Experiment: The Towers of Hanoi

left middle right

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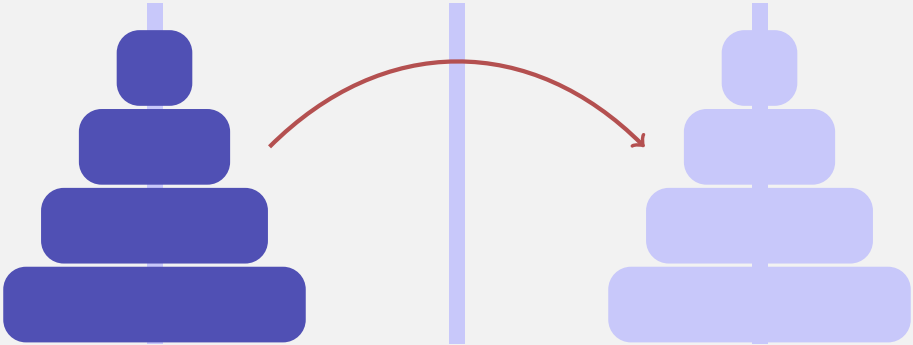

Die Türme von Hanoi - So gehts!

left middle right

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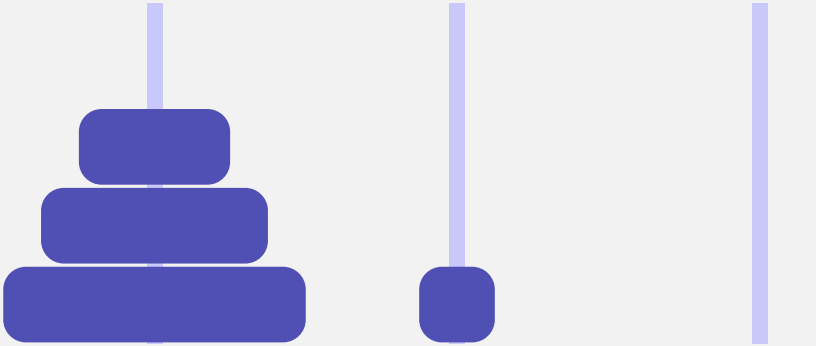

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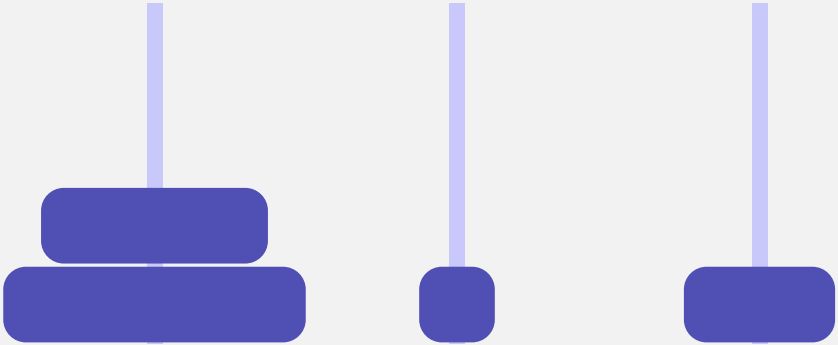

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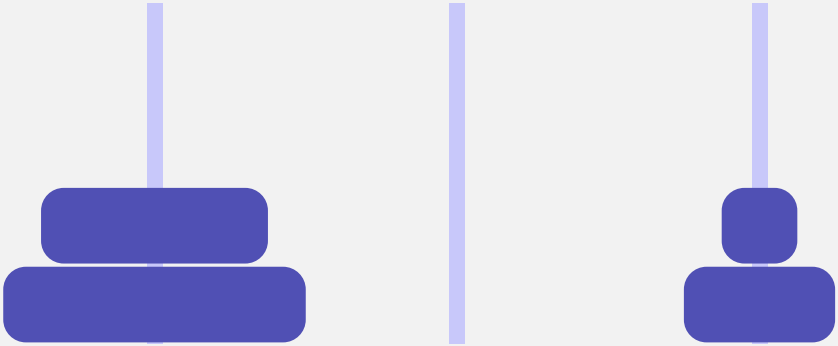

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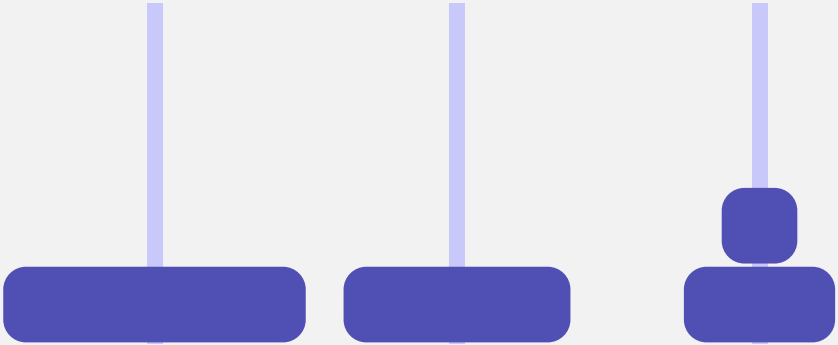

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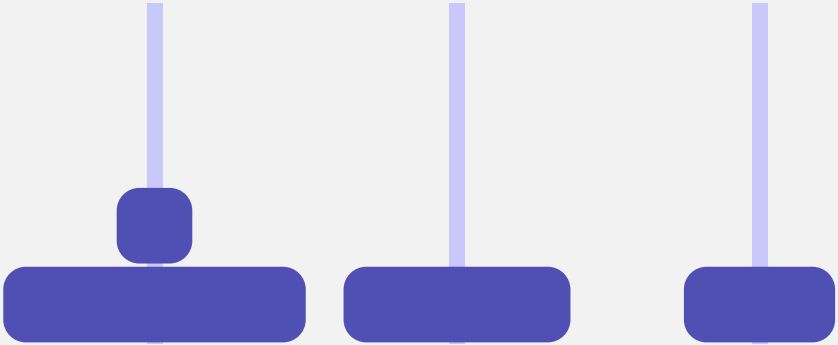

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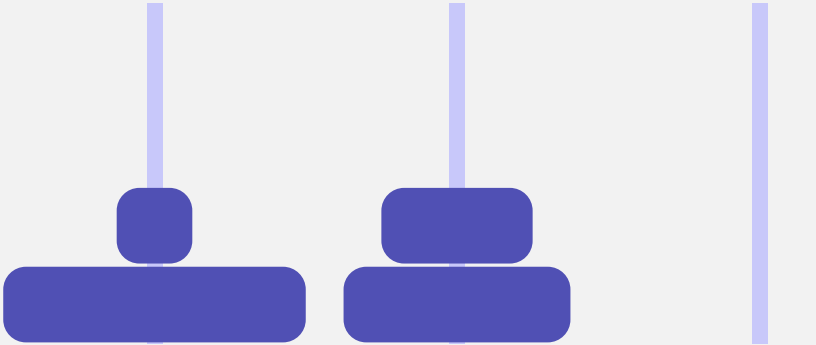

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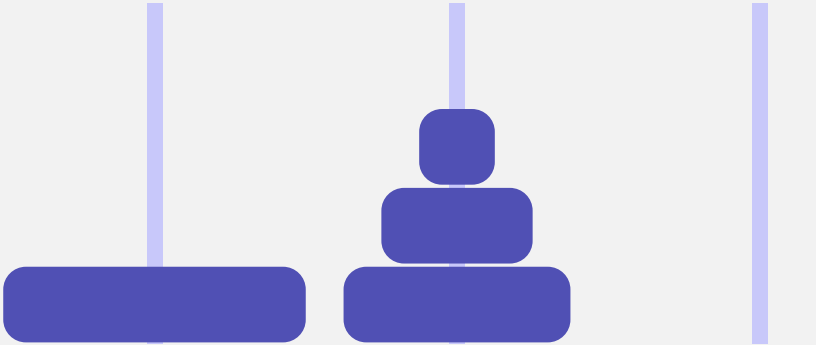

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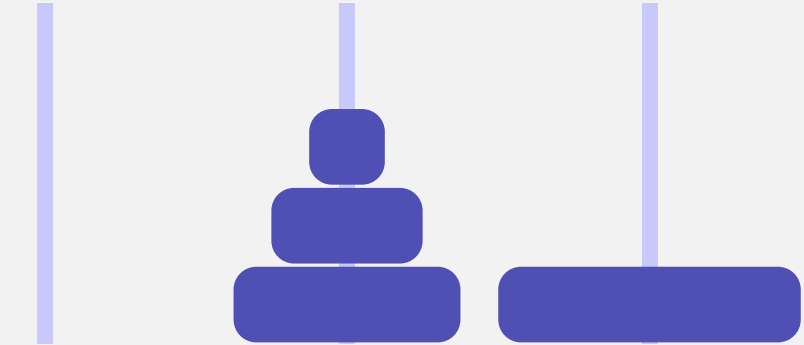

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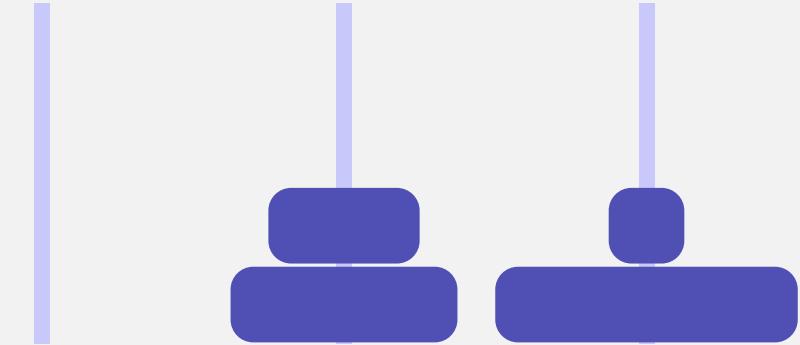

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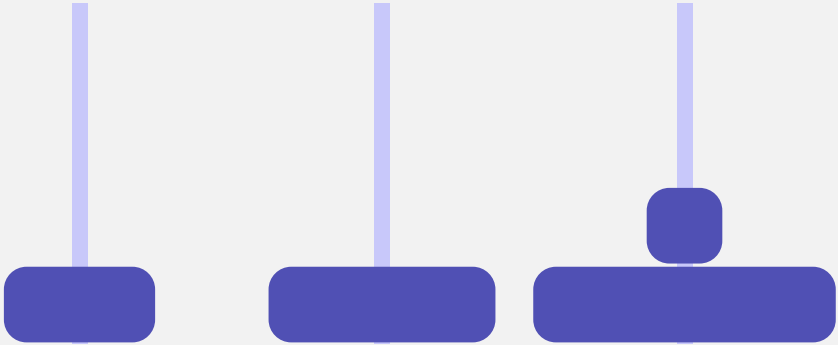

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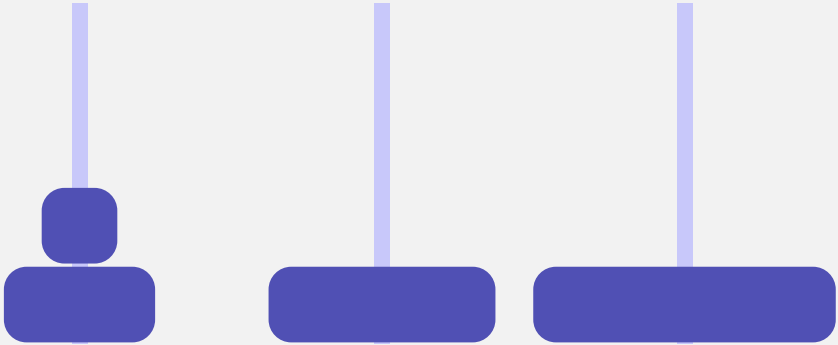

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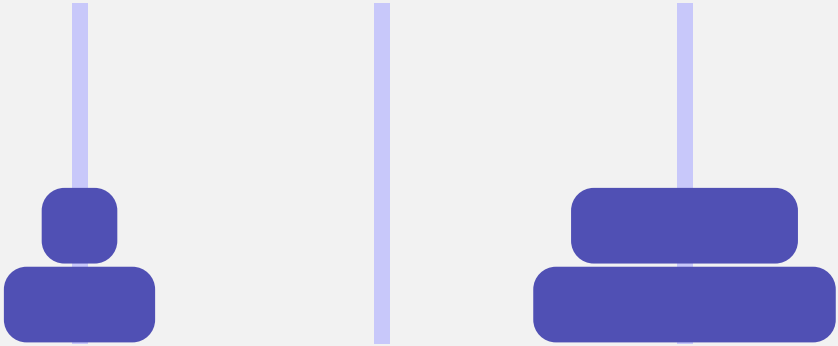

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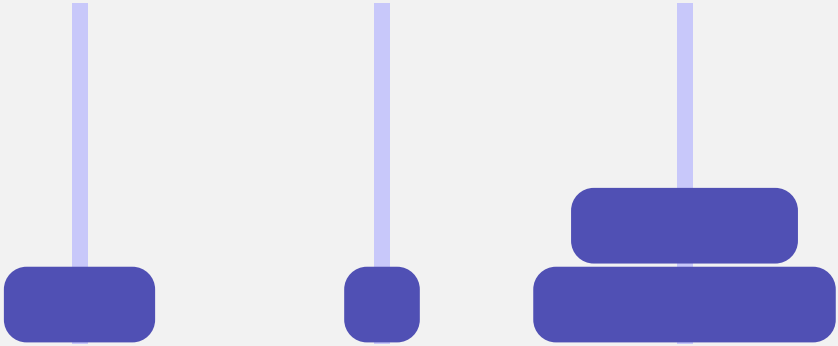

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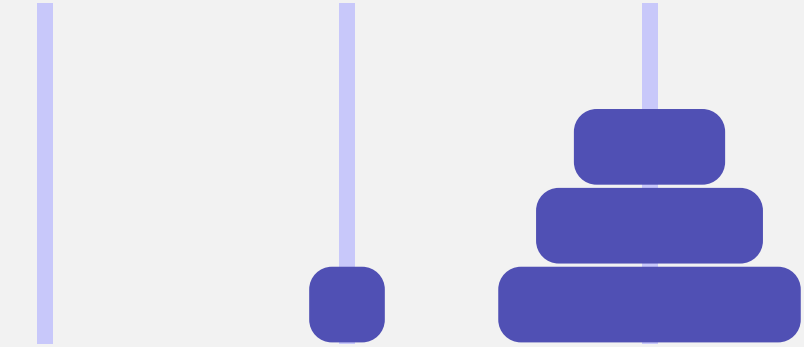

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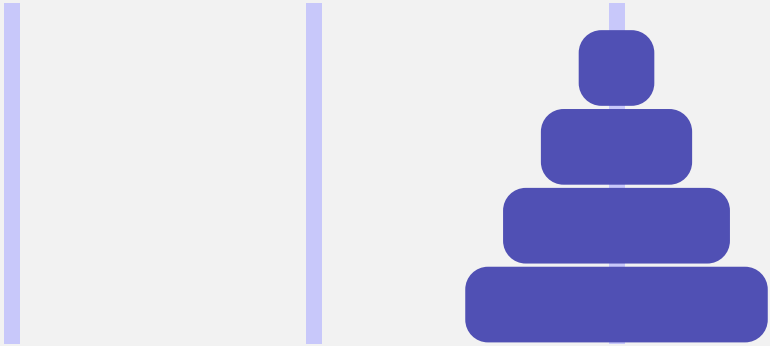
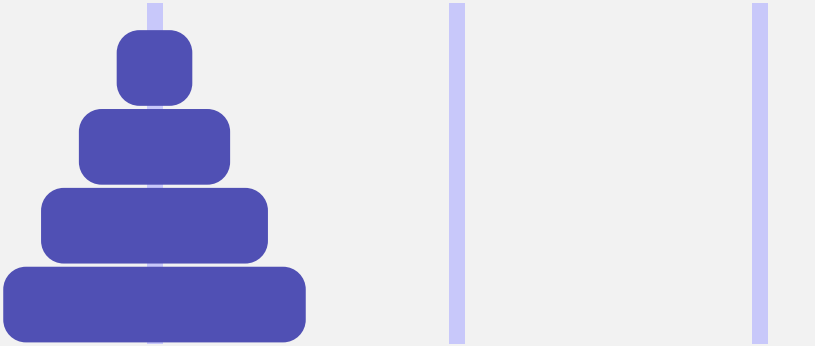
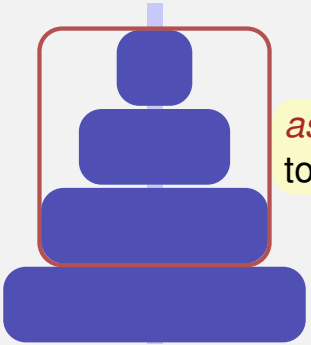


left middle right

The Towers of Hanoi – Recursive Approach



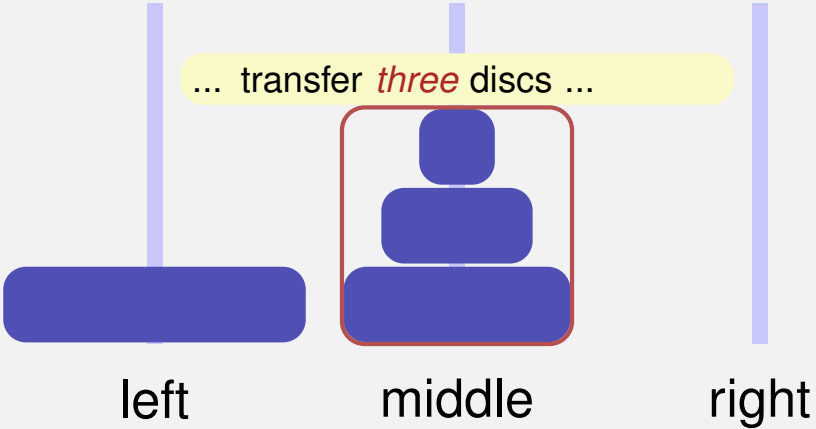
The Towers of Hanoi – Recursive Approach



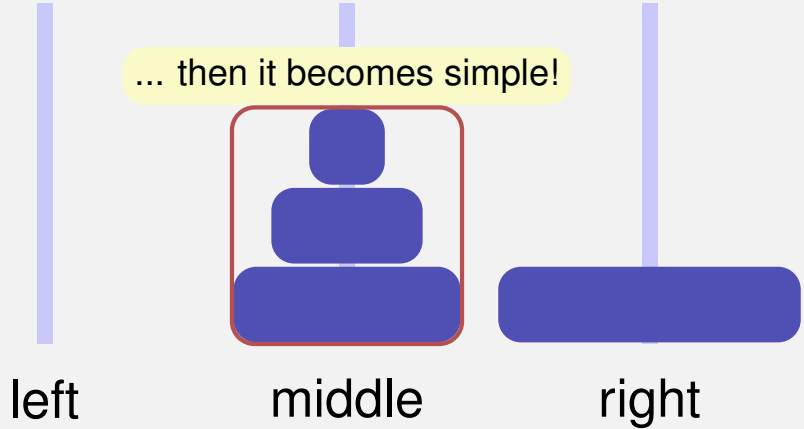
assume we knew how to ...

left middle right

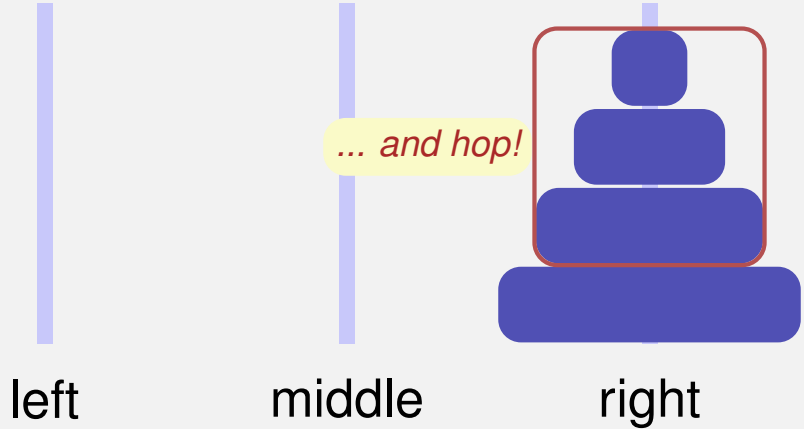
The Towers of Hanoi – Recursive Approach



The Towers of Hanoi – Recursive Approach



The Towers of Hanoi – Recursive Approach



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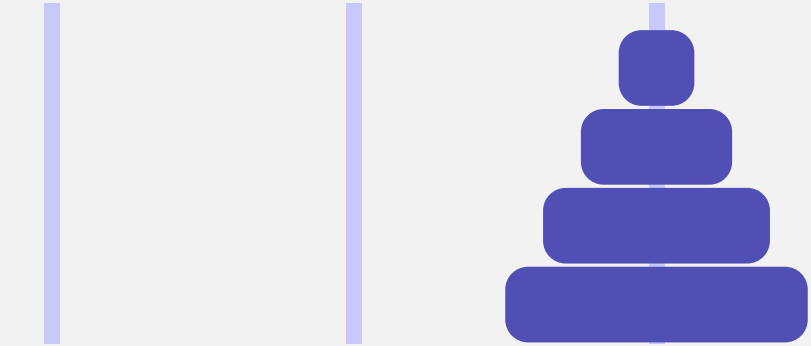
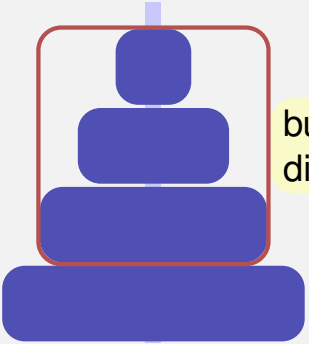


The Towers of Hanoi – Recursive Approach



but *how* can we move three discs?

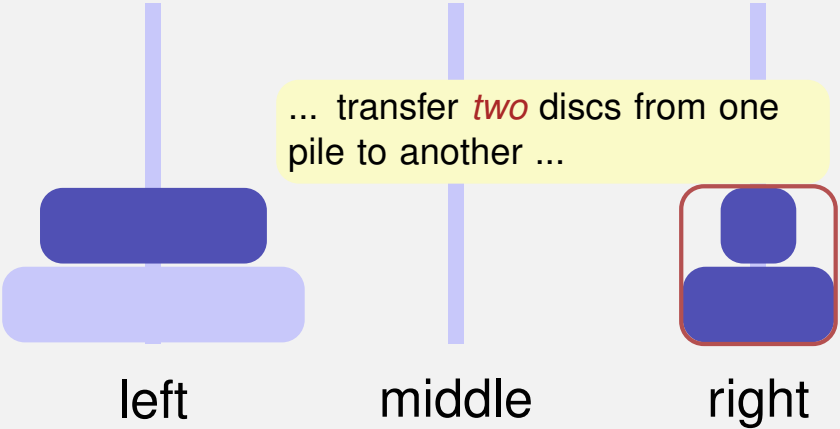
left middle right

The Towers of Hanoi – Recursive Approach

assume we knew how to ...

left middle right

The Towers of Hanoi – Recursive Approach



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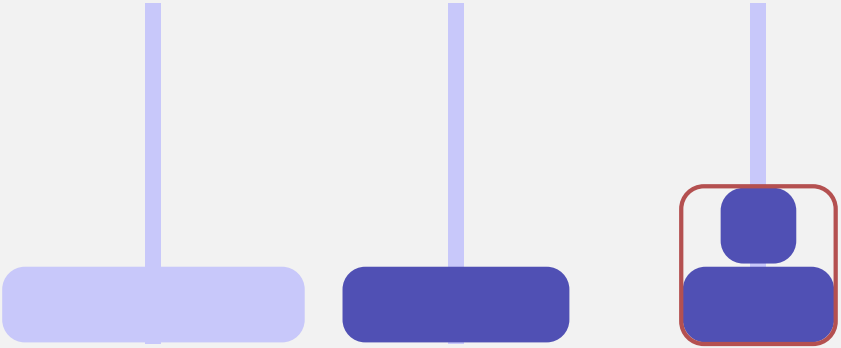

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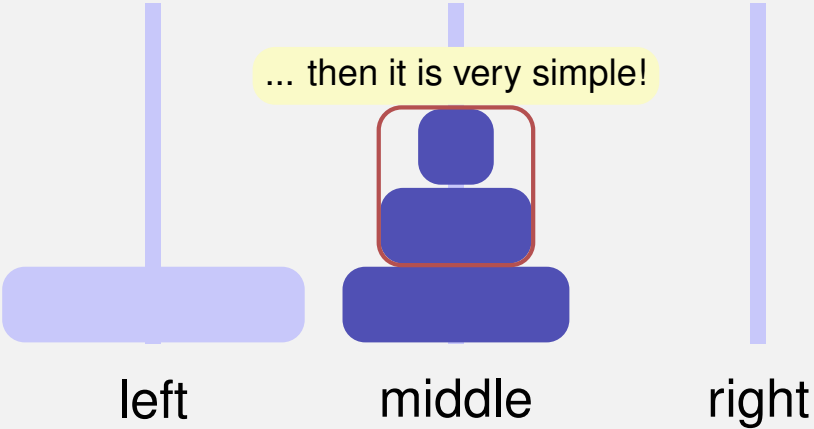

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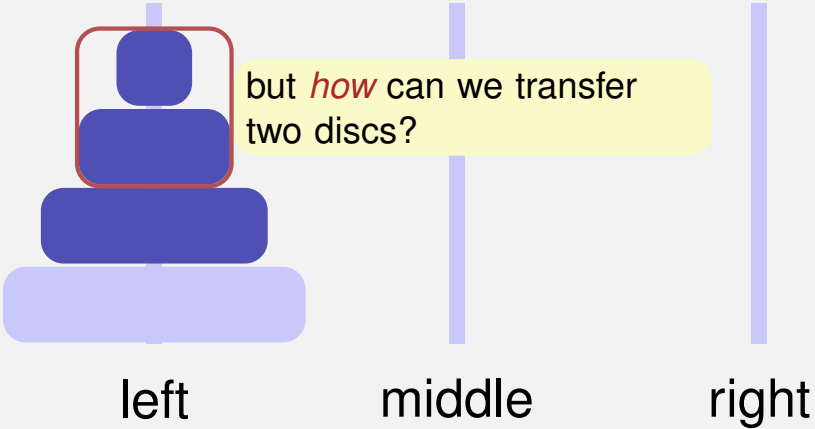

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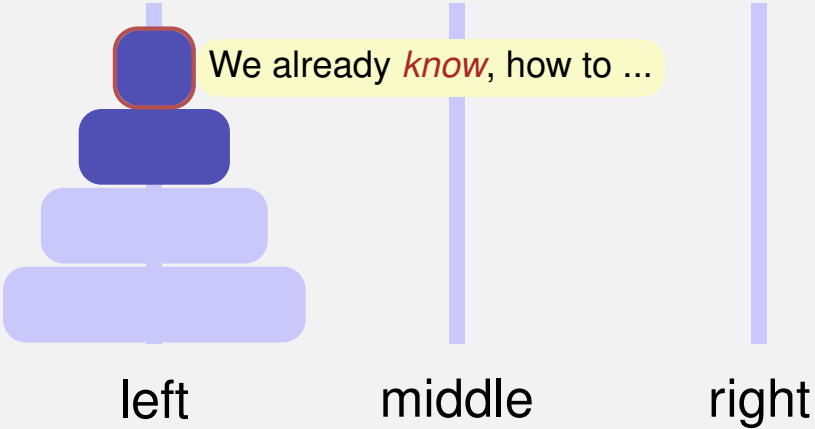

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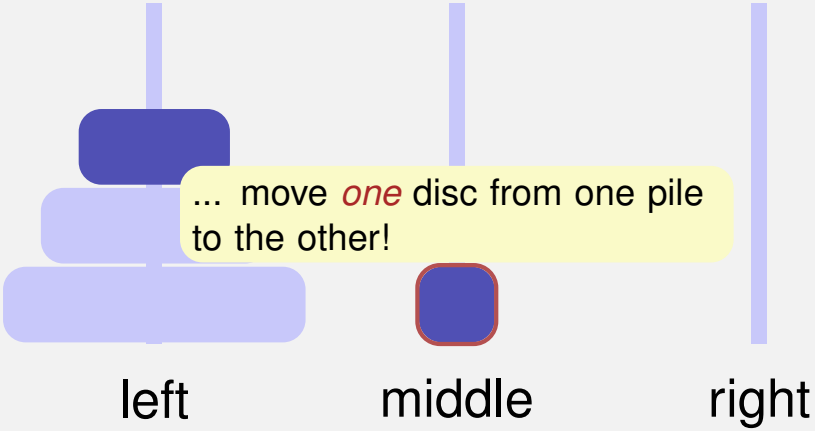

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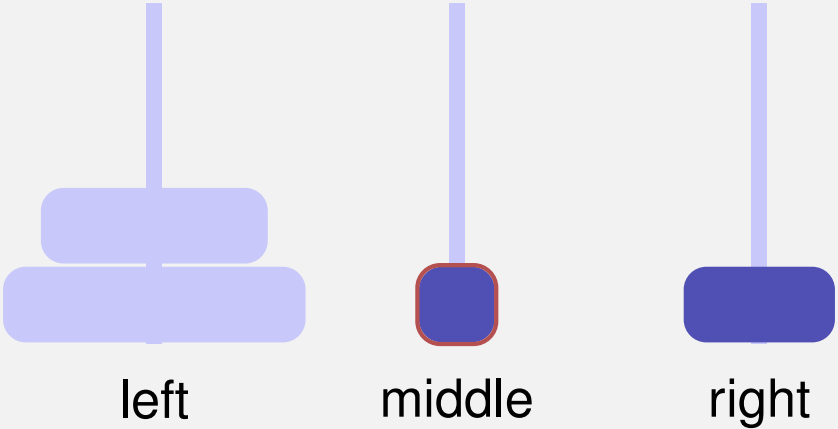

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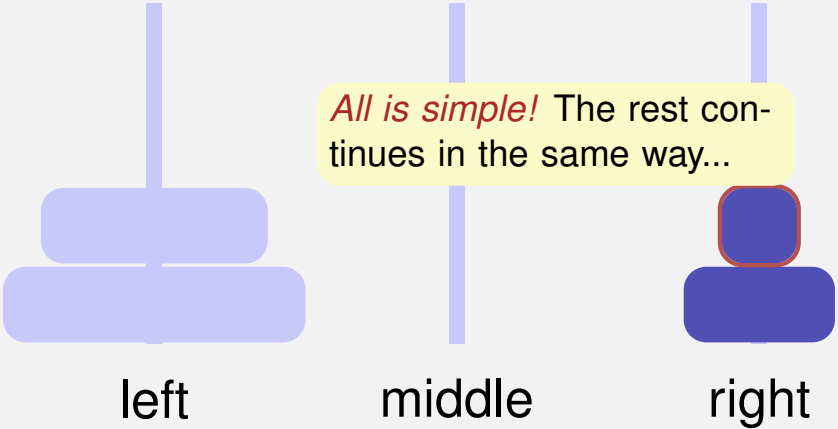
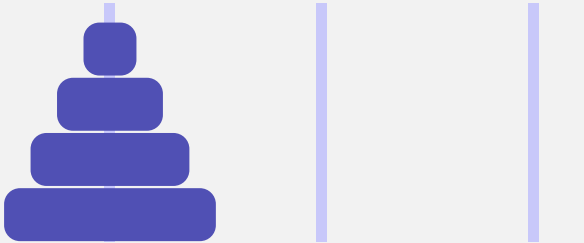


The Towers of Hanoi – Code



Move 4 discs from `left` to `right` with auxiliary staple `middle`:

```
move(4,"left","middle","right")
```

The Towers of Hanoi – Code

`move(`n`,` src`,` aux`,` dst`)` $\Rightarrow$

1. Move the top $n-1$ discs from src to aux with auxiliary staple dst:
   `move(`$n-1$`,` src`,` dst`,` aux`);`
2. Move 1 disc from src to dst
   `move(1,` src`,` aux`,` dst`);`
3. Move the top $n-1$ discs from aux to dst with auxiliary staple src:
   `move(`$n-1$`,` aux`,` src`,` dst`);`

The Towers of Hanoi – Code

```
void move(int n, const string &src, const string &aux, const string &dst){
    if (n == 1) {
        // base case ('move' the disc)
        std::cout << src << " --> " << dst << std::endl;
    } else {
        // recursive case



    }
}
```

The Towers of Hanoi – Code

```
void move(int n, const string &src, const string &aux, const string &dst){
    if (n == 1) {
        // base case (‘move’ the disc)
        std::cout << src << " --> " << dst << std::endl;
    } else {
        // recursive case
        move(n-1, src, dst, aux);


    }
}
```

The Towers of Hanoi – Code

```
void move(int n, const string &src, const string &aux, const string &dst){
    if (n == 1) {
        // base case (‘move’ the disc)
        std::cout << src << " --> " << dst << std::endl;
    } else {
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        move(n-1, src, dst, aux);
        move(1, src, aux, dst);

    }
}
```

The Towers of Hanoi – Code

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void move(int n, const string &src, const string &aux, const string &dst){
    if (n == 1) {
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```

The Towers of Hanoi – Code

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void move(int n, const string &src, const string &aux, const string &dst){
    if (n == 1) {
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        std::cout << src << " --> " << dst << std::endl;
    } else {
        // recursive case
        move(n-1, src, dst, aux);
        move(1, src, aux, dst);
        move(n-1, aux, src, dst);
    }
}
int main() {
    move(4, "left", "middle", "right");
    return 0;
}
```

The Towers of Hanoi – Code Alternative

```
void move(int n, const string &src, const string &aux, const string &dst){
    // base case
    if (n == 0) return;

    // recursive case
    move(n-1, src, dst, aux);
    std::cout << src << " --> " << dst << "\n";
    move(n-1, aux, src, dst);
}


int main() {
    move(4, "left", "middle", "right");
    return 0;
}
```