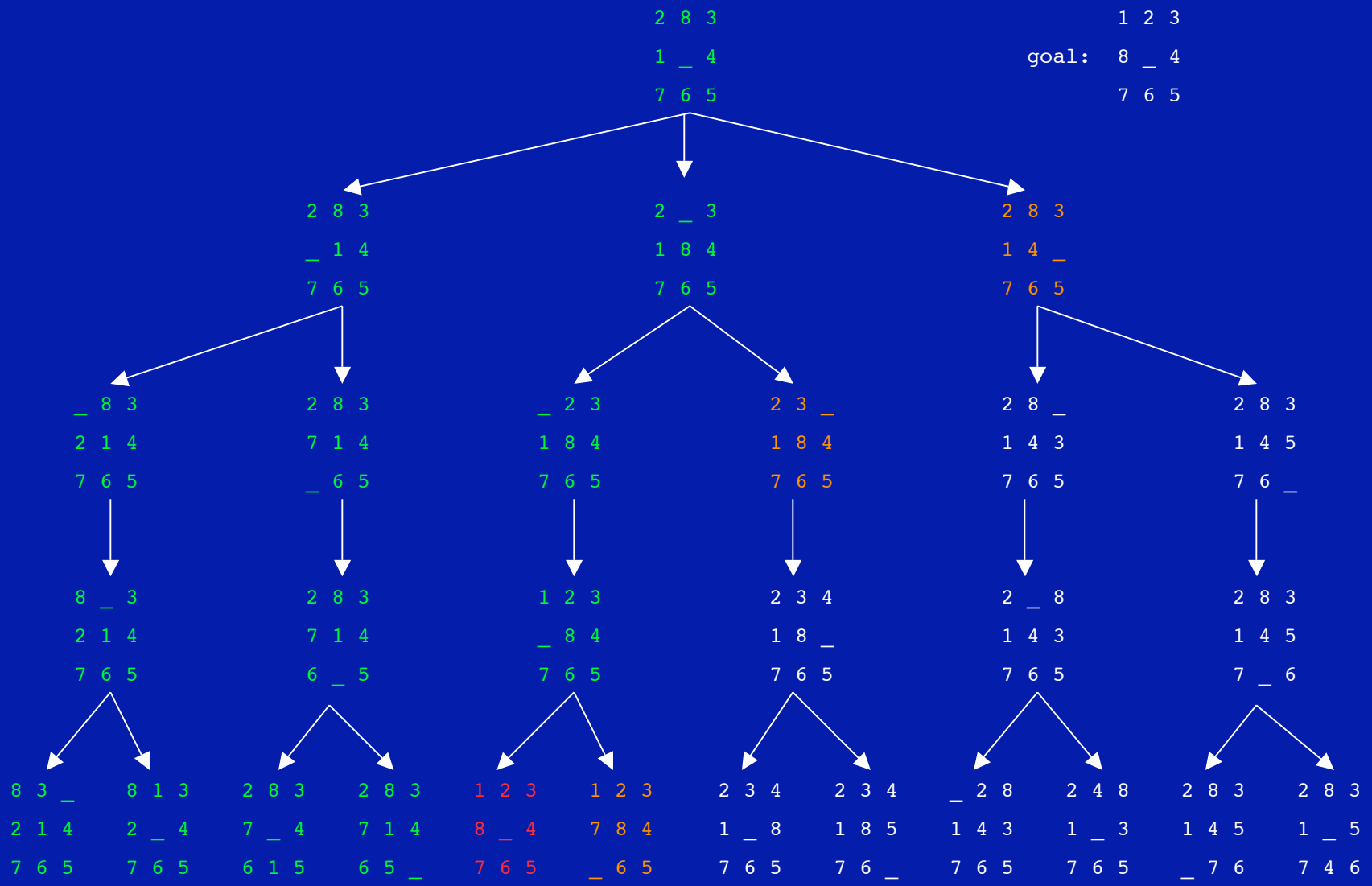

So many things to consider

Is graph search feasible on really big problems?

8-tile puzzle: 9! nodes = 362,880
4.2 days if enter 1 every second

15-tile puzzle: 15! nodes = 1,307,674,368,000
41,466 years...

chess: 10^{120} nodes = a lot!
roughly 10^{79} atoms in universe
you do the math

So many things to consider

Is graph search feasible on really big problems?

Is there an alternative to graph search?

How does the way I choose nodes from the frontier change the search?

Can I use additional information to reduce the amount of search?