Tries

Tries

- We have seen a few data structures that handle the mapping of key-value pairs.
  - Arrays: The key is the element index, the value is the data at that location.
  - Hash tables: The key is the hash code of the data, the value is a linked list of data hashing to that hash code.

- What about a slightly different kind of data structure where the key is guaranteed to be unique, and the value could be as simple as a Boolean that tells you whether the data exists in the structure?

Tries

- Tries combine structures and pointers together to store data in an interesting way.

- The data to be searched for in the trie is now a roadmap.
  - If you can follow the map from beginning to end, the data exists in the trie.
  - If you can't, it doesn't.

- Unlike with a hash table, there are no collisions, and no two pieces of data (unless they are identical) have the same path.

Tries

- Let’s map key-value pairs where the keys are four-digit years (YYYY) and the values are names of universities founded during those years.

- In a trie, the paths from a central **root** node to a **leaf** node (where the school names would be), would be labeled with digits of the year.

- Each node on the path from root to leaf could have 10 pointers emanating from it, one for each digit.

Tries

- To insert an element into the trie, simply build the correct path from the root to the leaf.

Tries

```
typedef struct _trie
{
    char university[20];
    struct _trie* paths[10];
}
trie;
```

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{
    char university[20];
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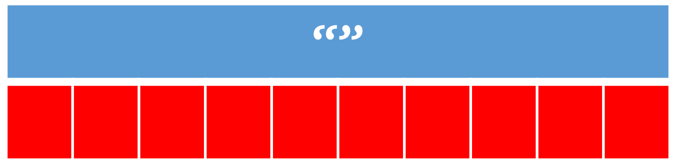
trie;
```

Tries



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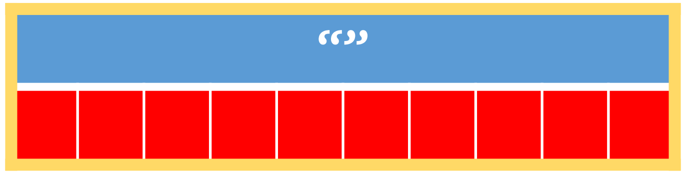
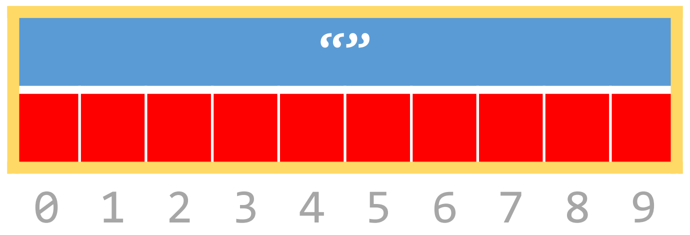


Insert “Harvard”, founded 1636

Tries



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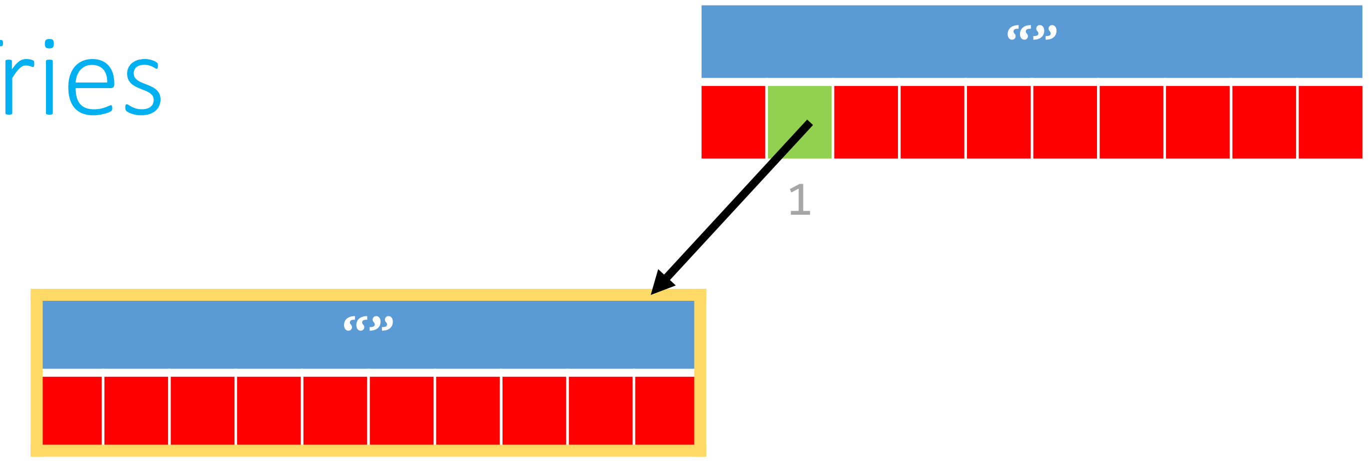

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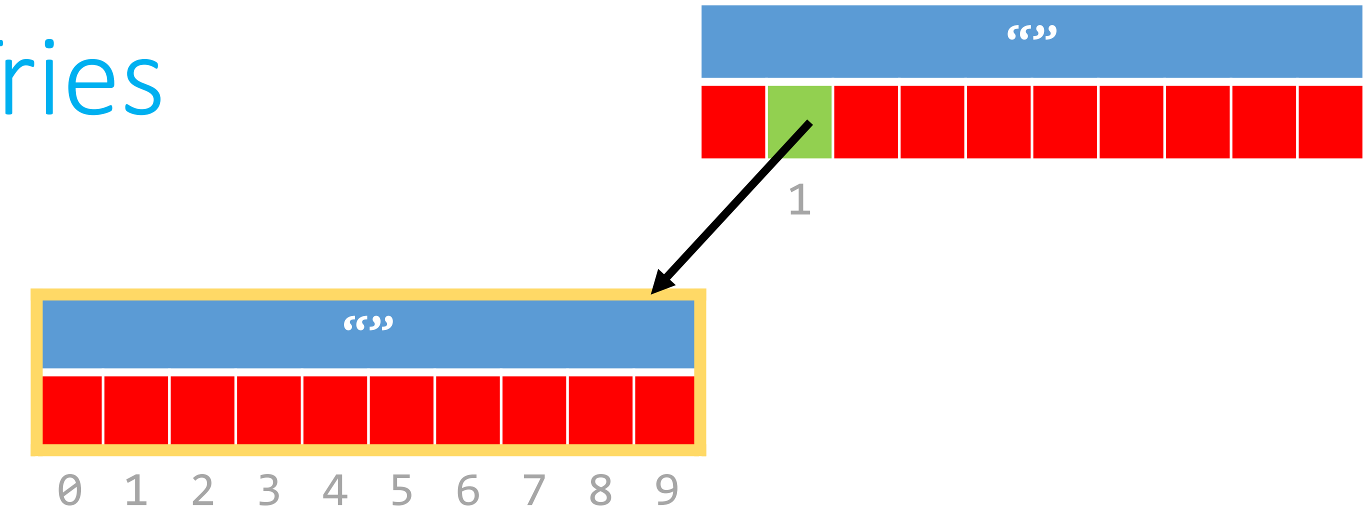

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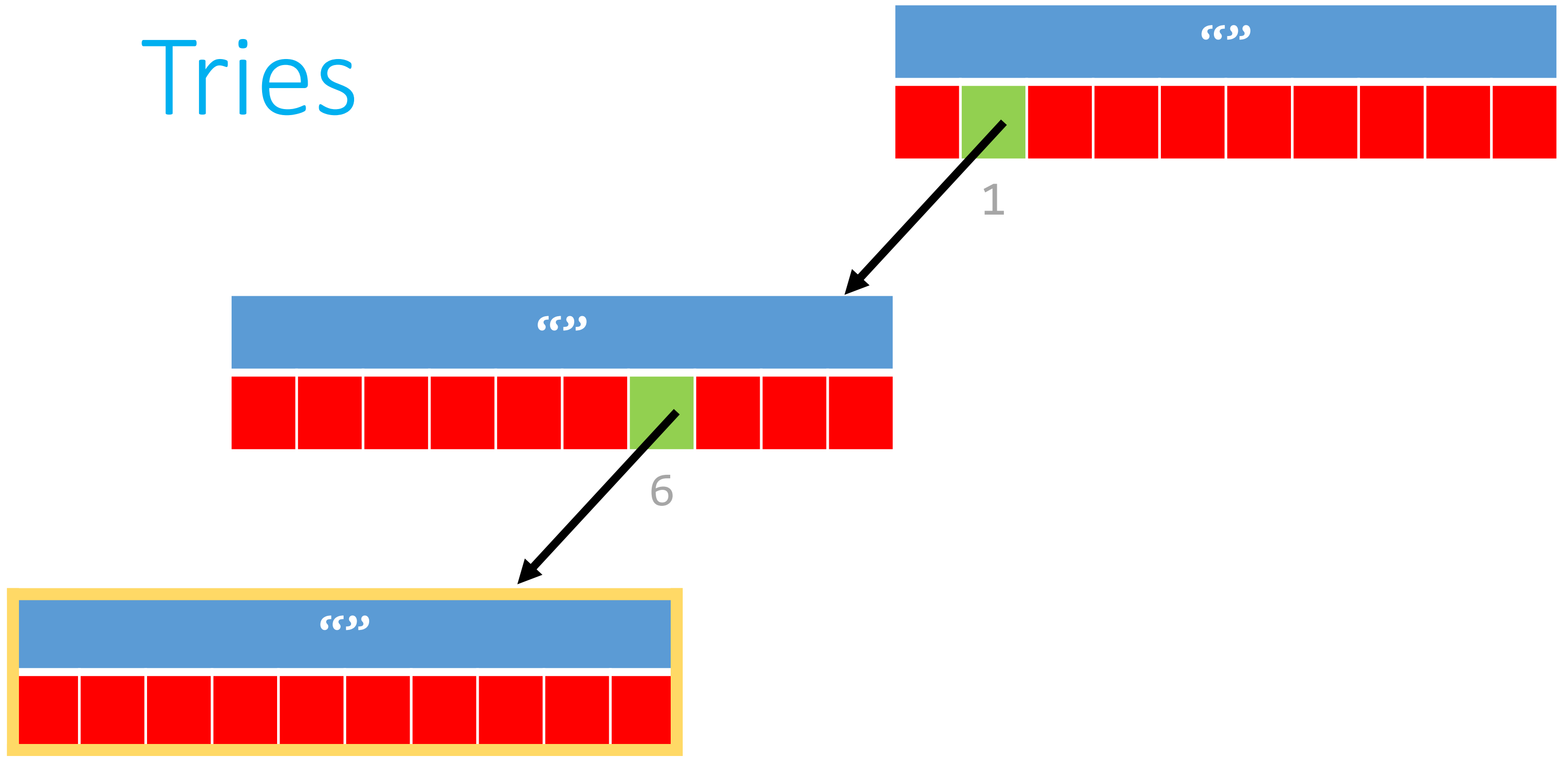

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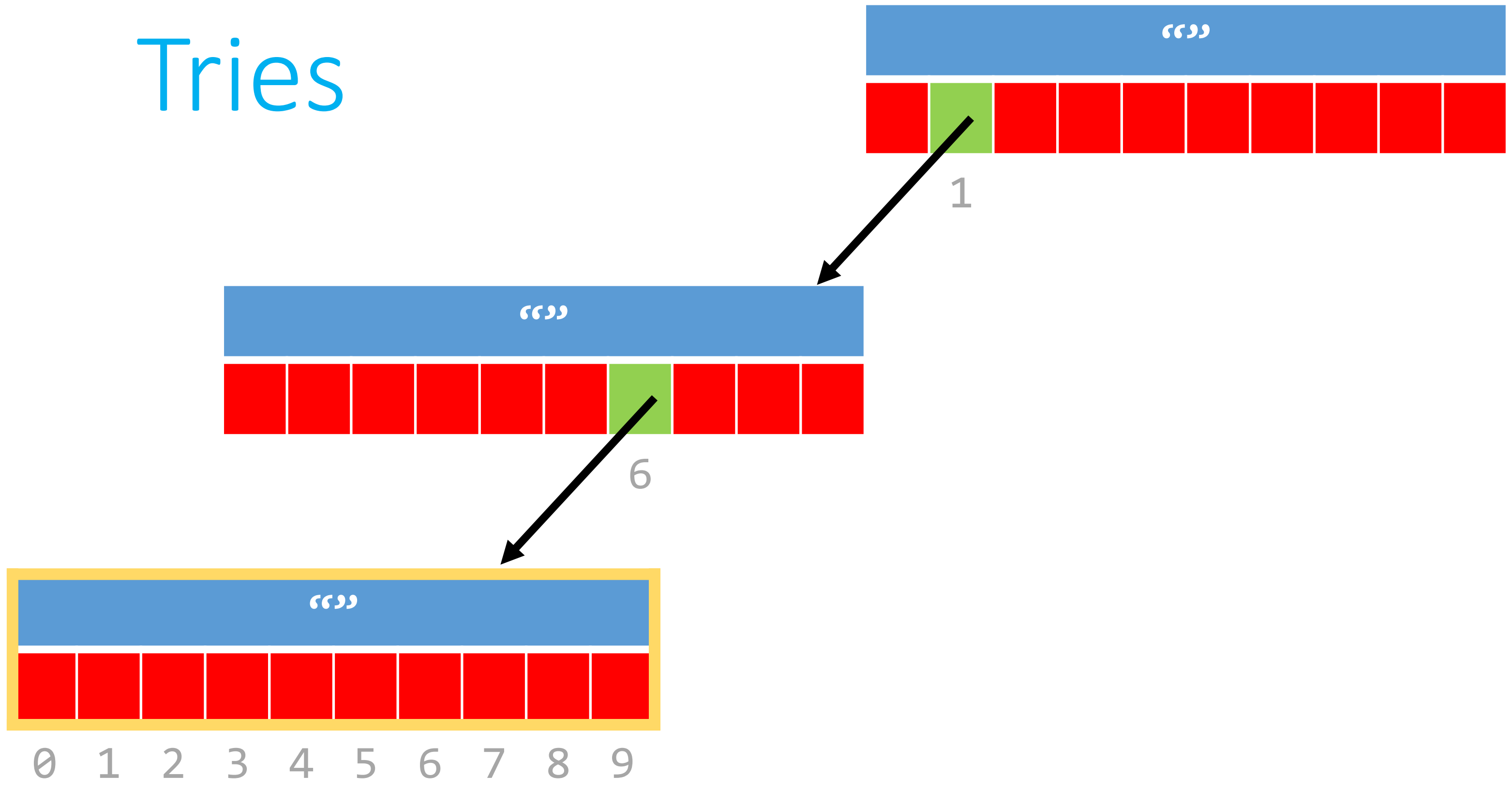

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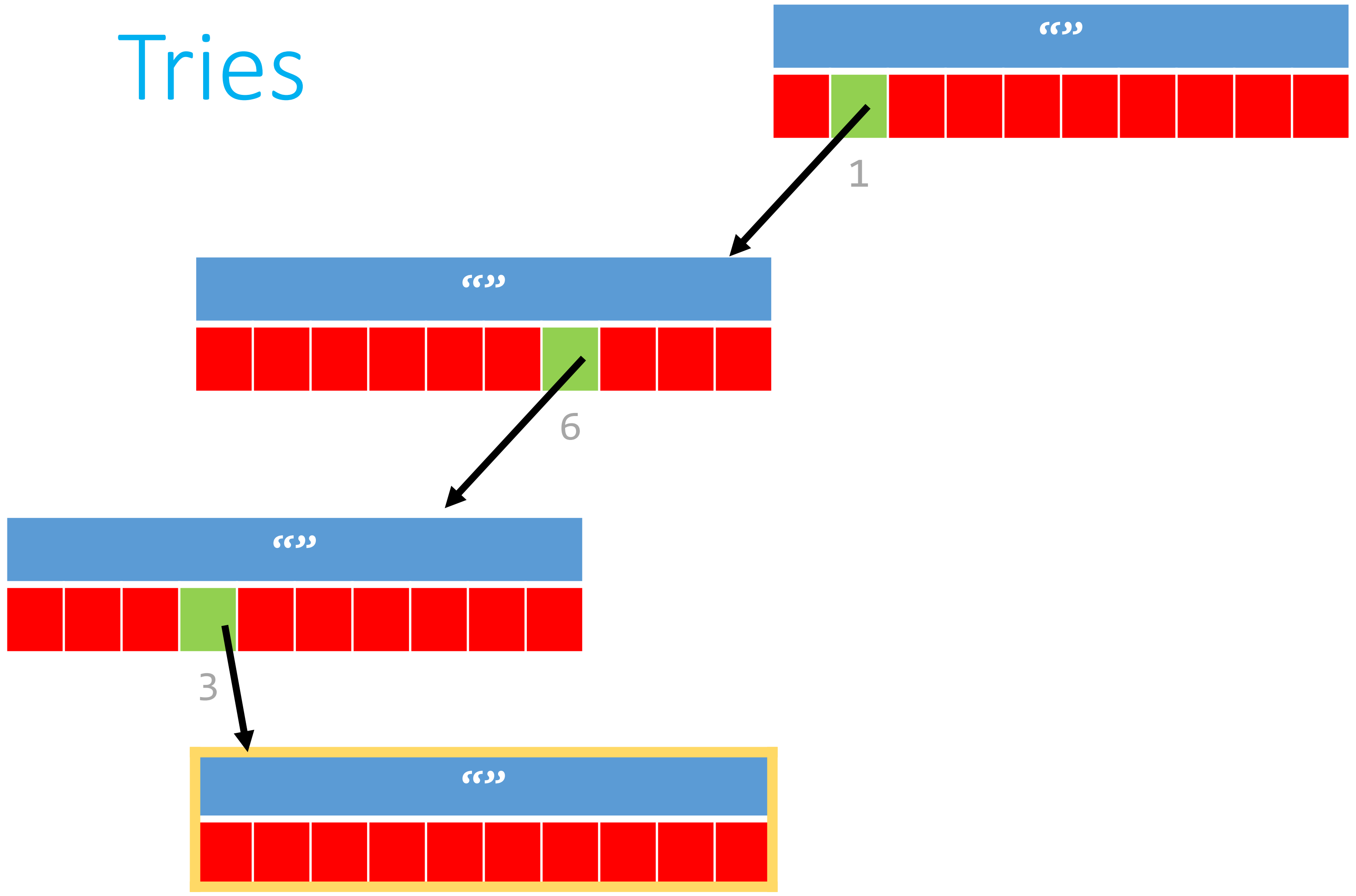

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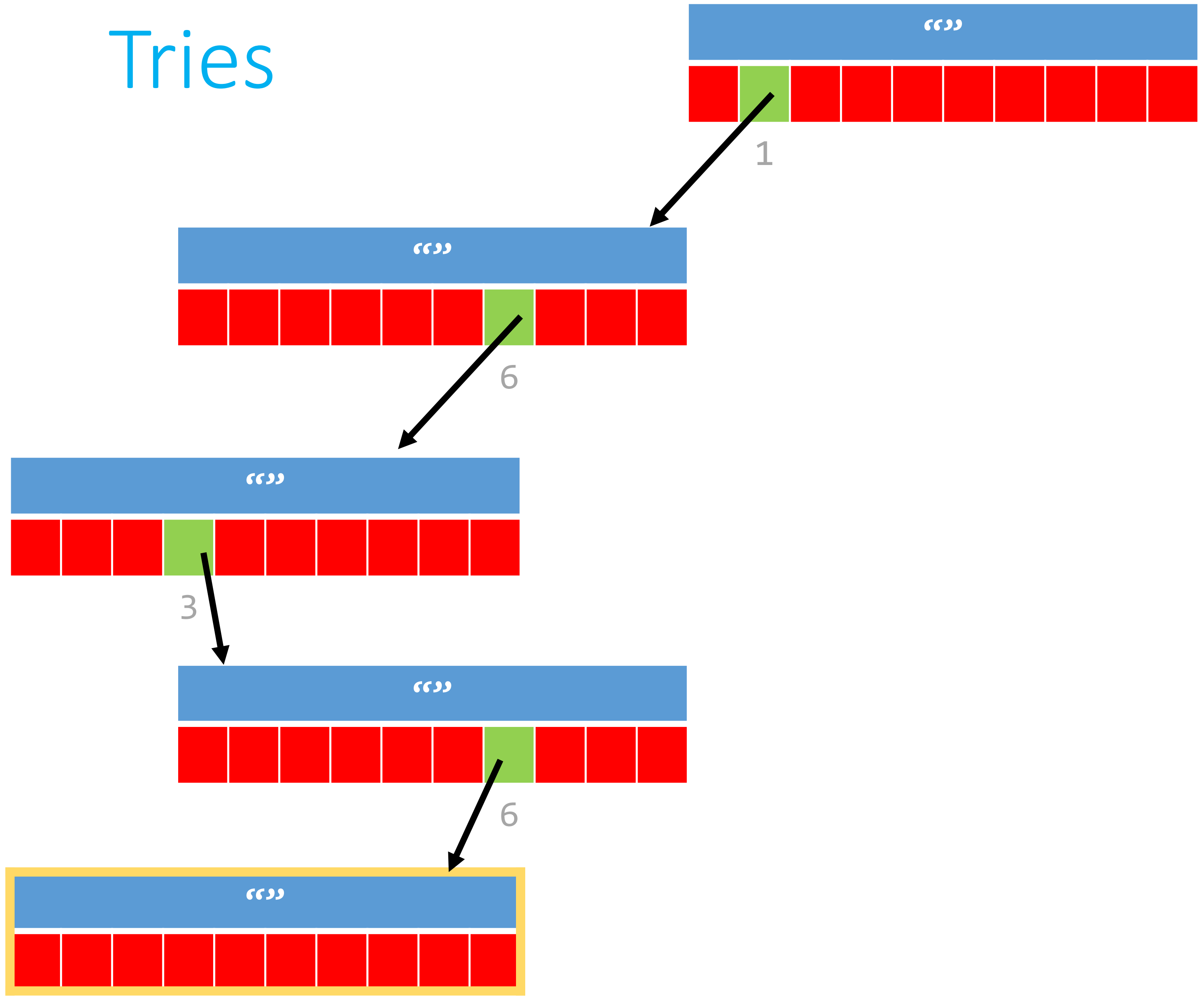

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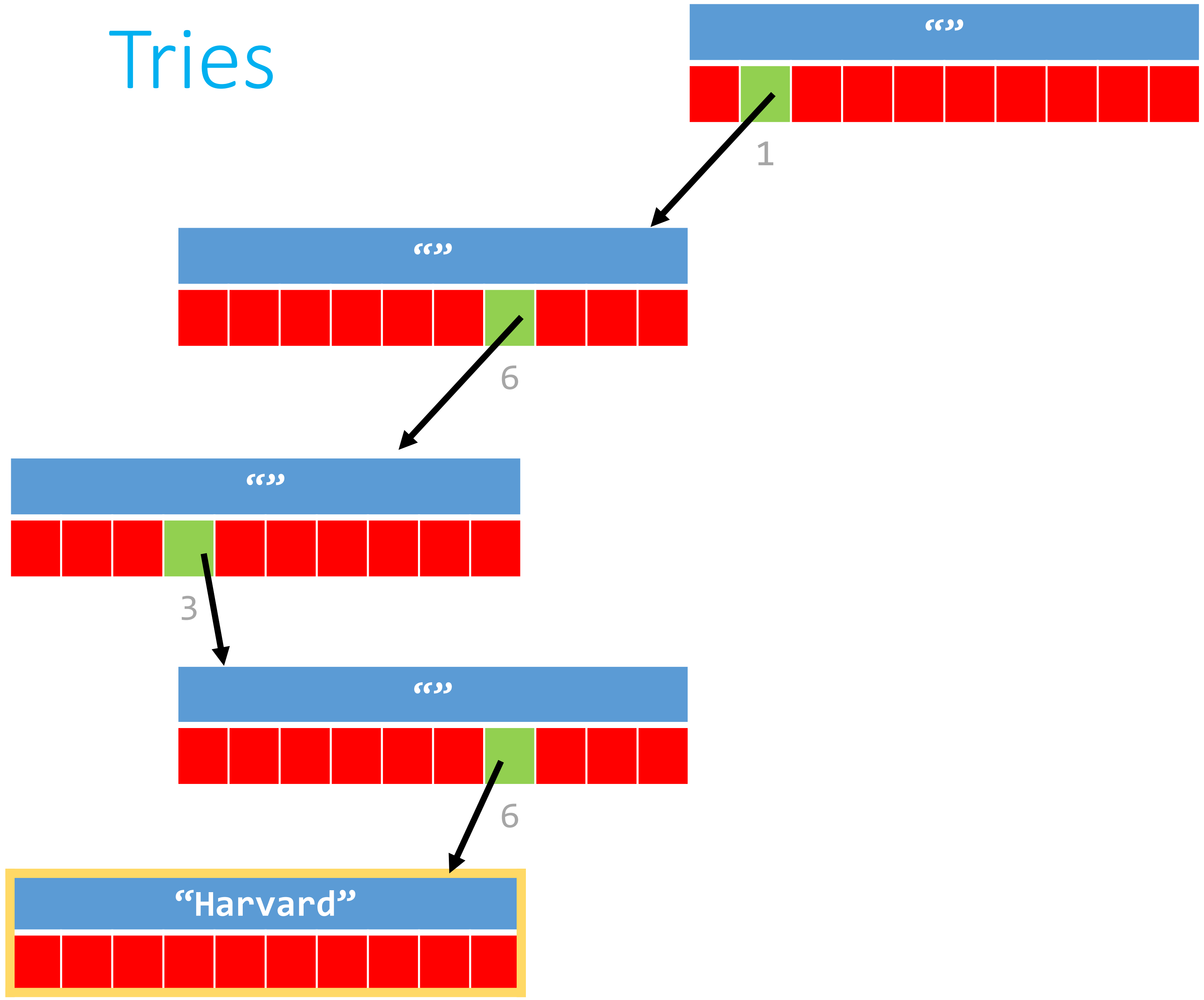

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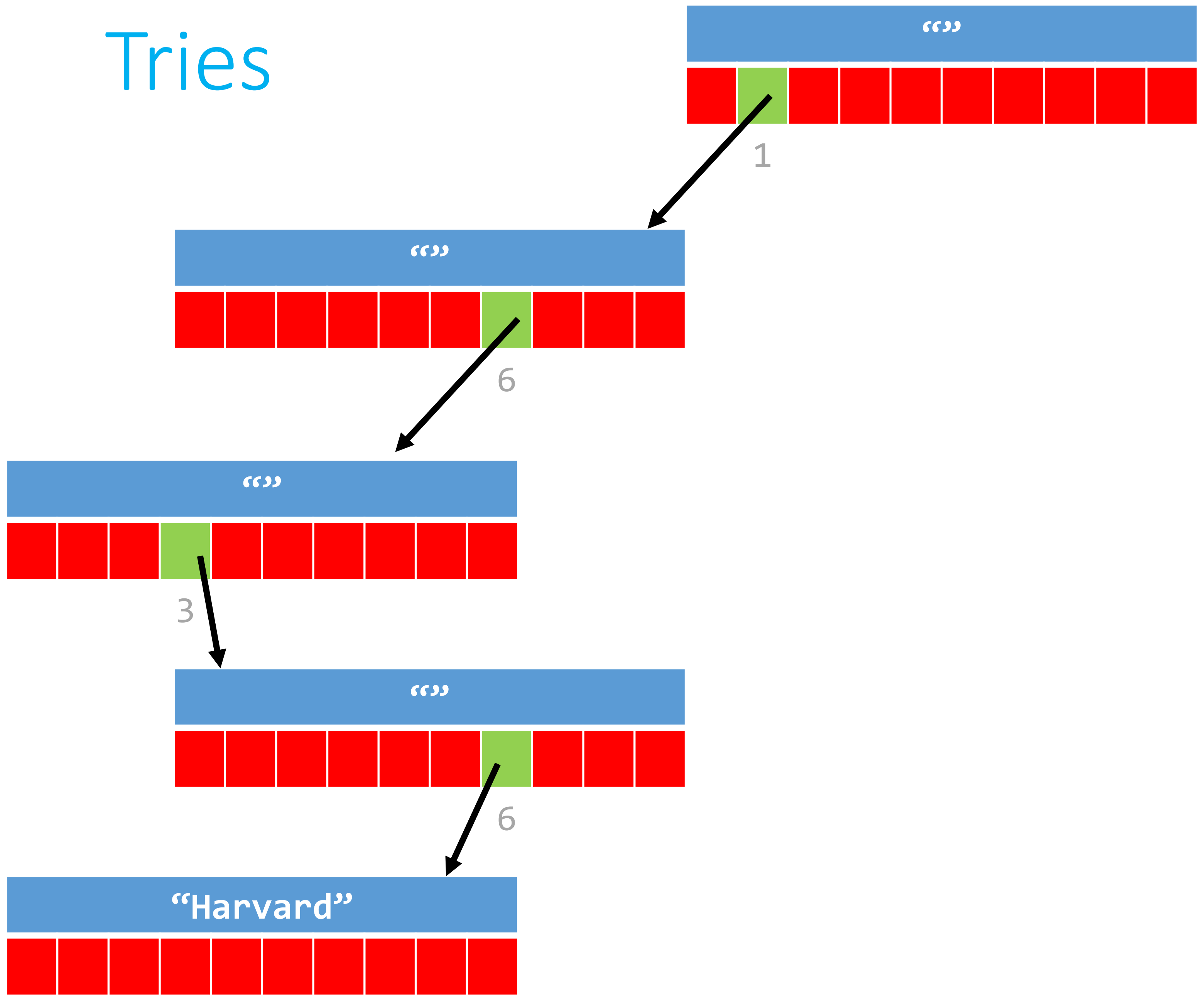

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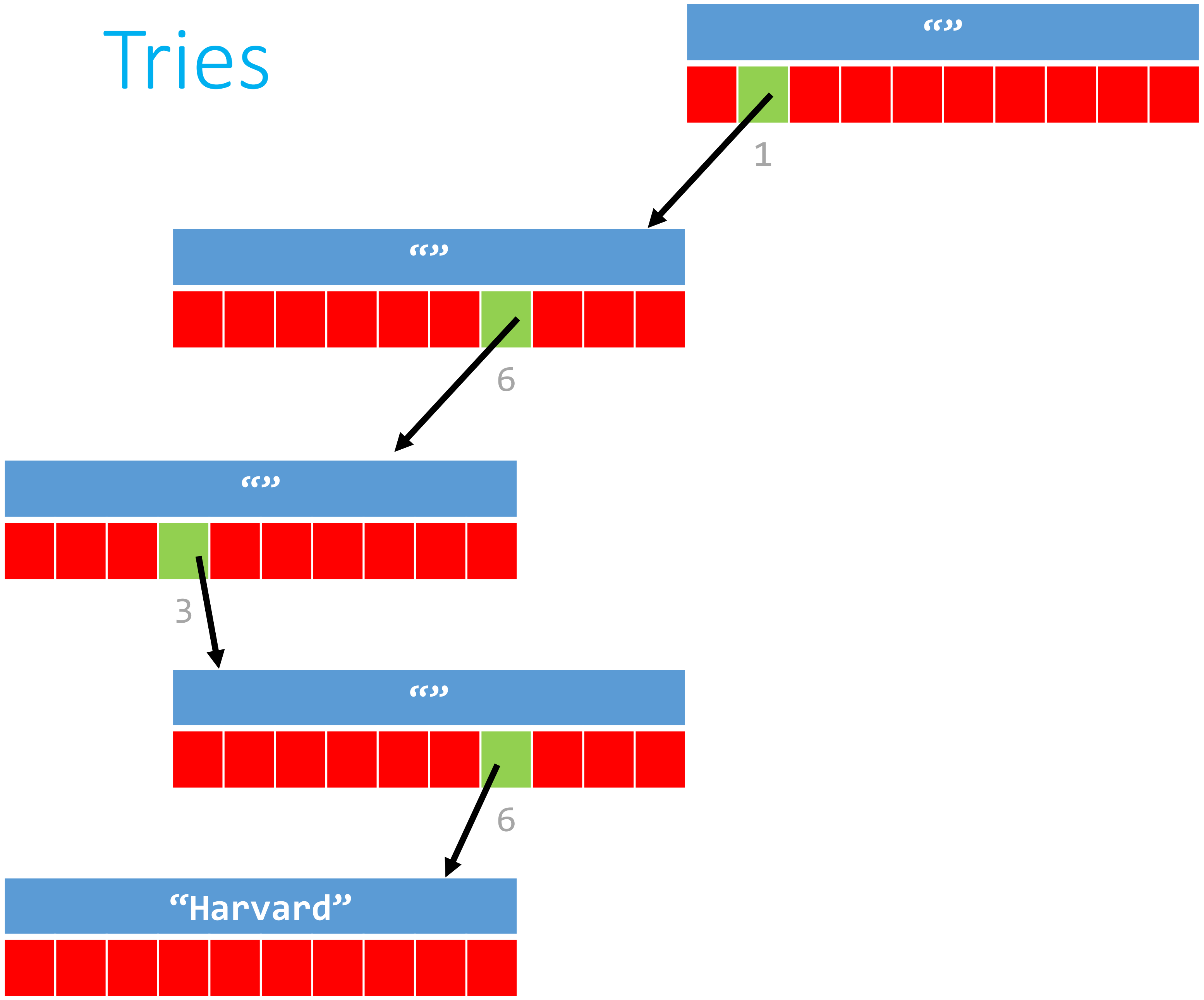

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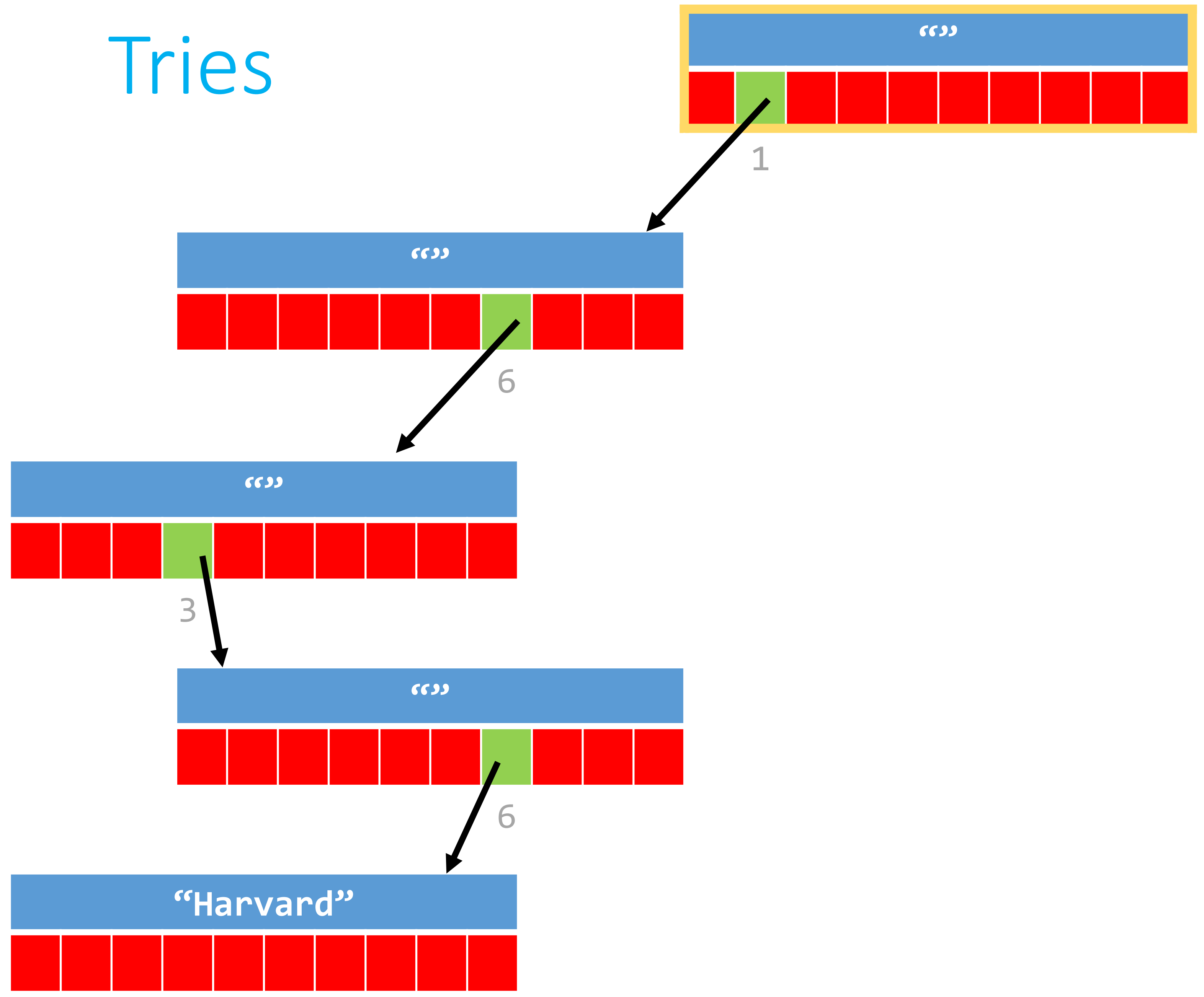

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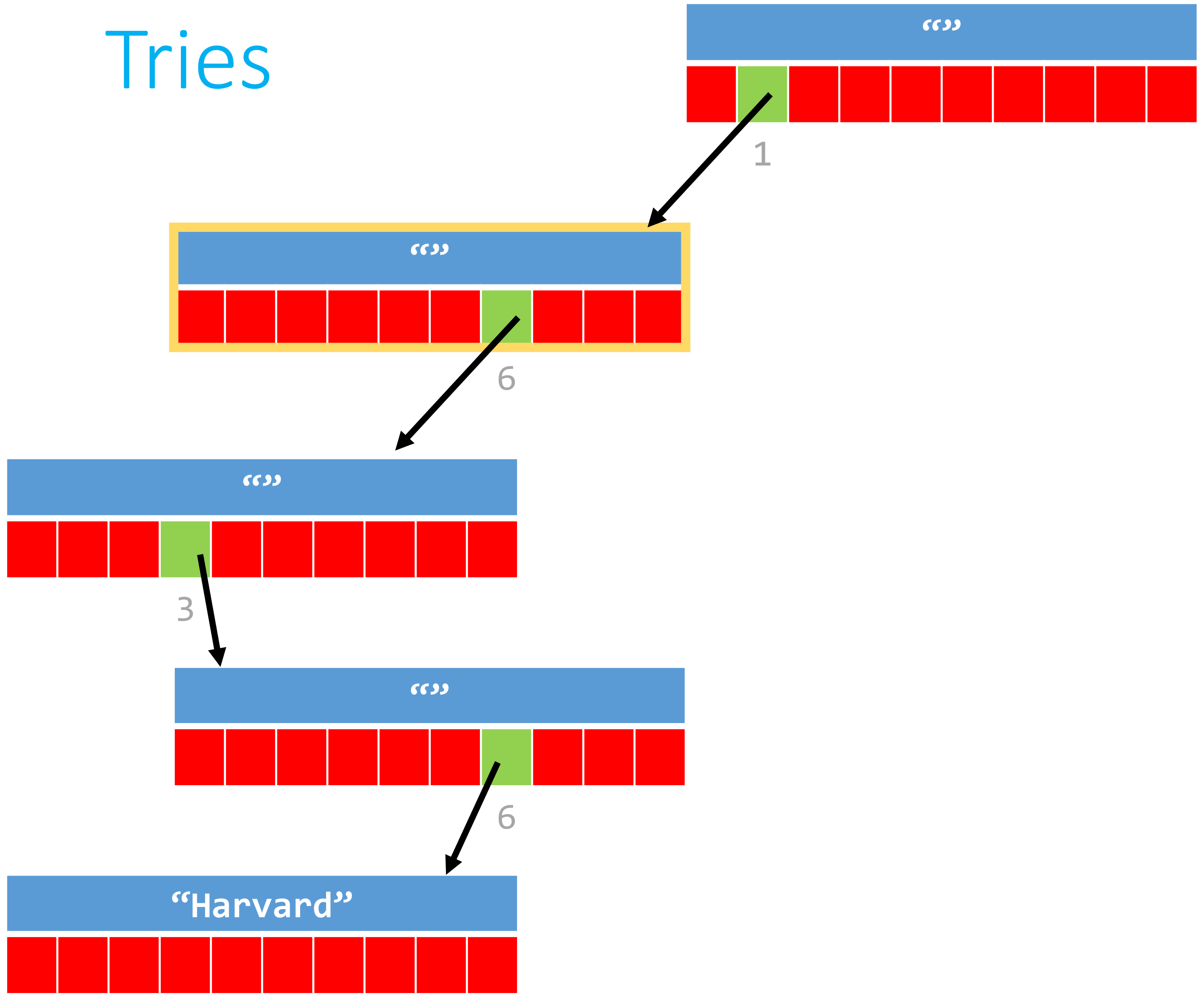

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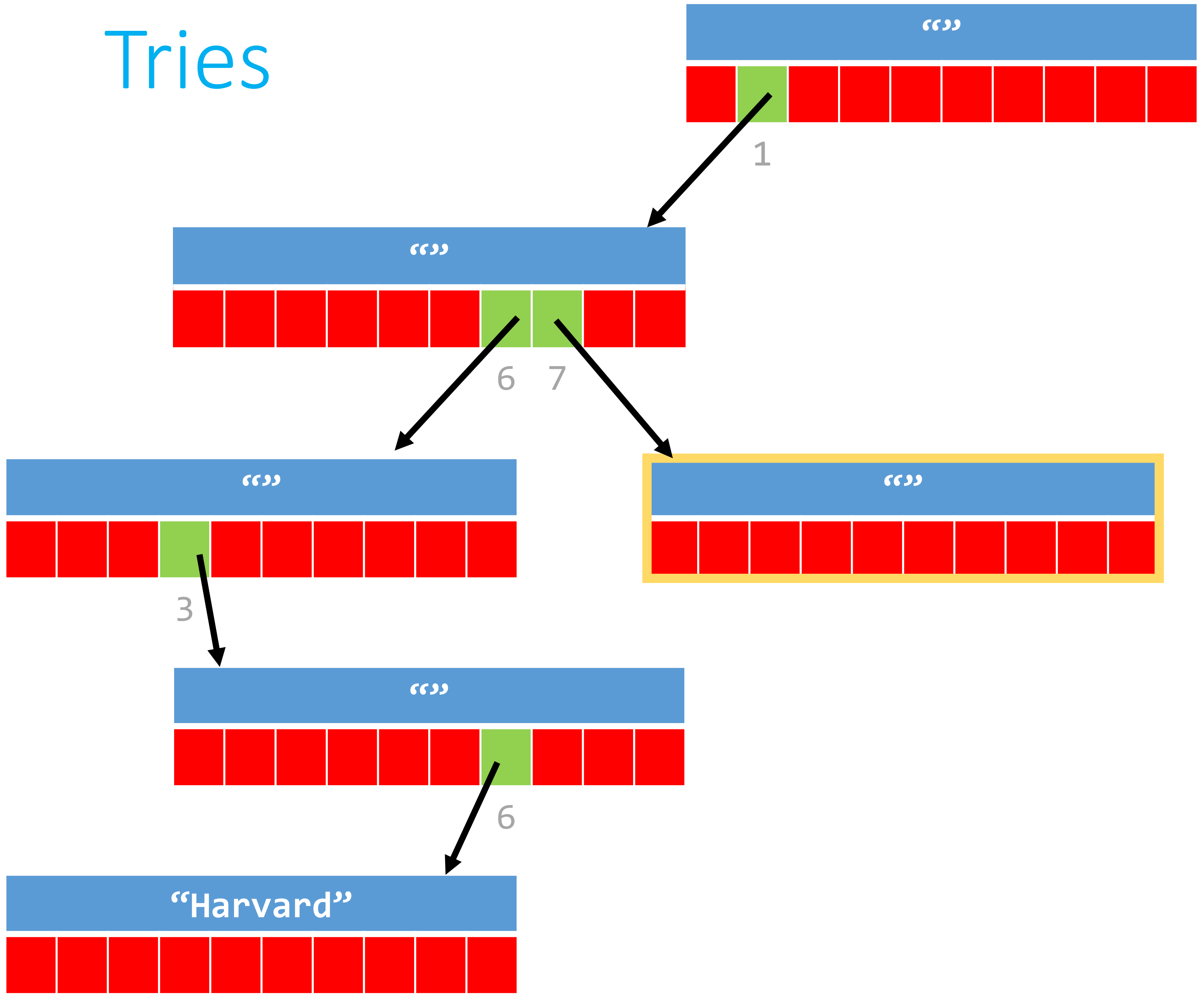

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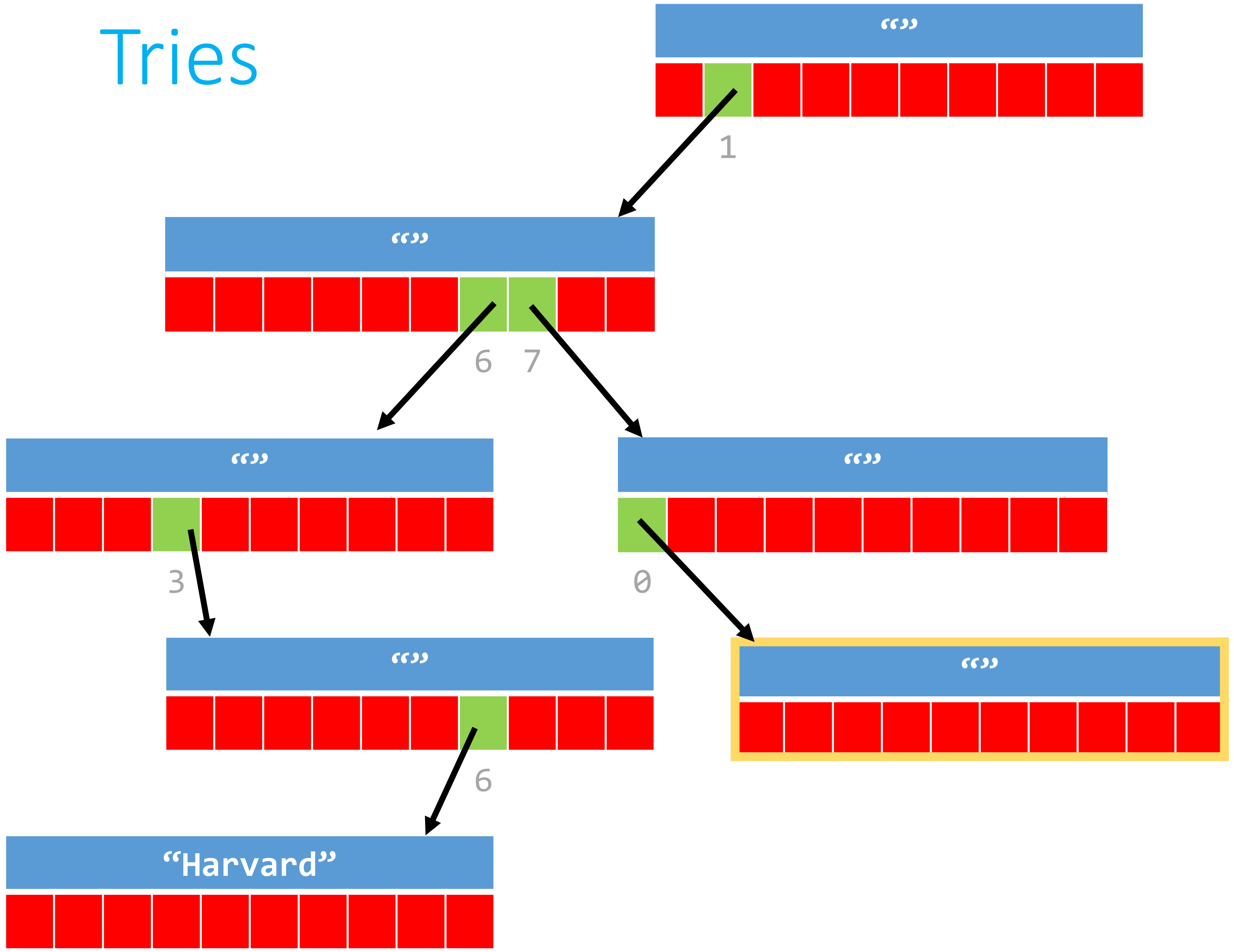

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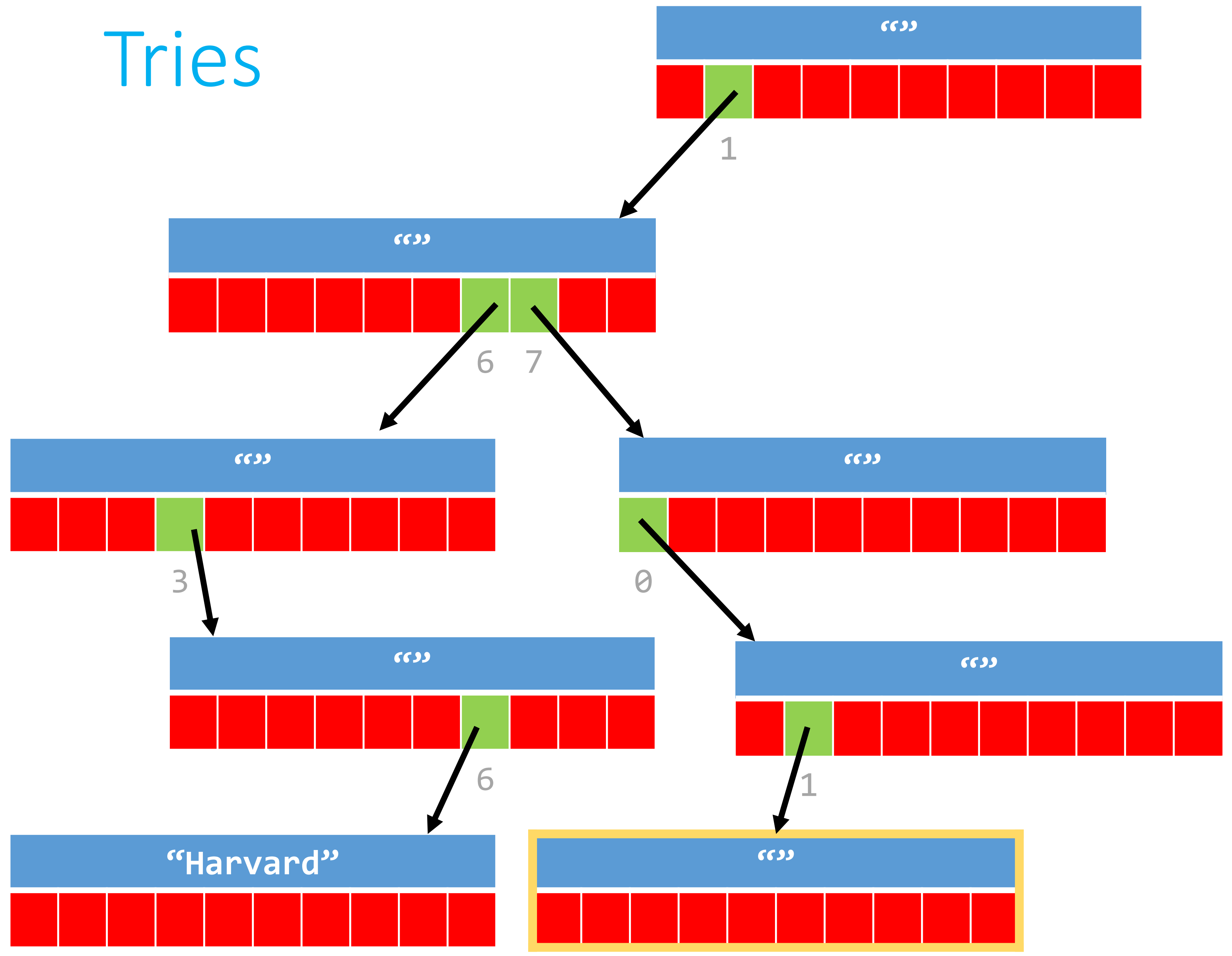

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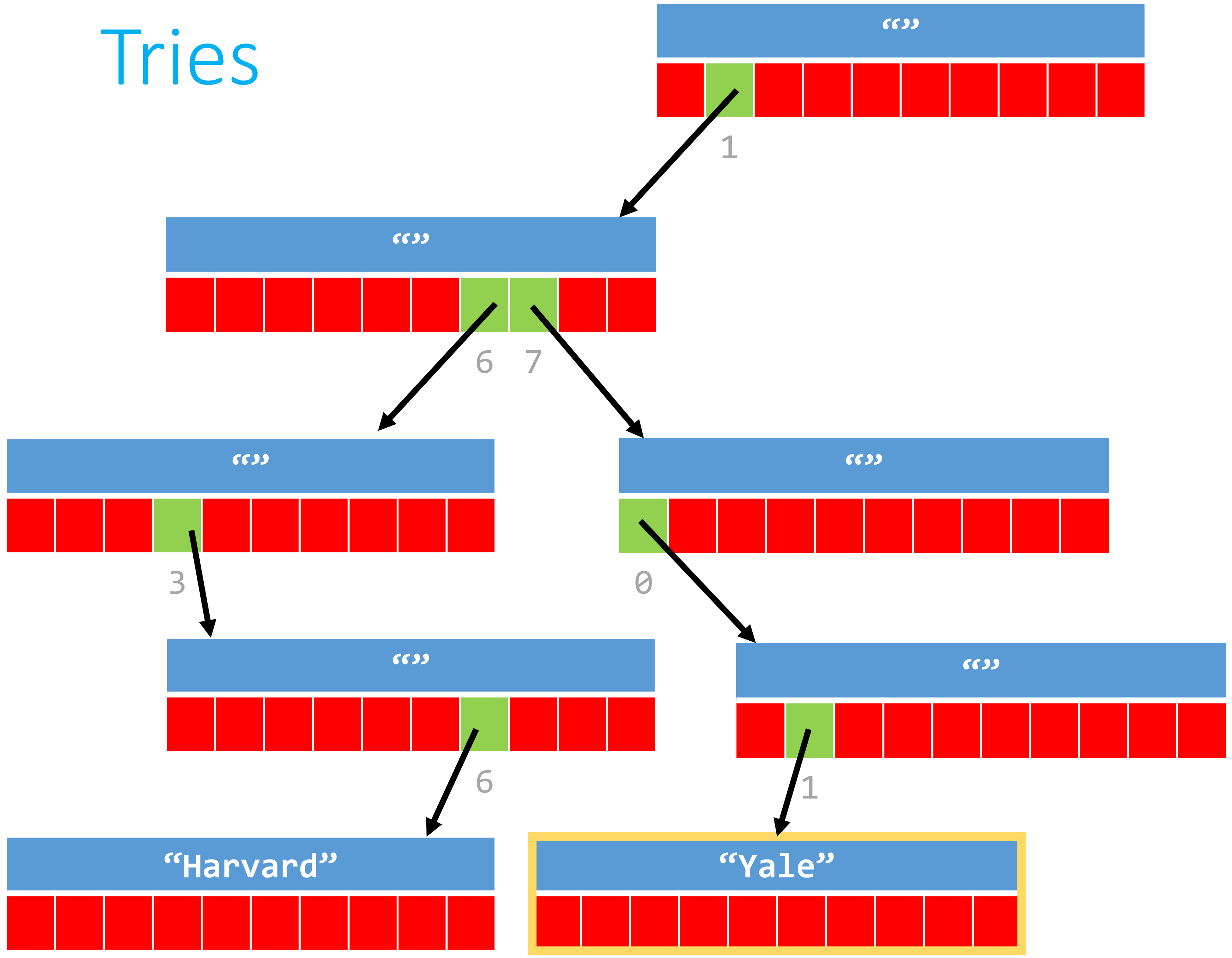

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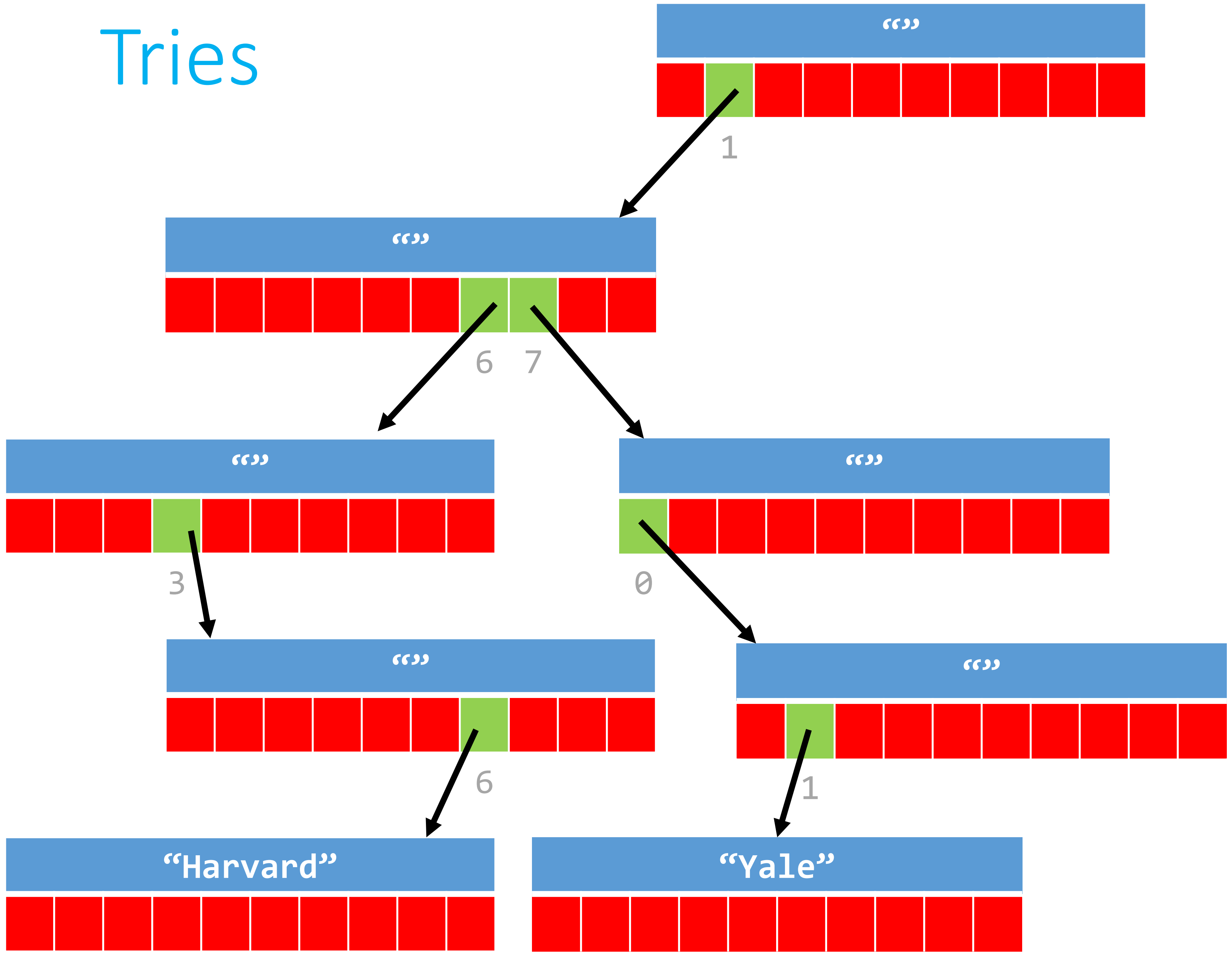
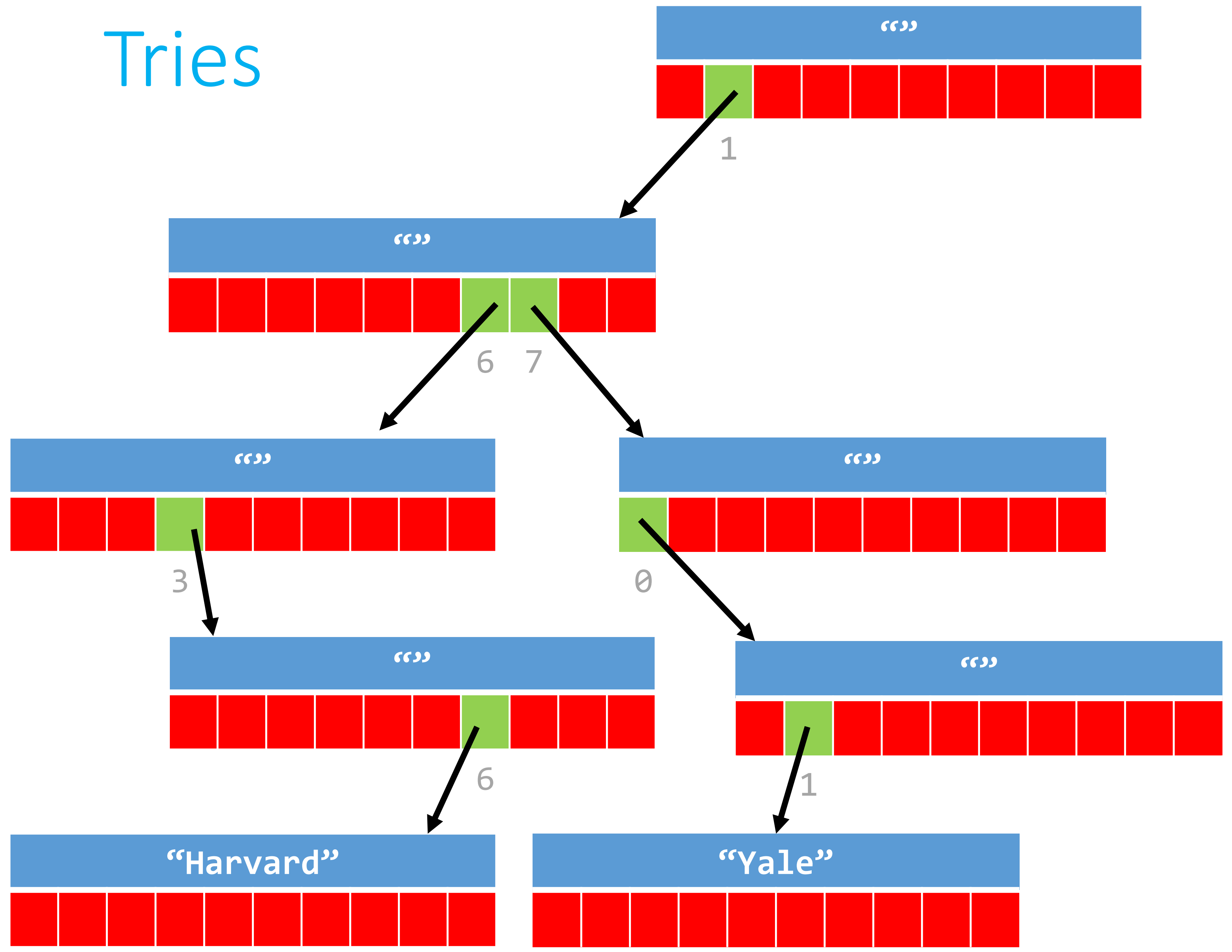


Tries

Insert “Dartmouth”, founded 1769



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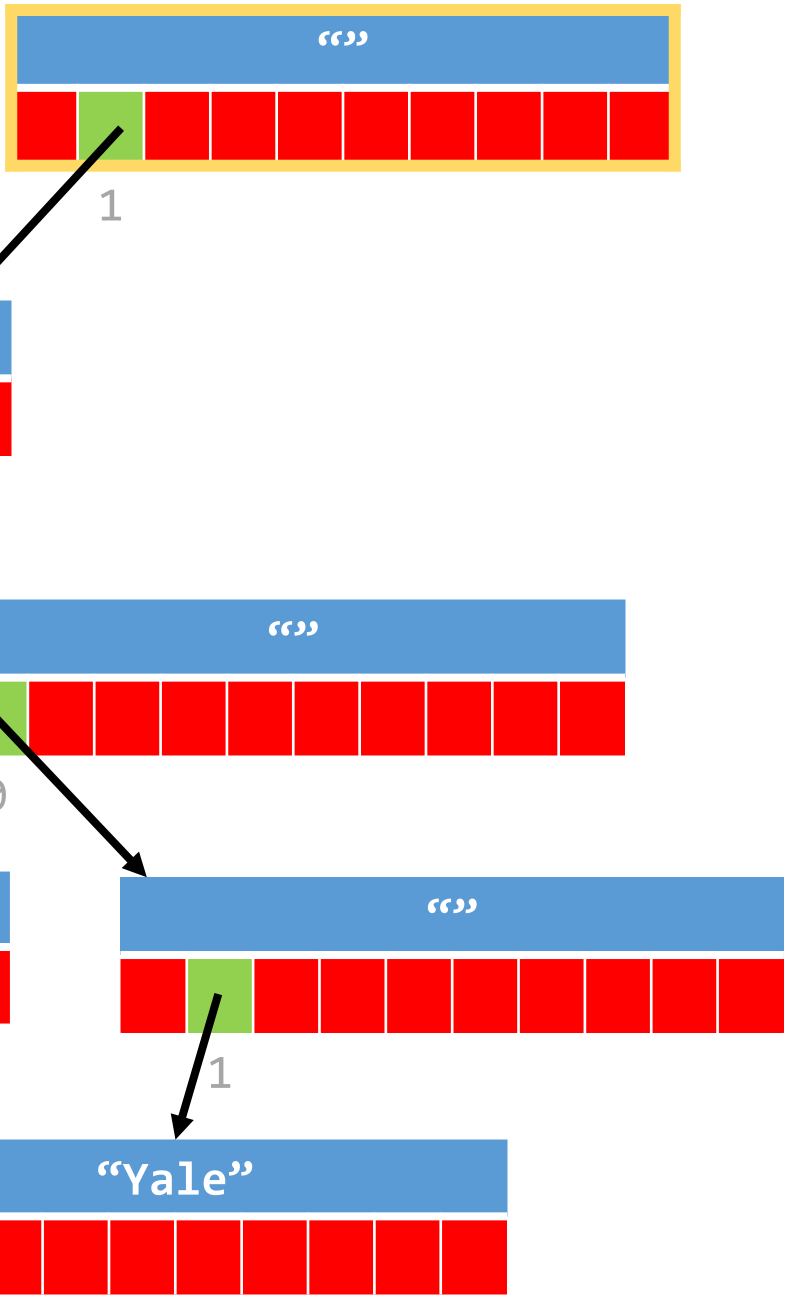

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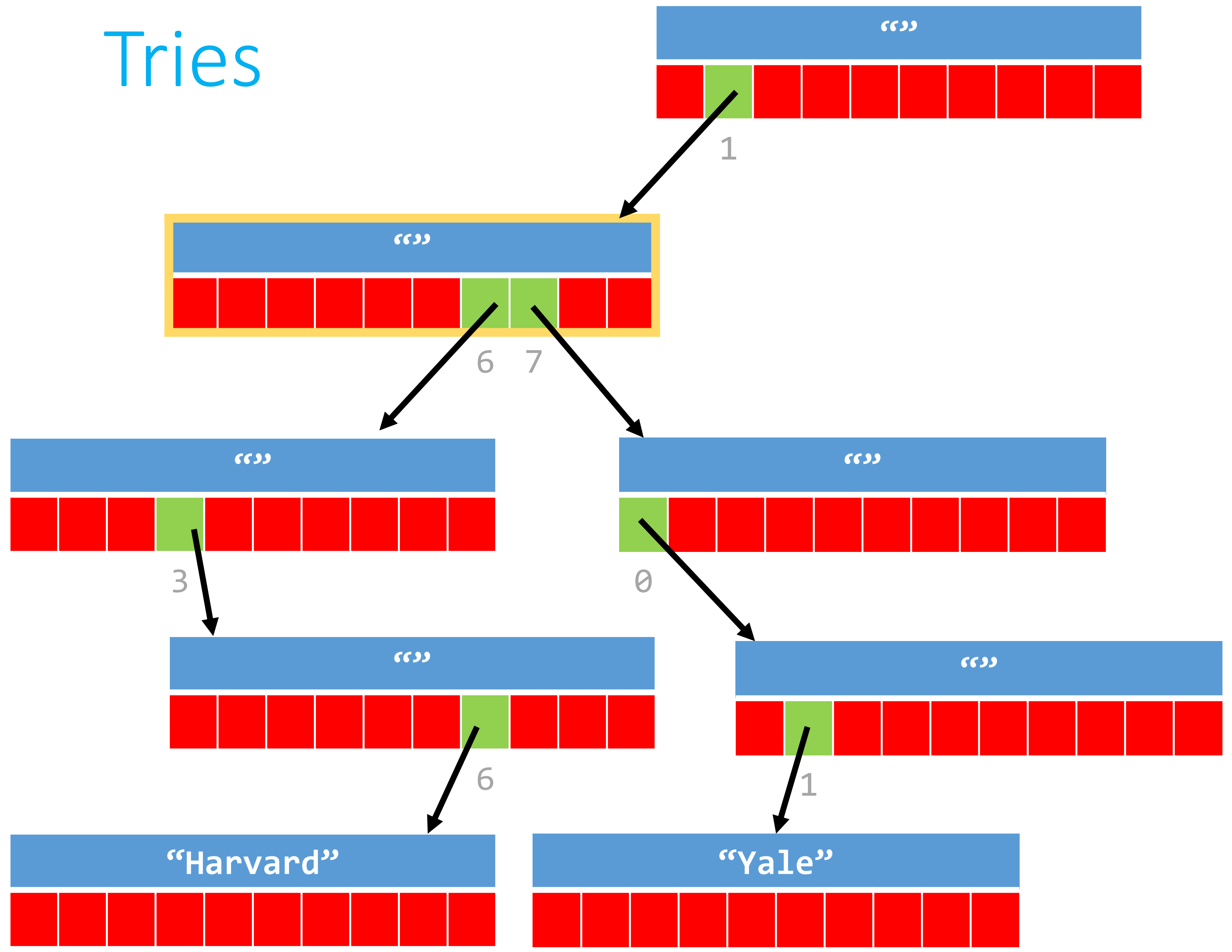

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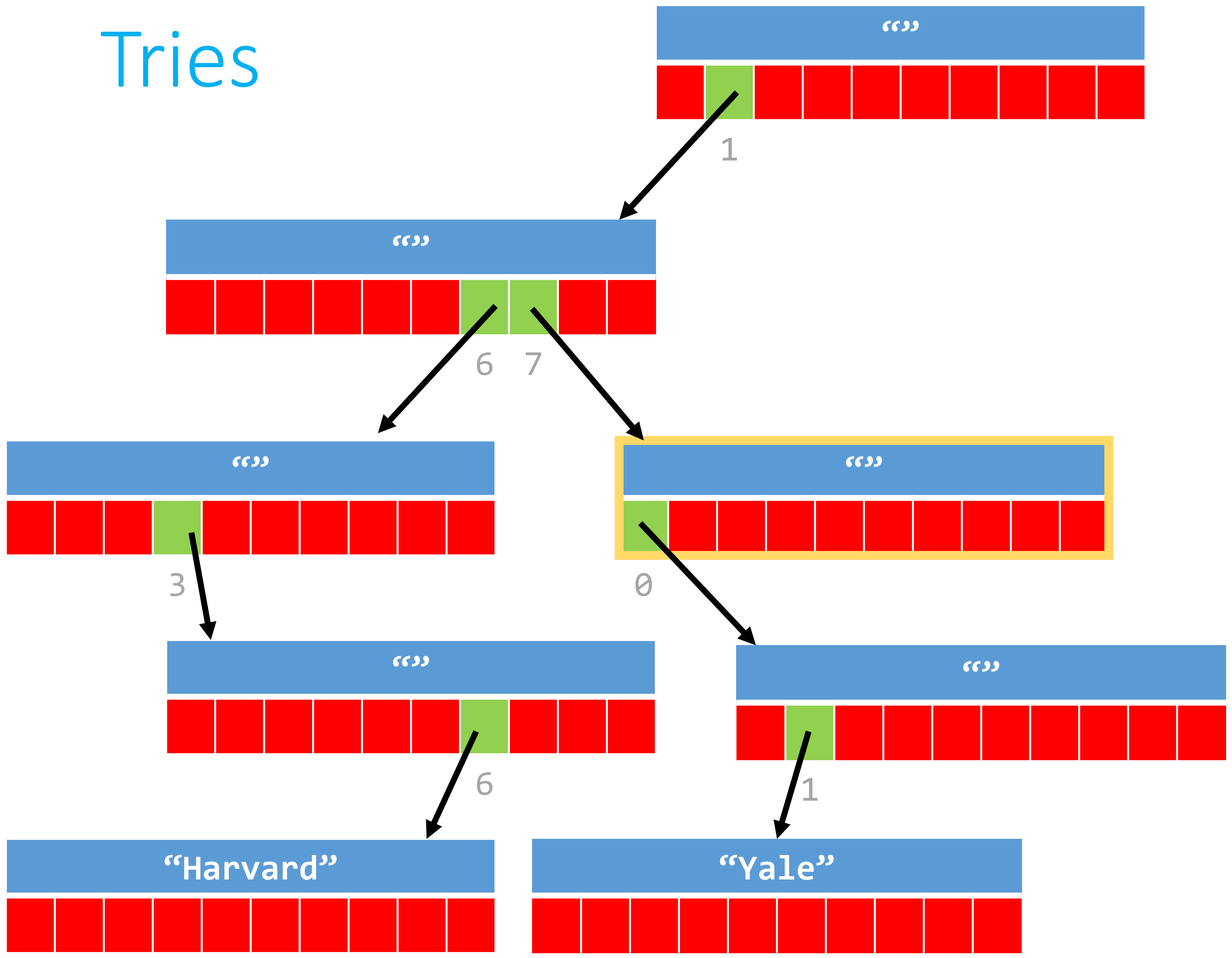

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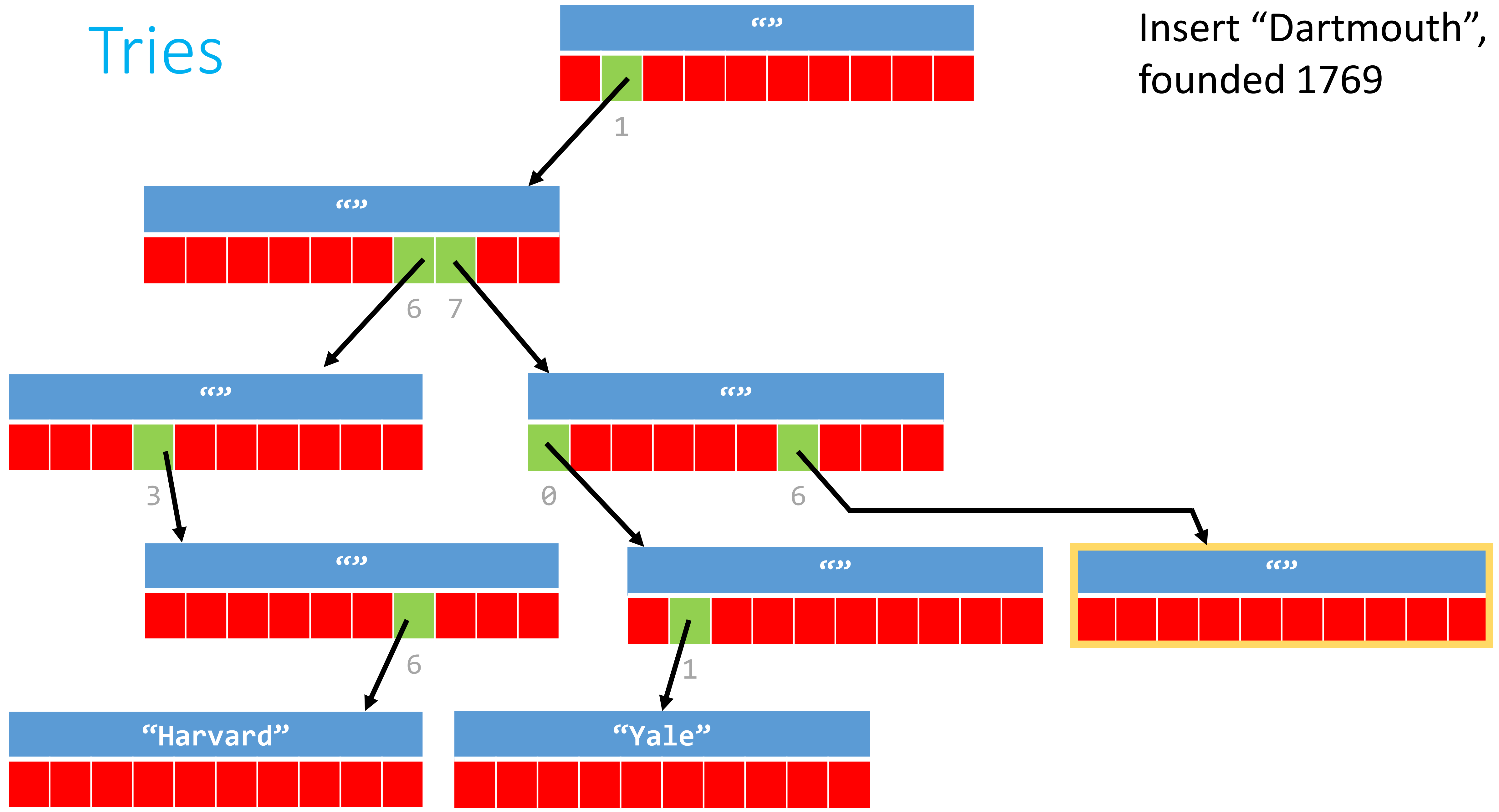

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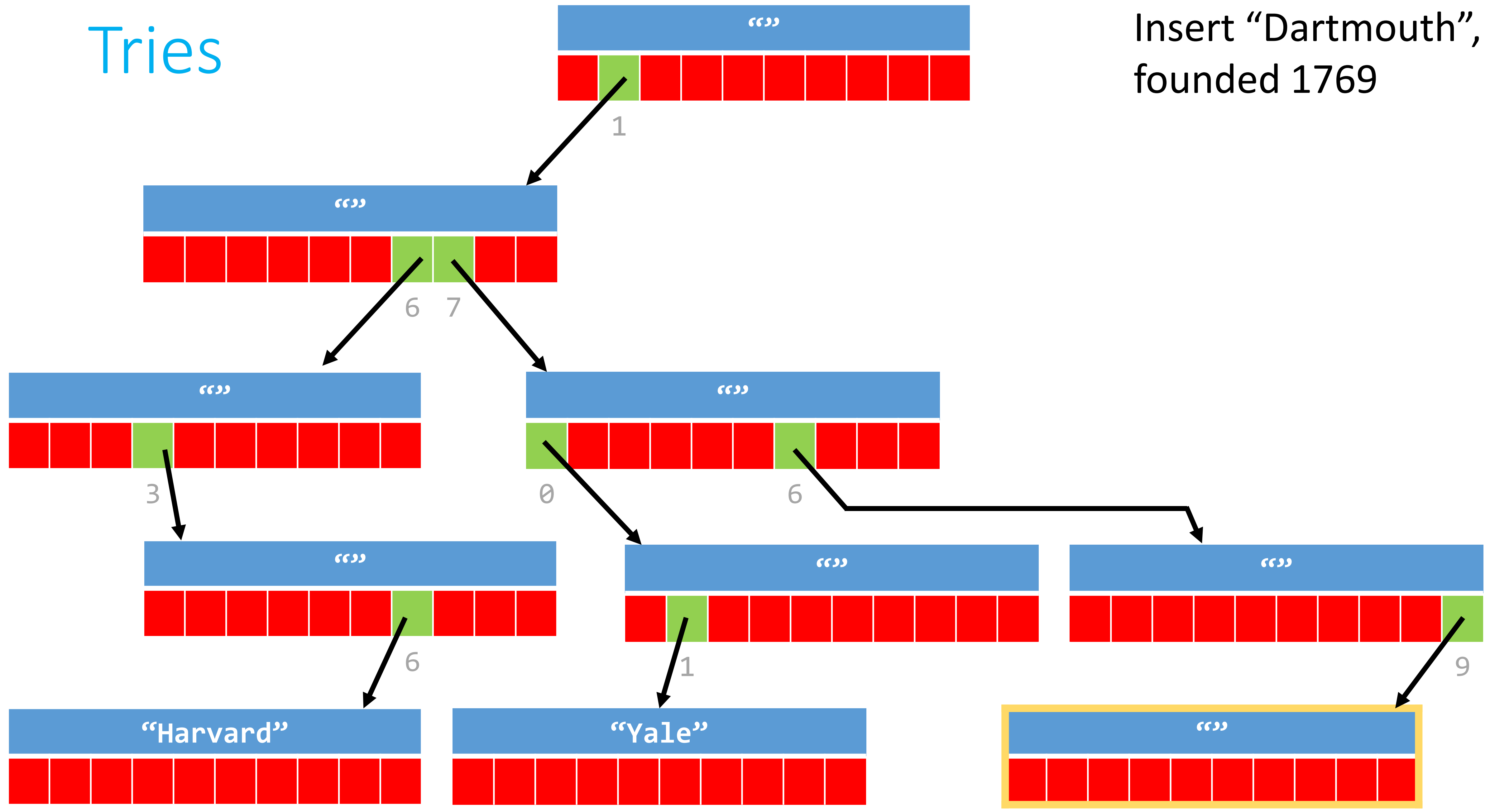

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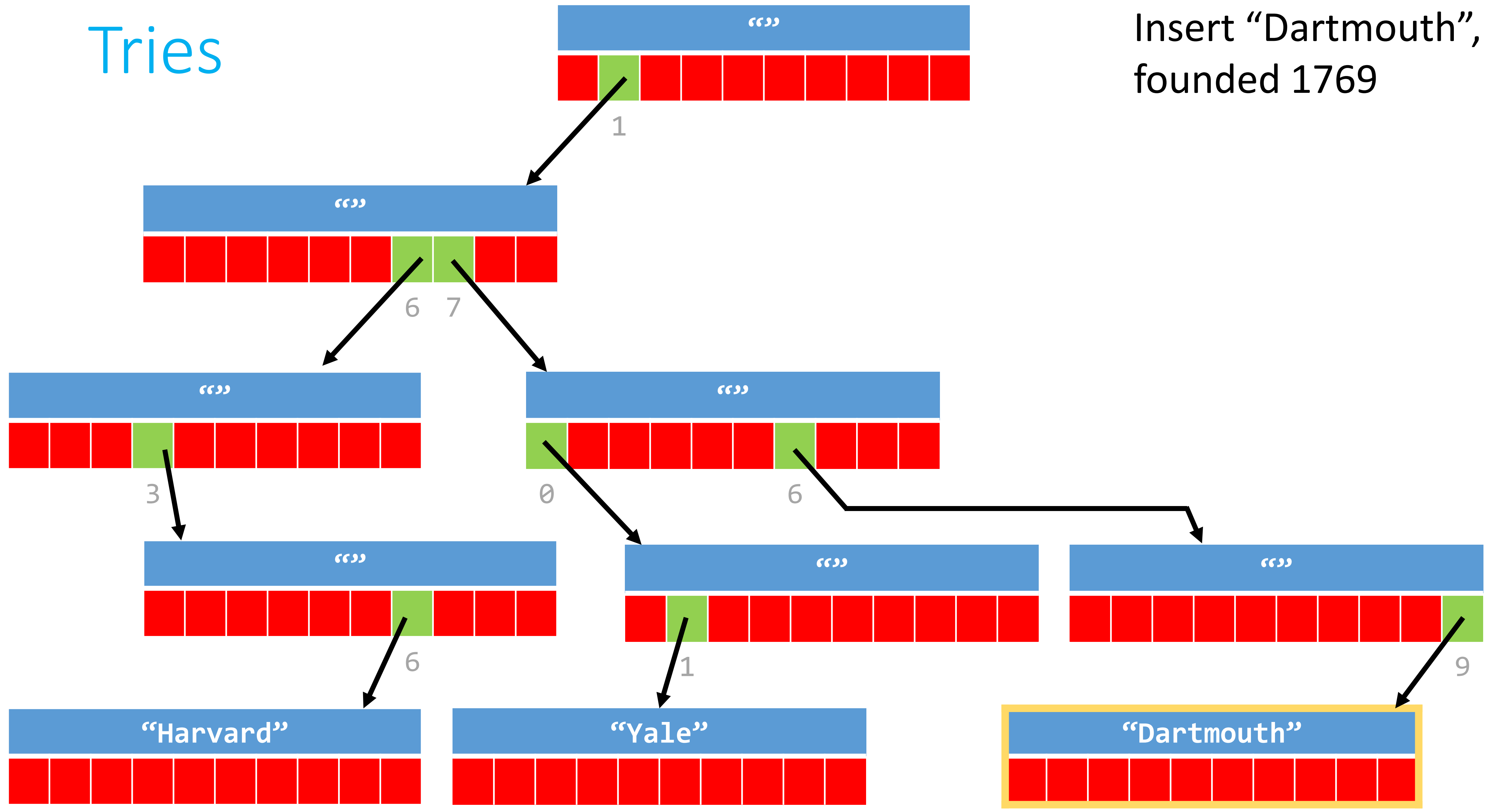

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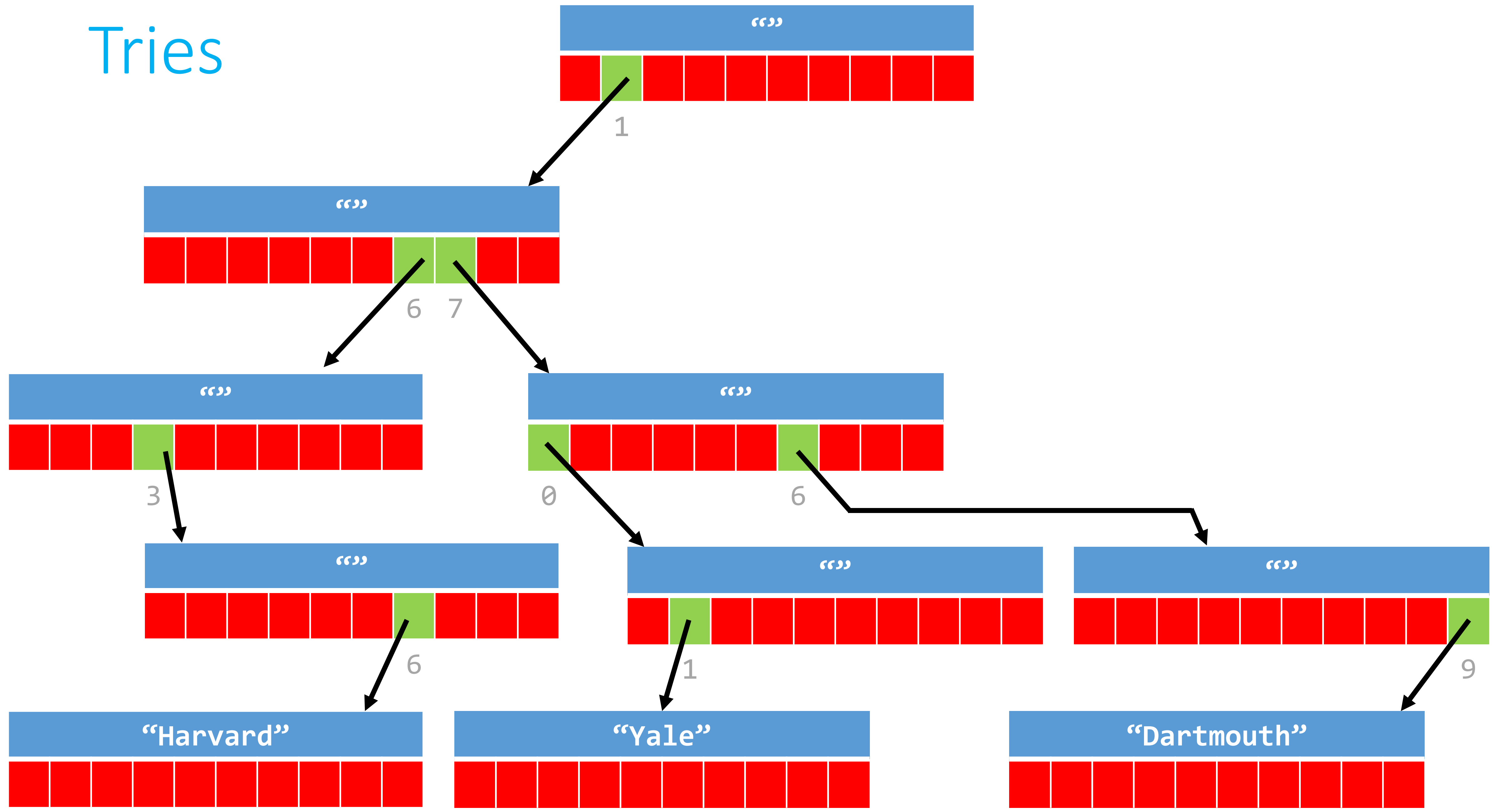
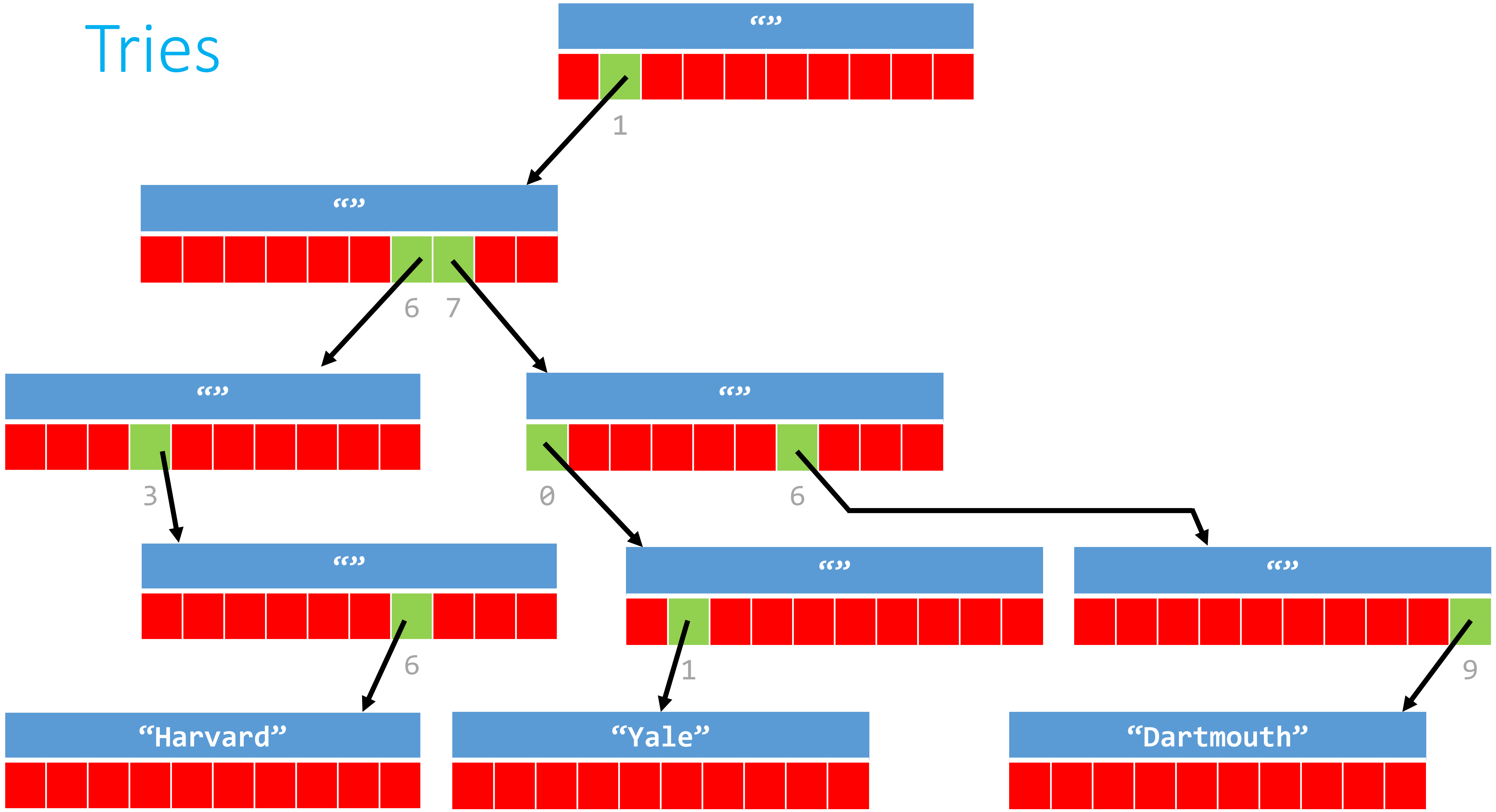


Tries

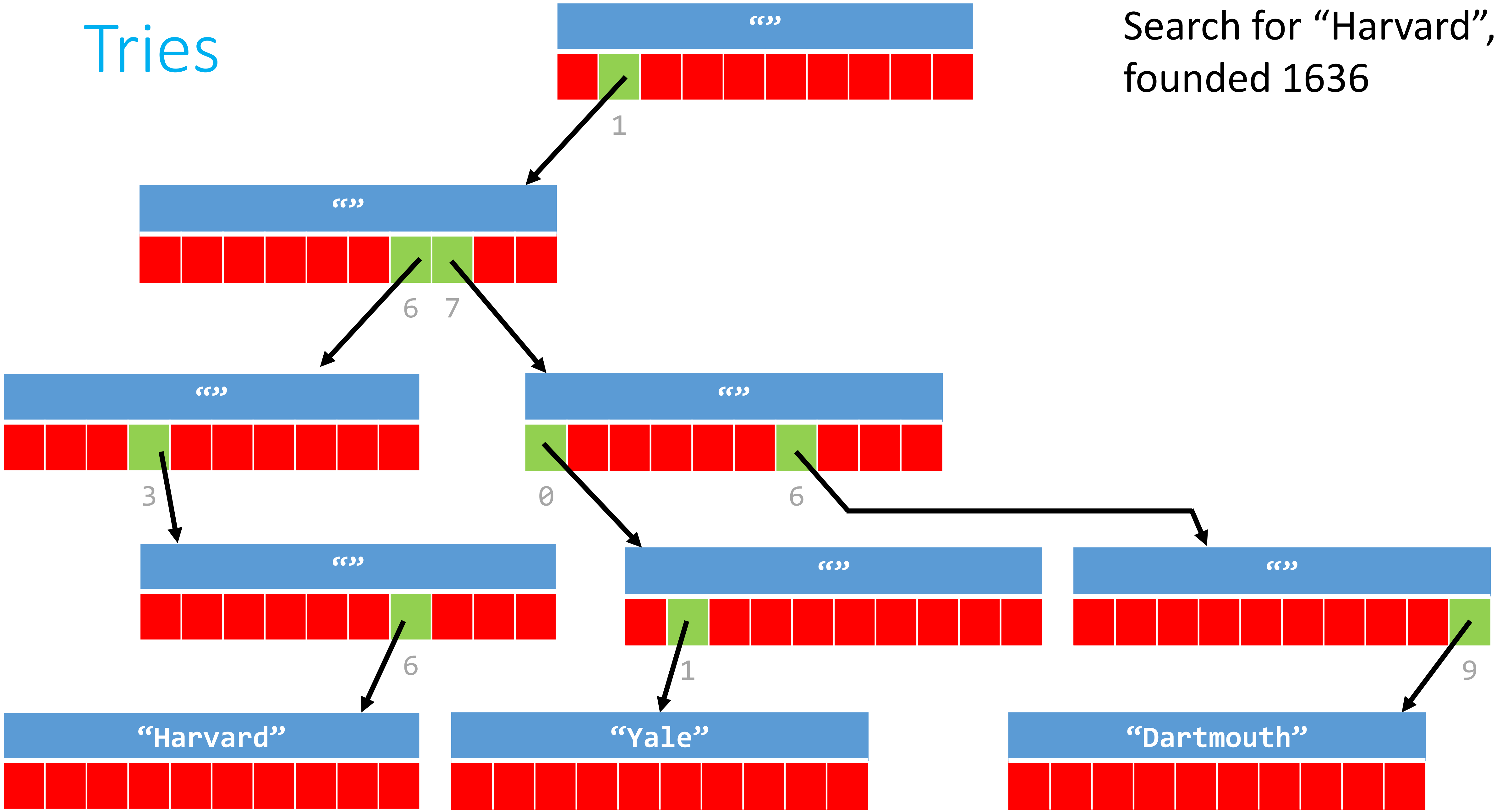
- To search for an element in the trie, use successive digits to navigate from the root, and if you can make it to the end without hitting a dead end (a NULL pointer), you’ve found it.

Tries



Tries

Search for “Harvard”, founded 1636



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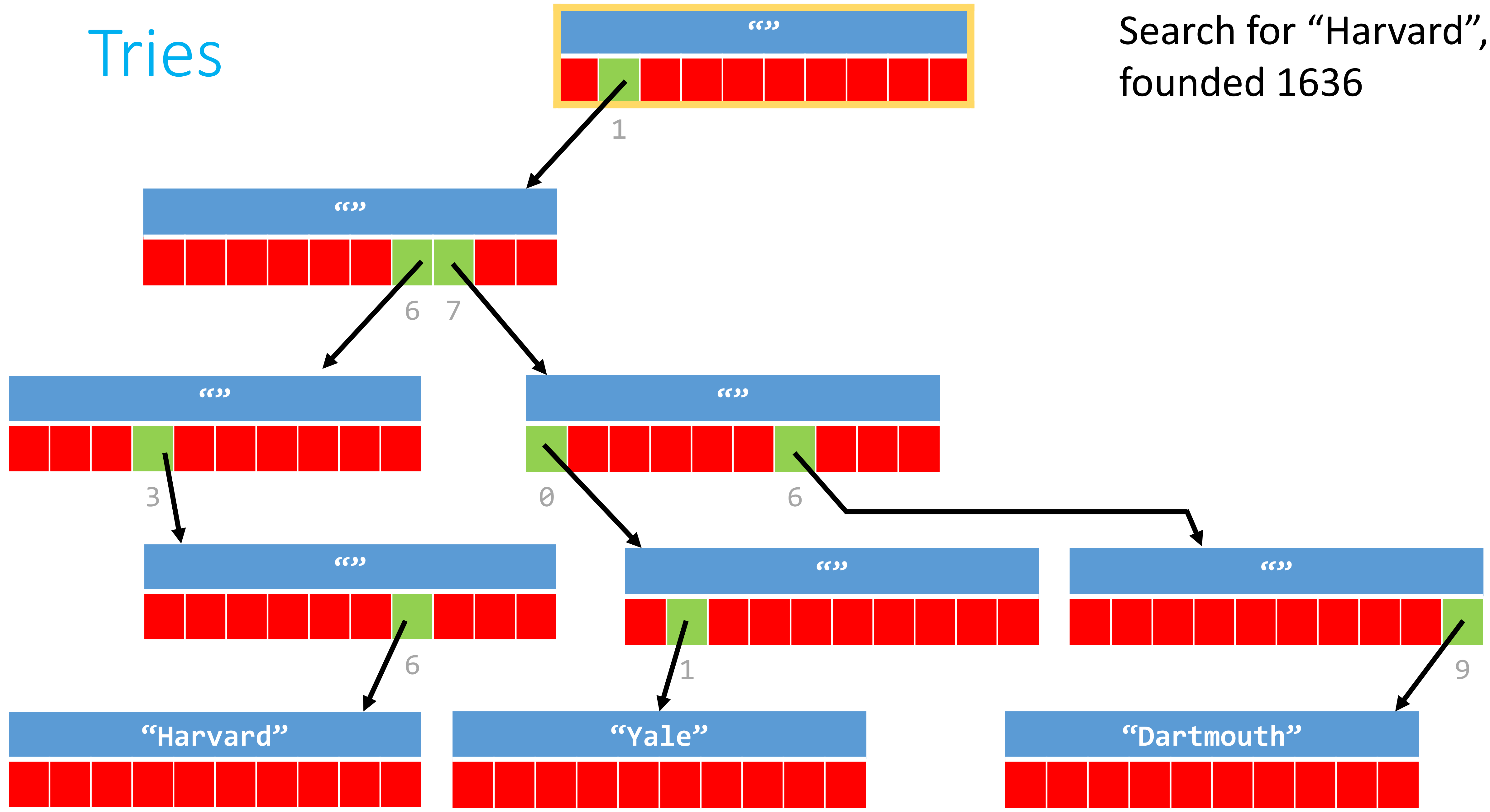

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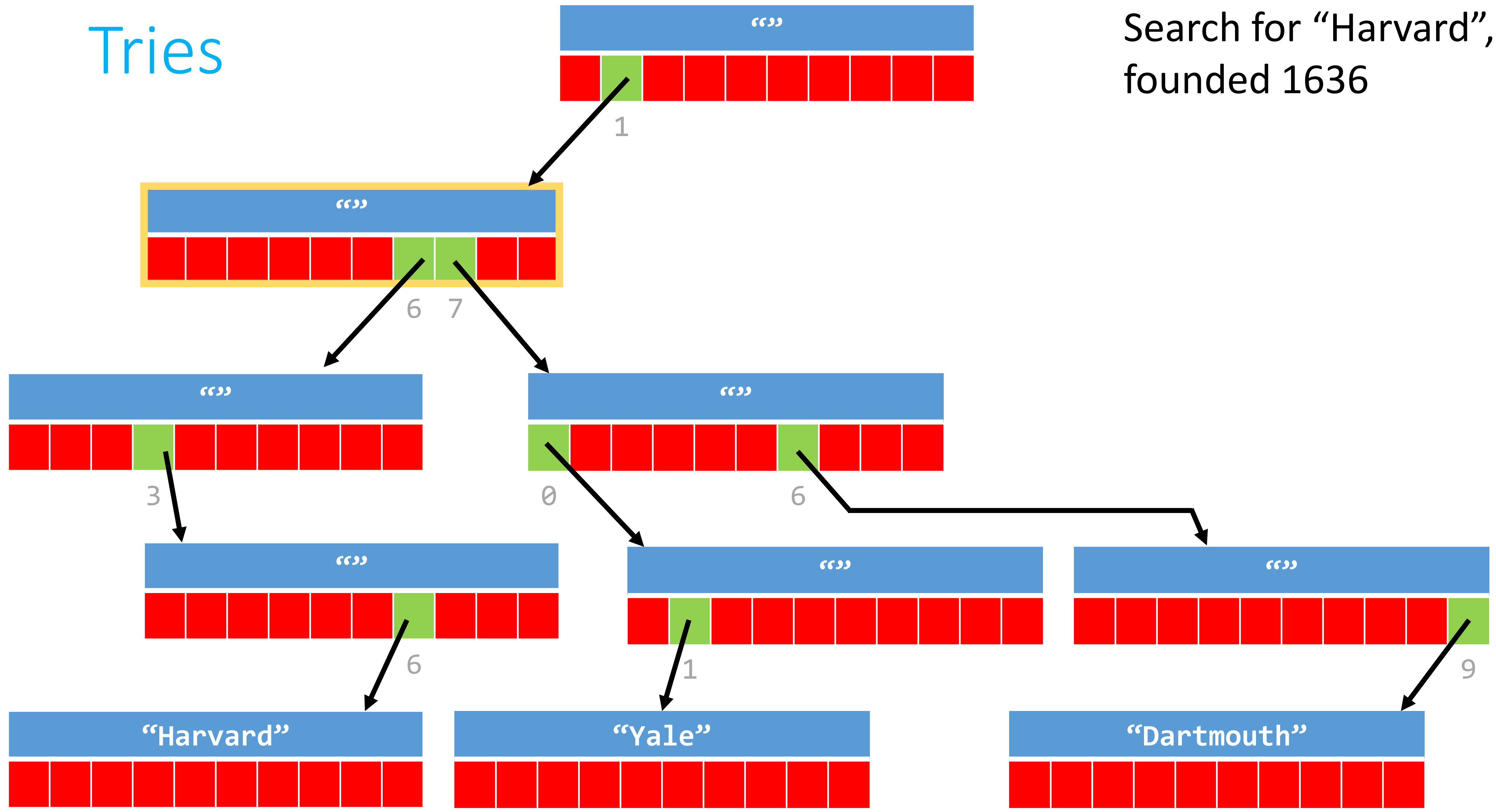

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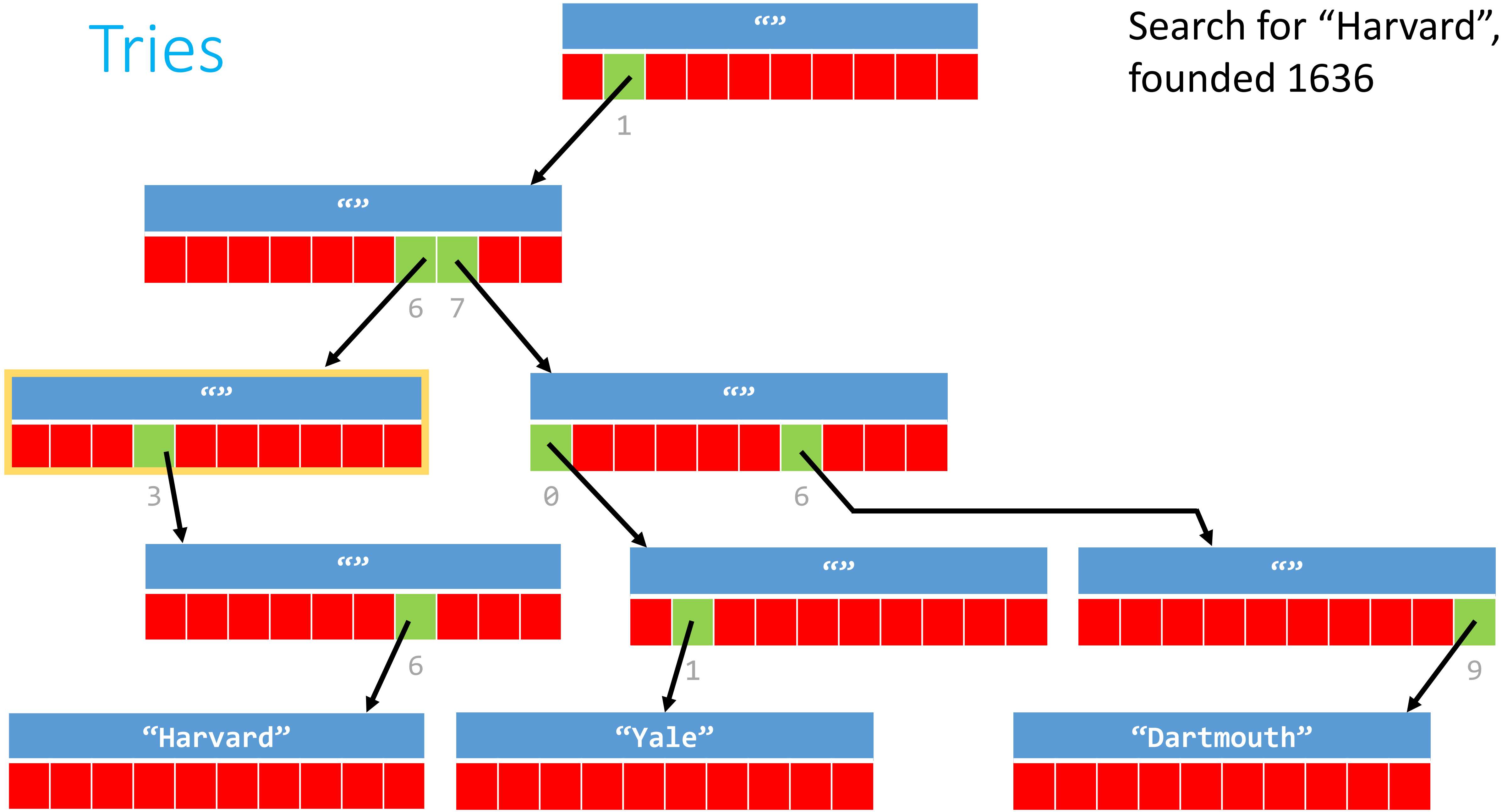

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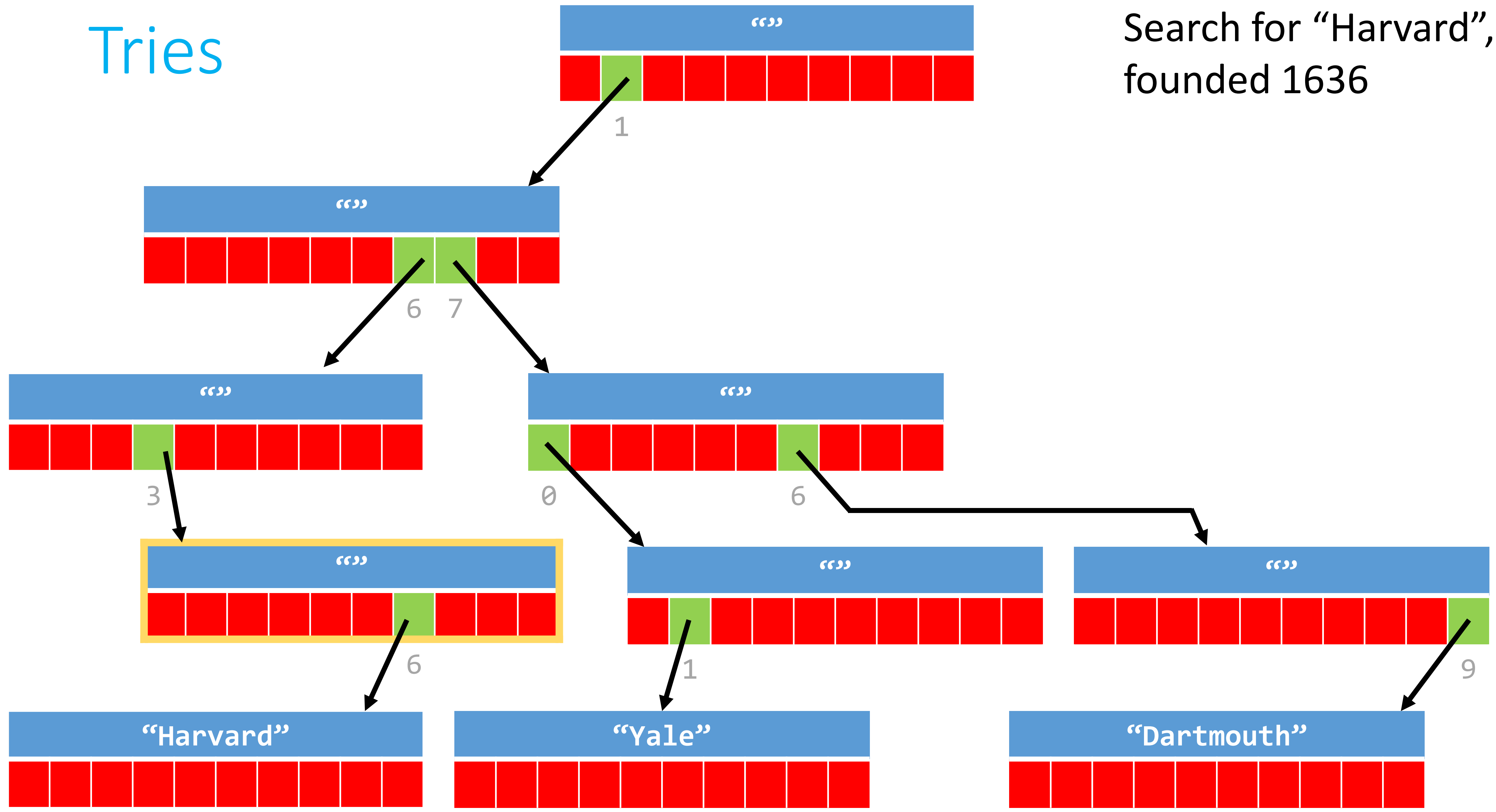

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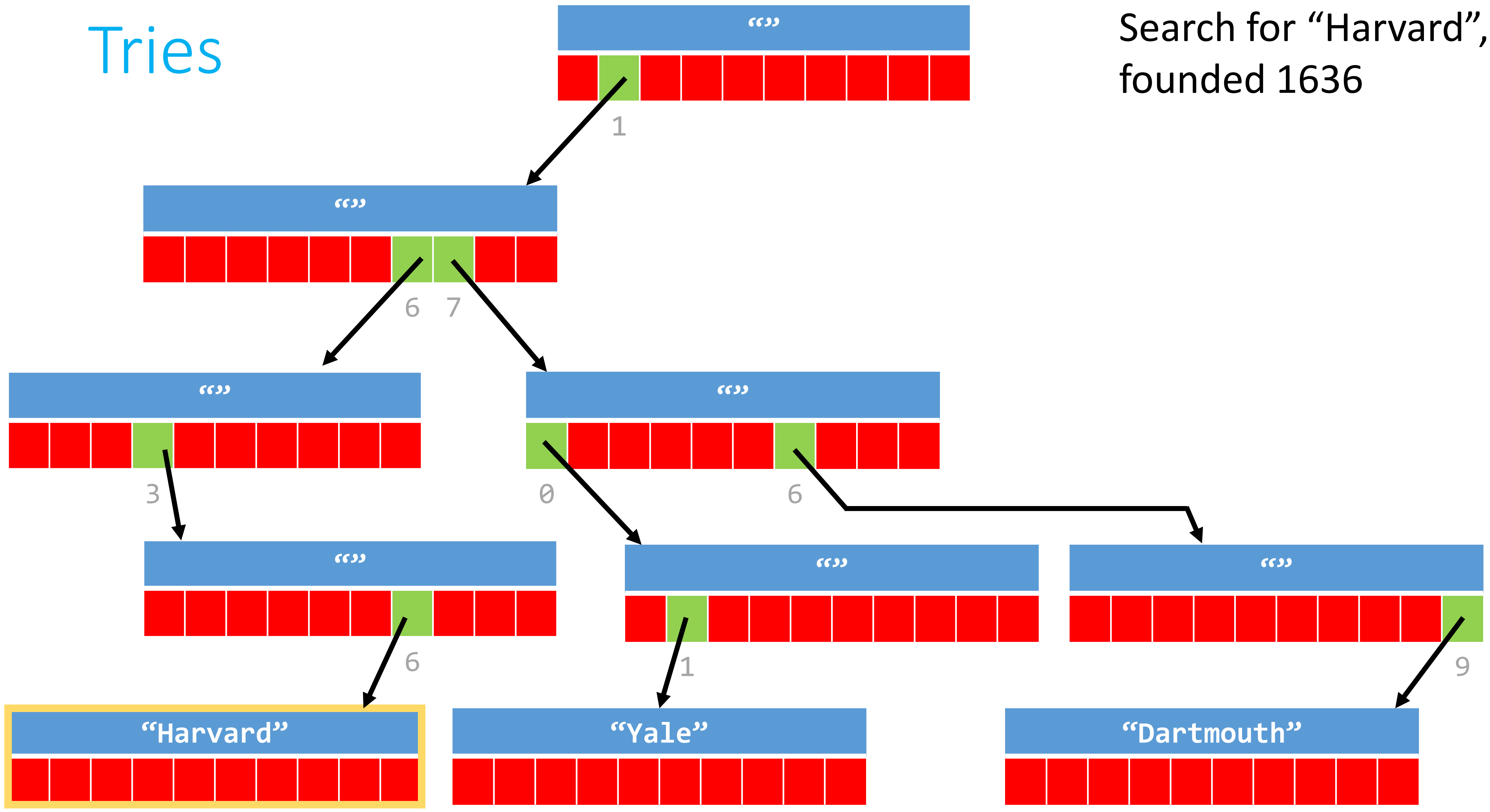

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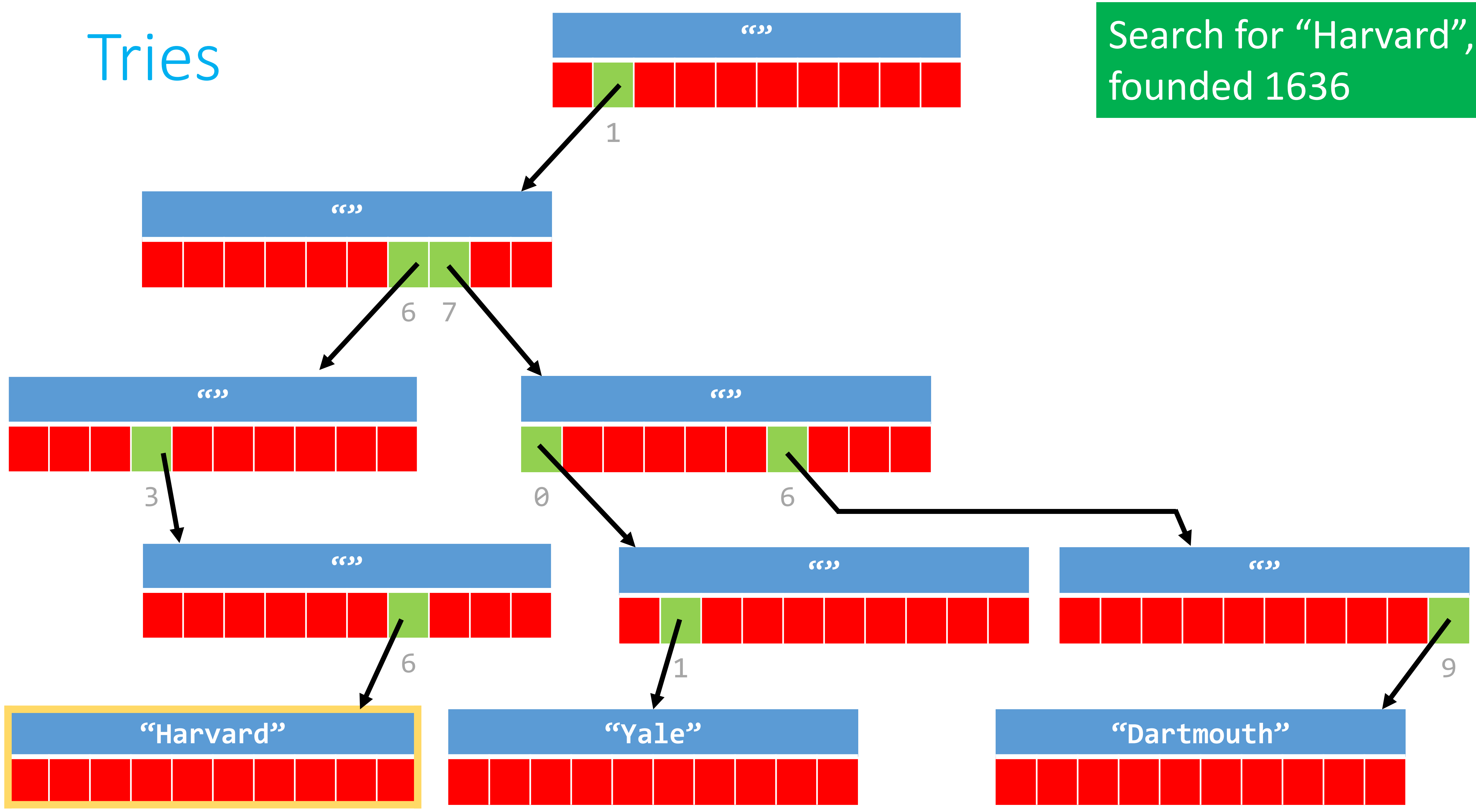

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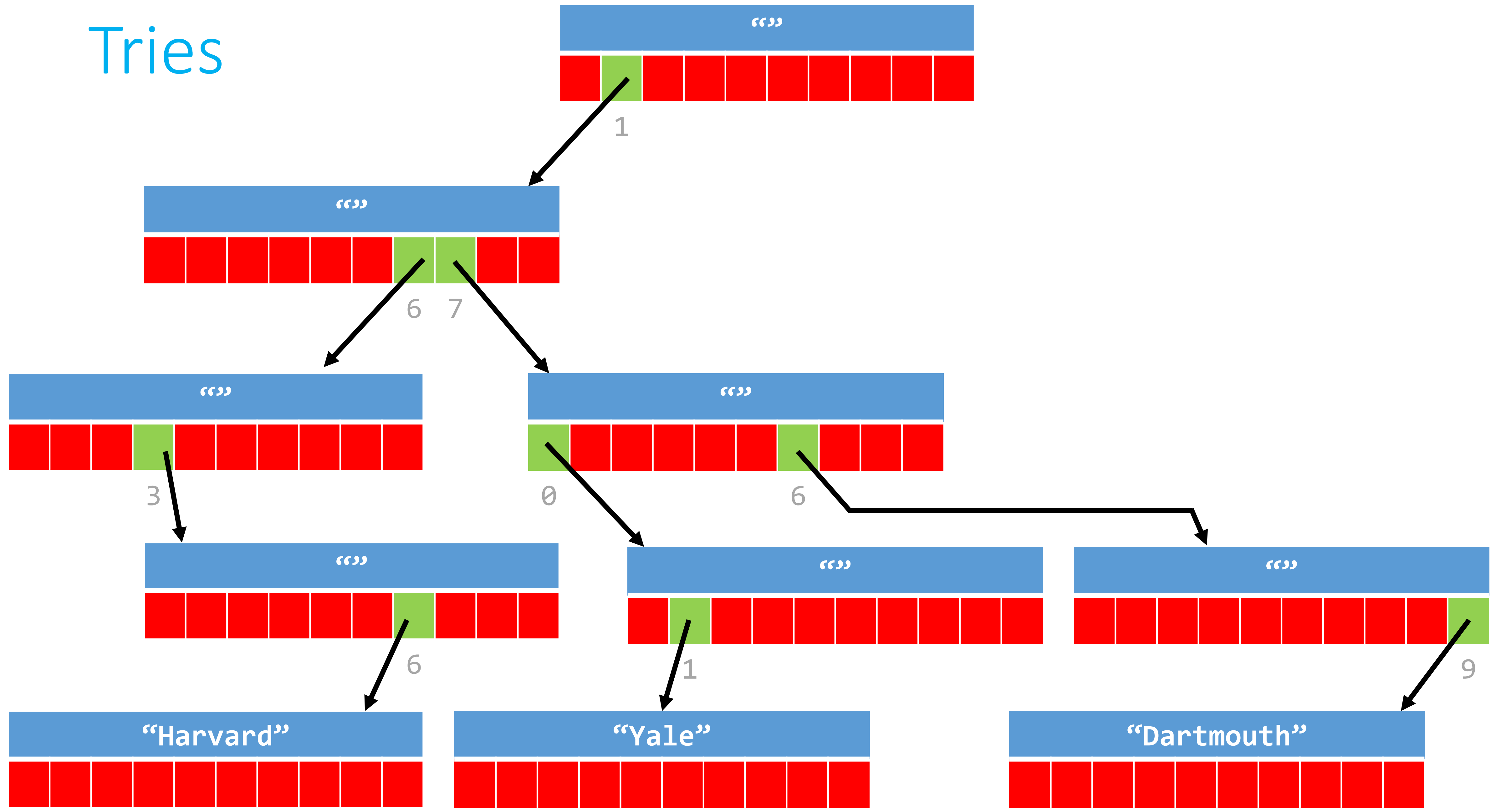

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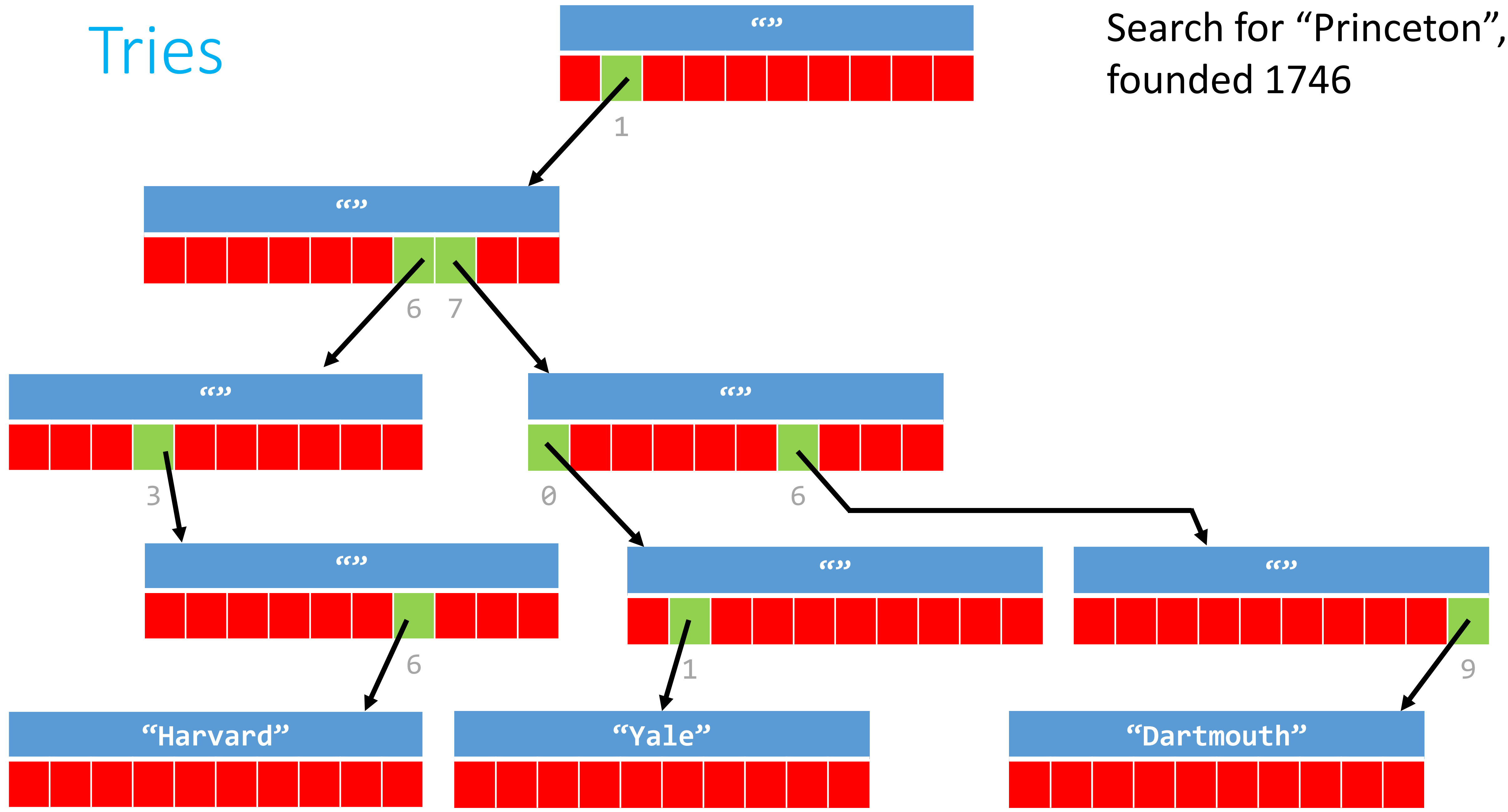
Search for “Princeton”, founded 1746



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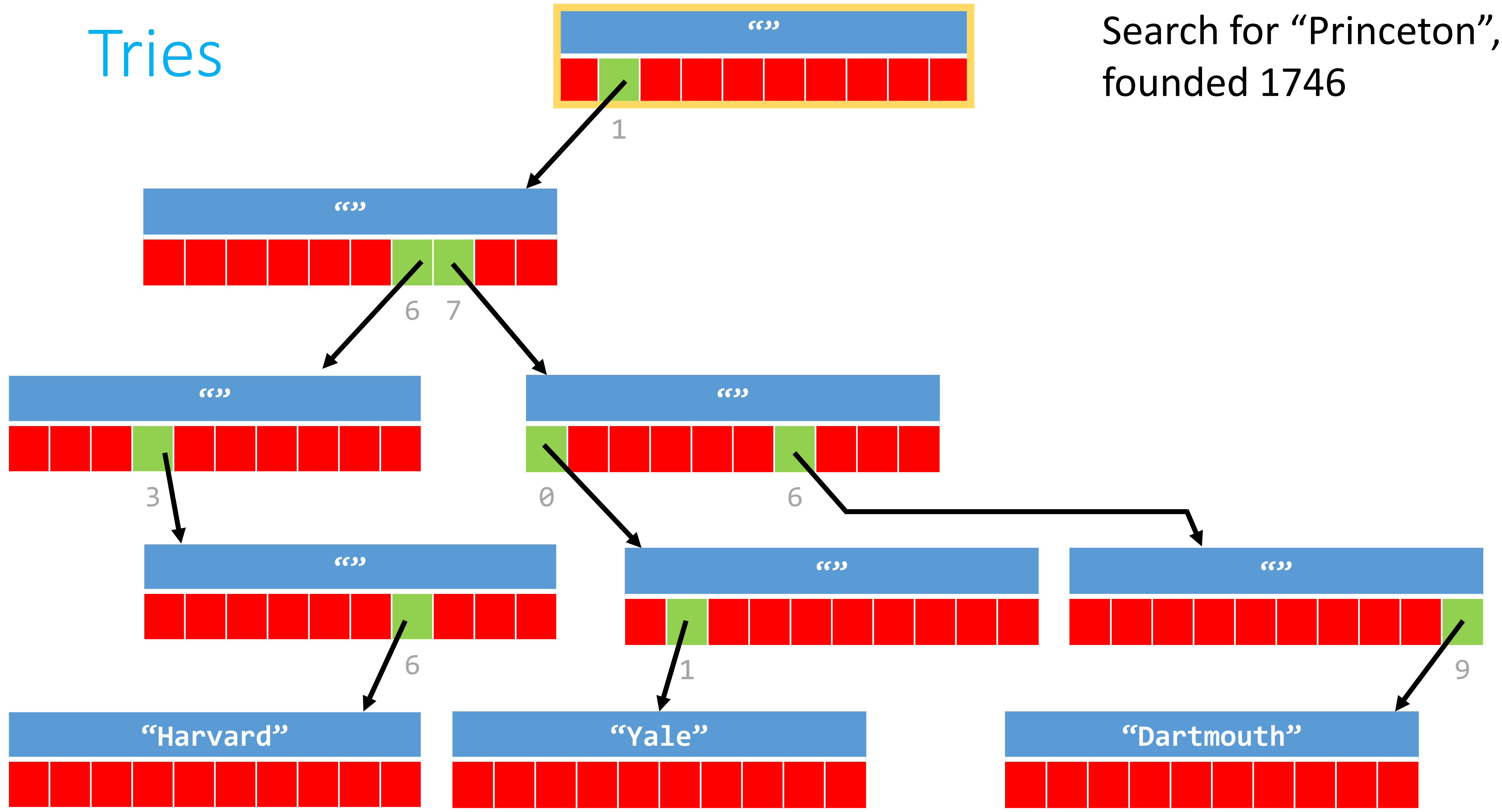

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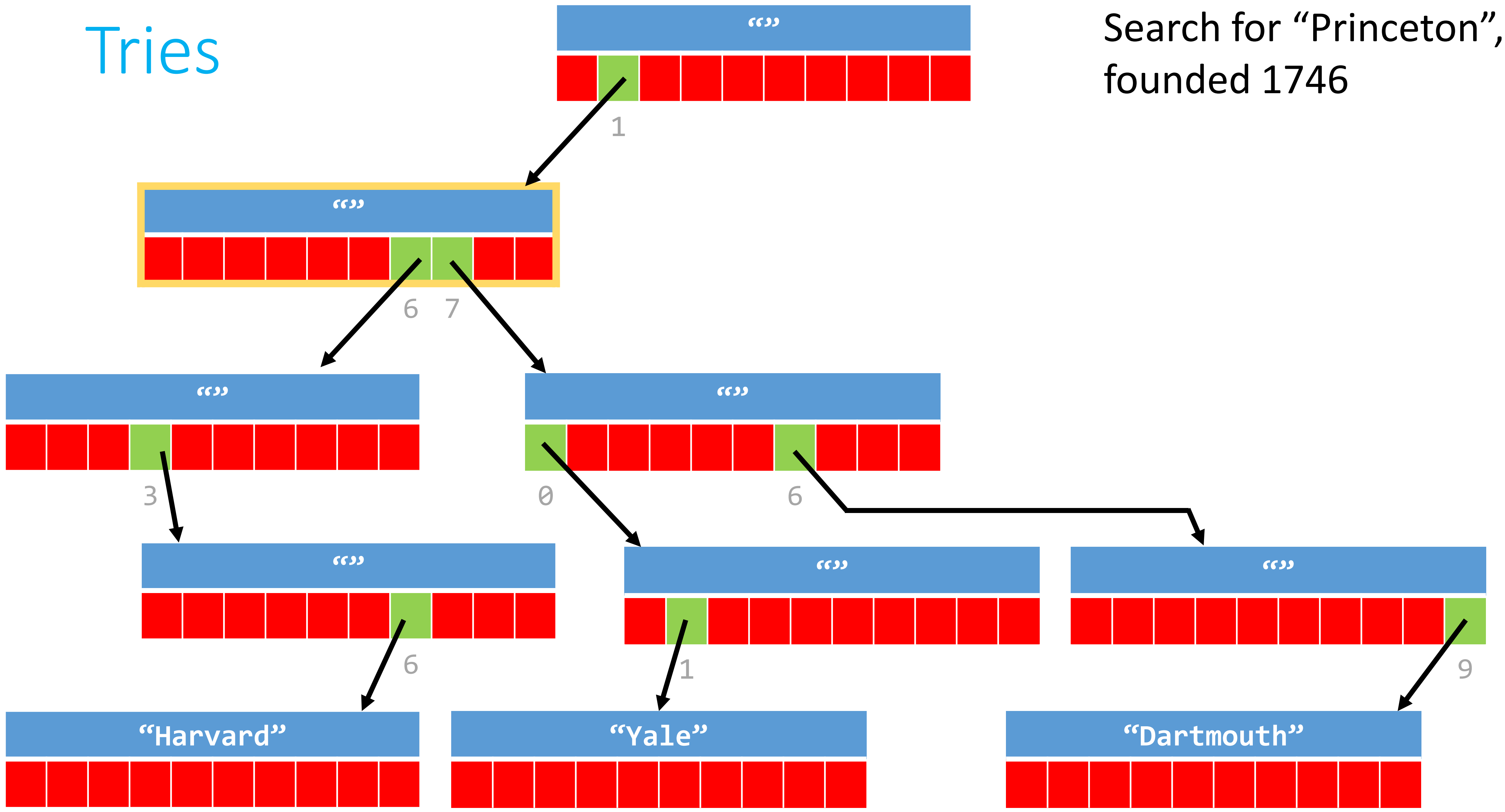

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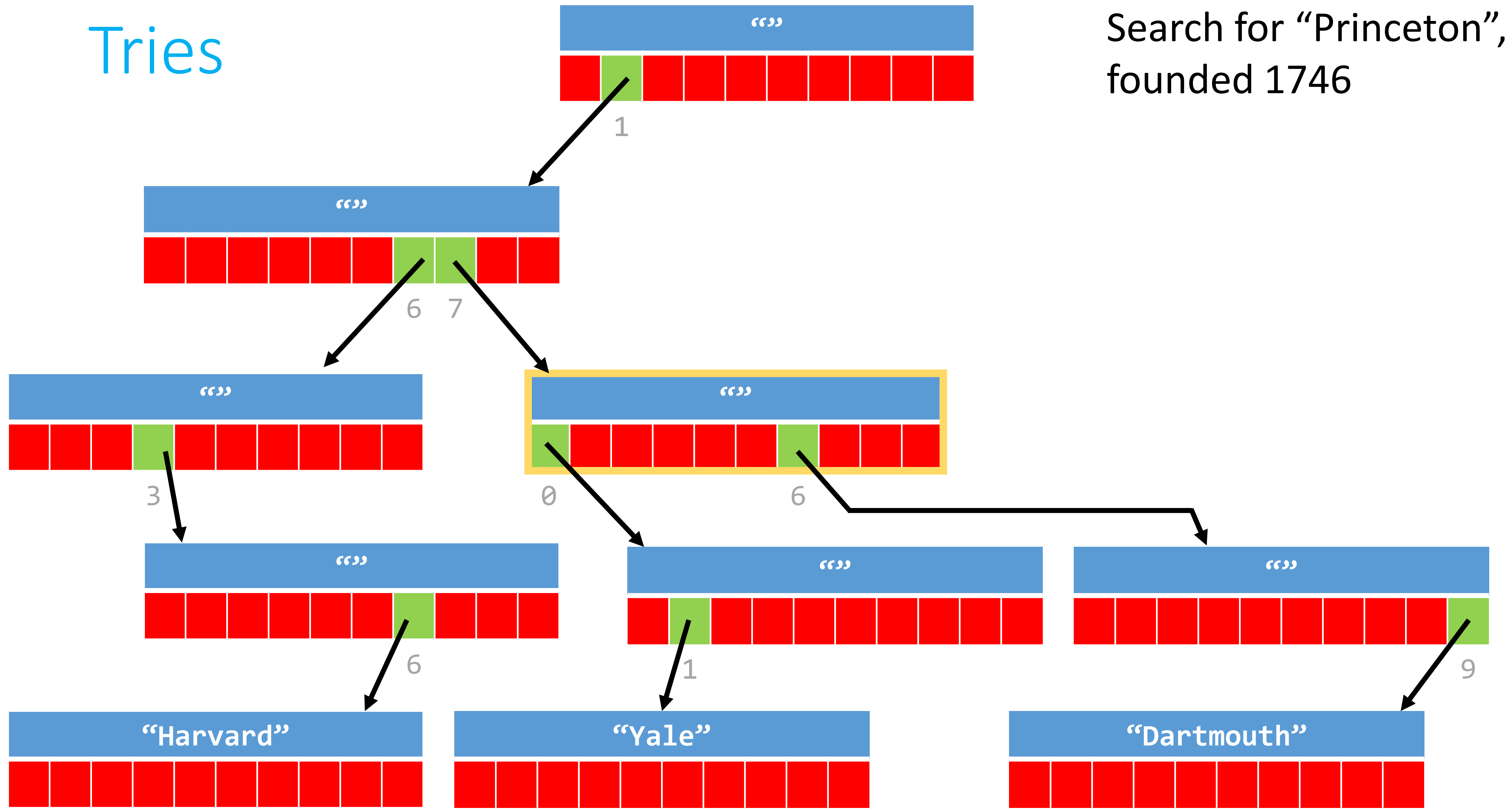

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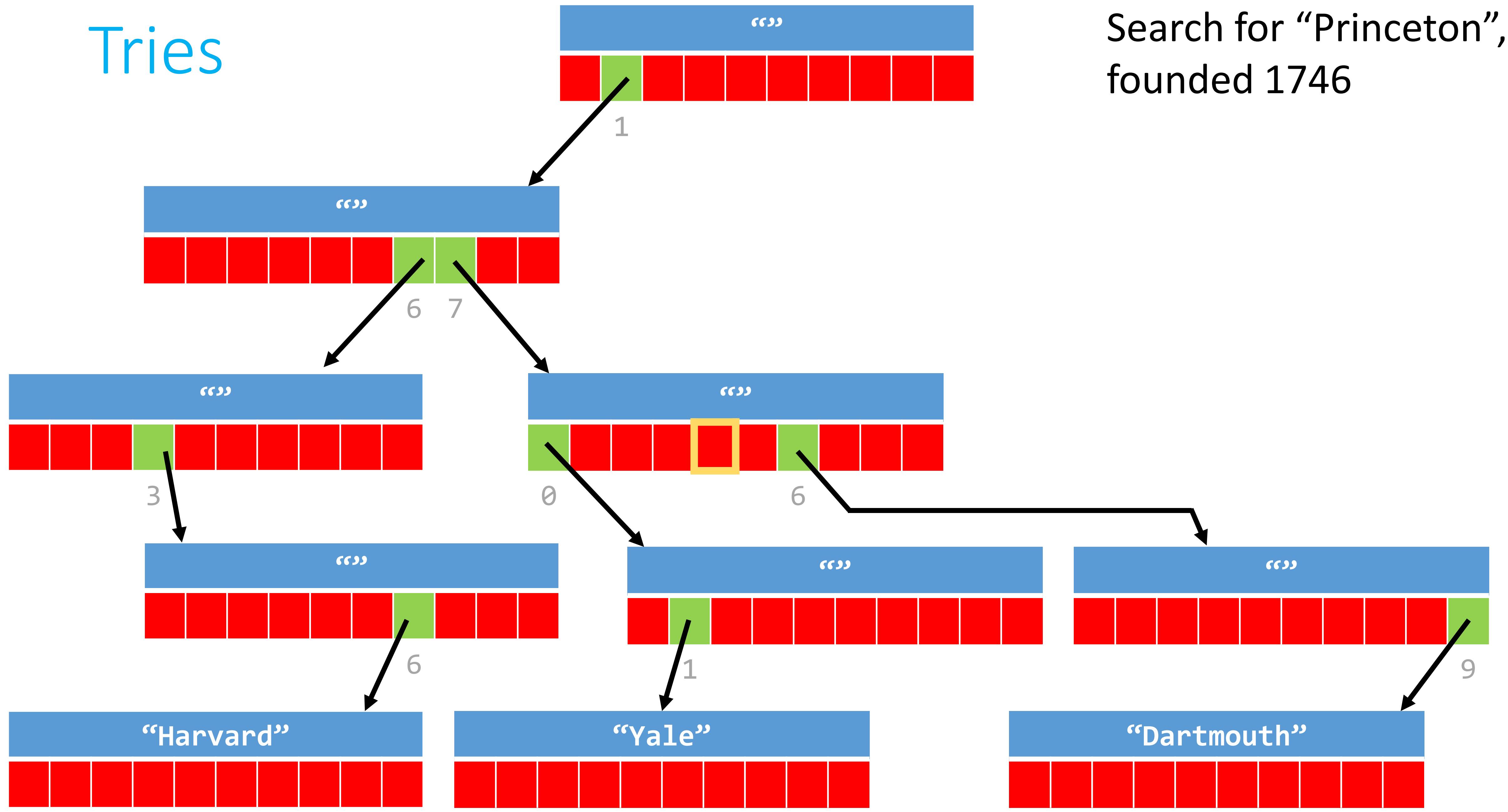

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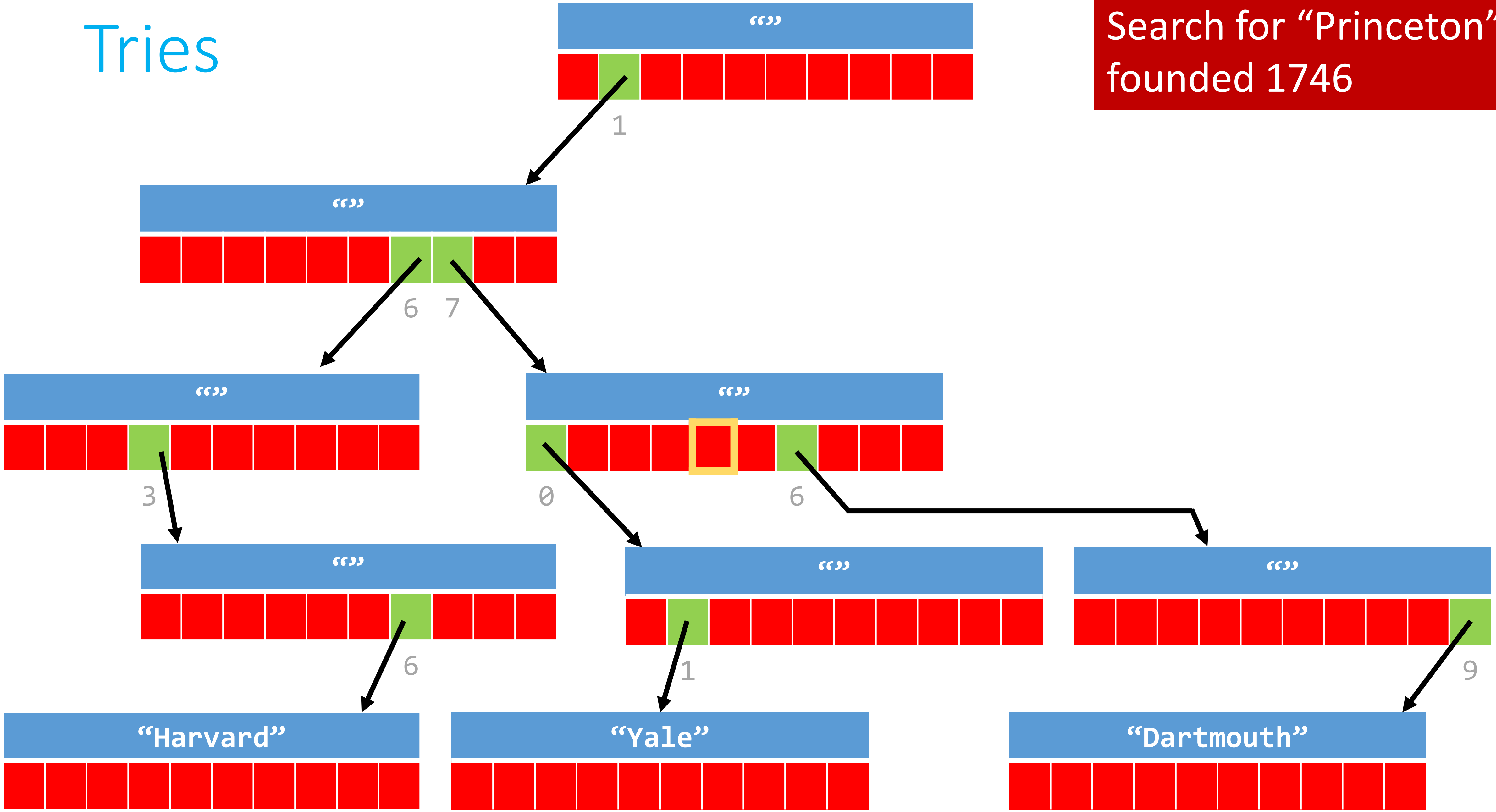

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