Adobe

Algorithms - Preliminaries

Rubric: No Raw Loops

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Definition

"An *Algorithm* is a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer." – *New Oxford American Dictionary*

A Simple Algorithm

```
int r = a < b ? a : b;
```

- What does this line of code do?

A Simple Algorithm

```
// r is the minimum of `a` and `b`
int r = a < b ? a : b;
```

A Simple Algorithm

```
int r = min(a, b);
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/// returns the minimum of `a` and `b`
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- The preconditions of each statement must be satisfied by the statements before
  - Or implied by the preconditions of the algorithm
- The postconditions for the algorithm must follow from the sequence of statements

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Functions allow us to build a vocabulary focused on semantics.

Naming Functions

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- copular constructions: `is_blue`
- consider a verb if the complexity is greater than expected

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- `name()` not `get_name()`

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- `T&&`, where `T` is not deduced
- `T,` For known or expected small types and to avoid forward references

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- Functions with names with *unambiguous* verbs have *in-out* arguments
- All other arguments are *let* (read-only, copied if escaped)
- Results of functions with names starting with "alloc," "new," "copy," or "create" are owned solely by the caller; other results are read-only

Argument Types

```
void display(const vector<unique_ptr<widget>>& a) {
    //...

    a[0]->set_name("displayed"); // DO NOT

    //...
}
```

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Meaningless objects

- A meaningless object should not be passed as an argument (i.e., an invalid pointer).

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display(a);
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auto f = begin(a);
a.push_back(5);
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- Example: the reference returned from `vector::back()`

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A *non-trivial* algorithm requires iteration

- iteration may be implemented as a loop or recursion

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- A finite decreasing property where termination happens when the property is zero

The postcondition of the iteration is the above invariant when the decreasing property reaches zero

Erase

```
template <class T>
void erase(vector<T>& c, const T& value) {
    c.erase(remove(begin(c), end(c), value), c.end());
}
```

Remove

```
/**
    Removes values equal to `a` in the range `[f, l)`.

    \return the position, `b`, such that `[f, b)` contains all the
        values in `[f, l)` not equal to `a` in the original order

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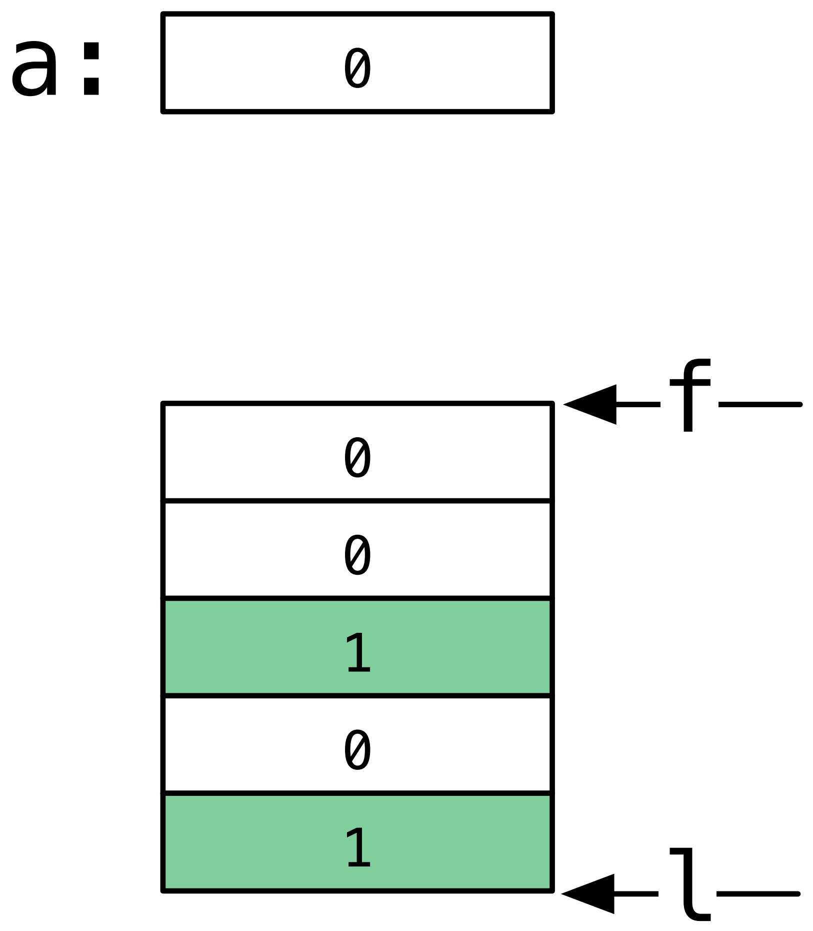

Remove

```
template <forward_iterator I, class T>
auto remove(I f, I l, const T& a) -> I {
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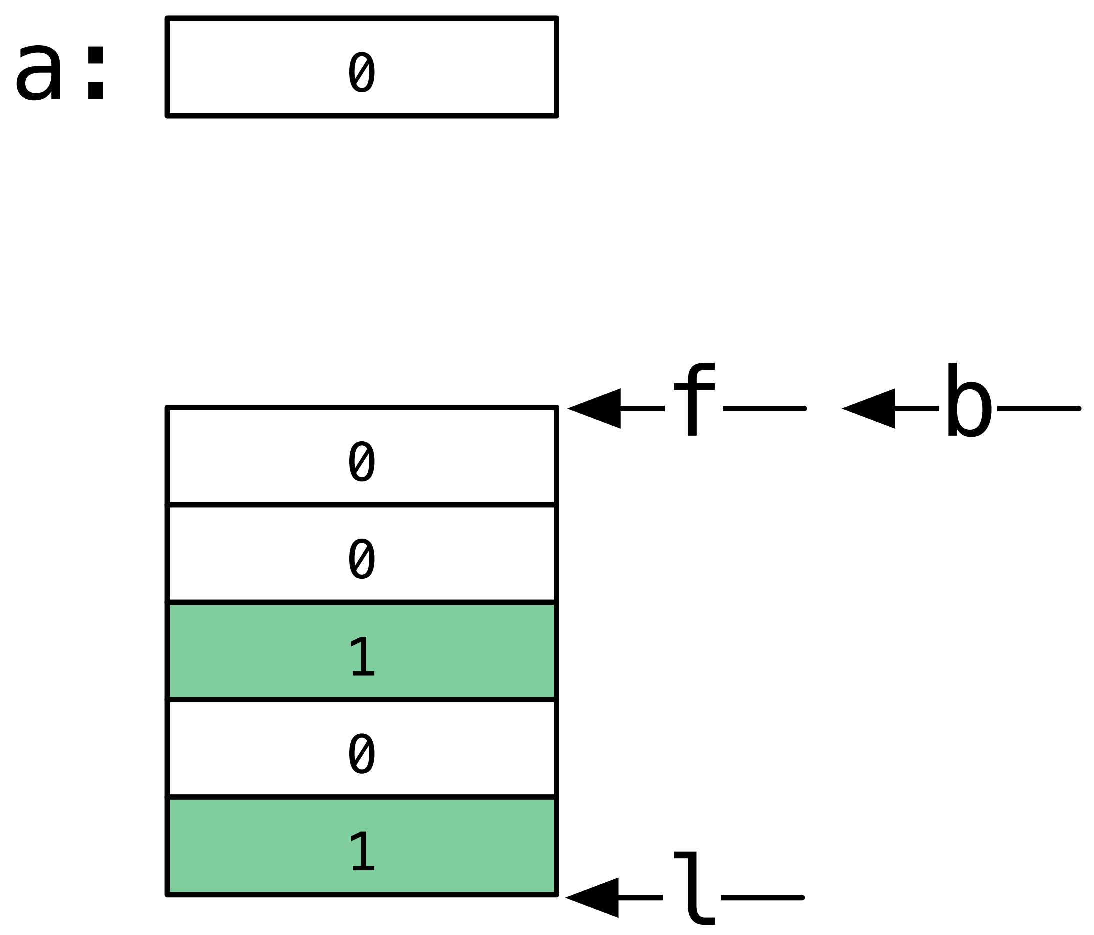

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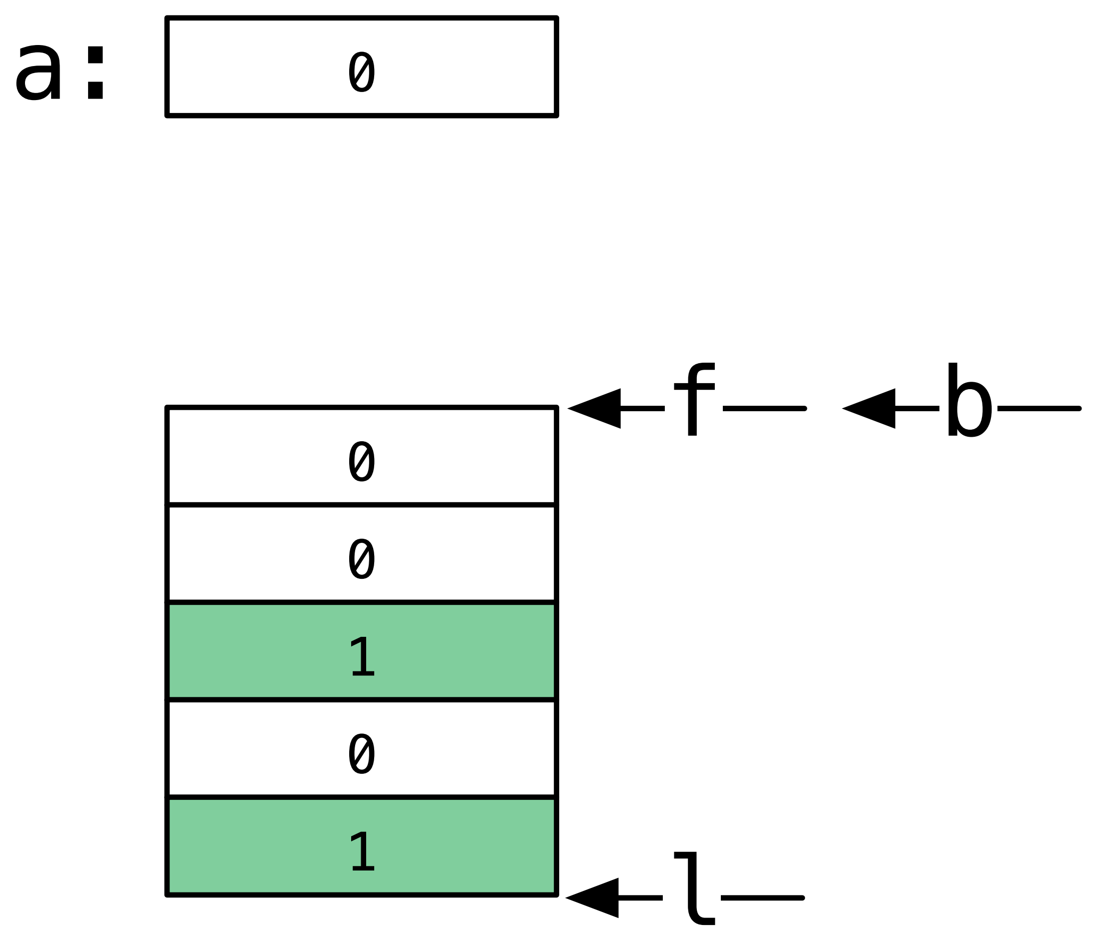

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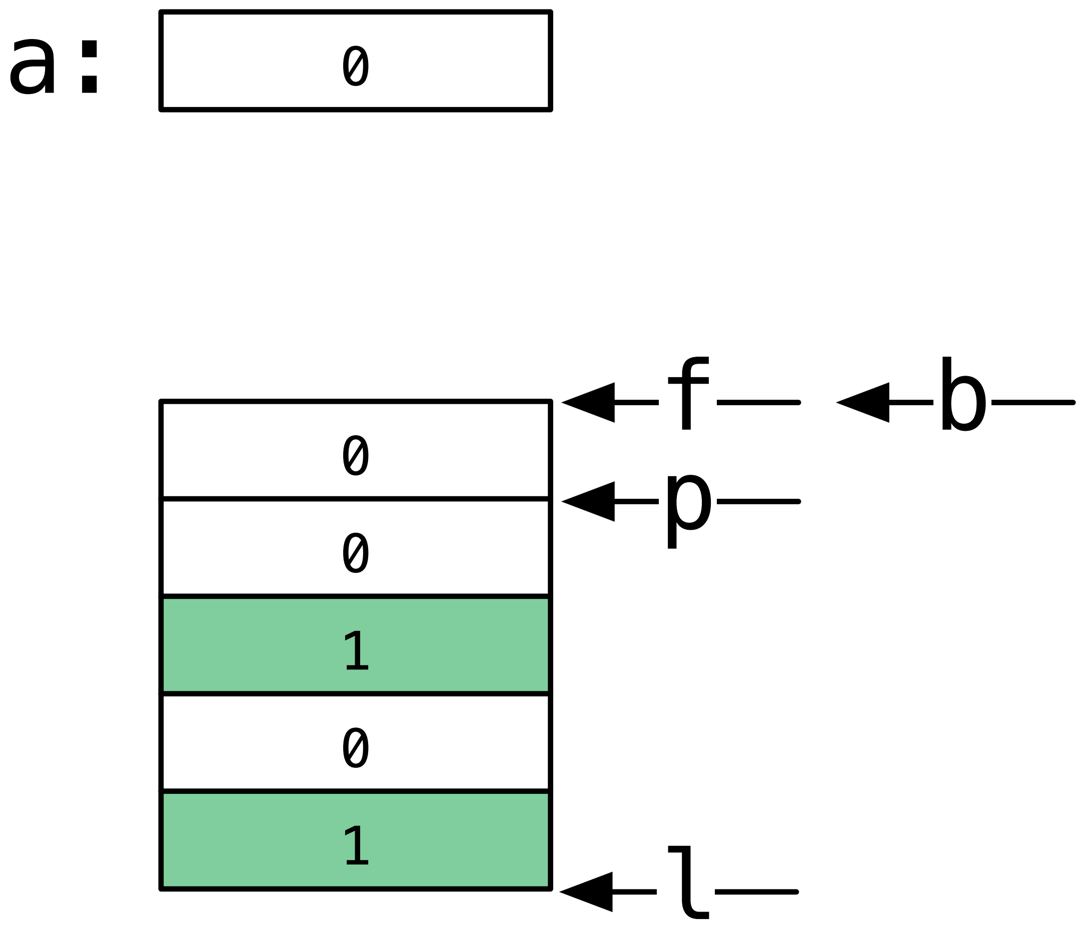

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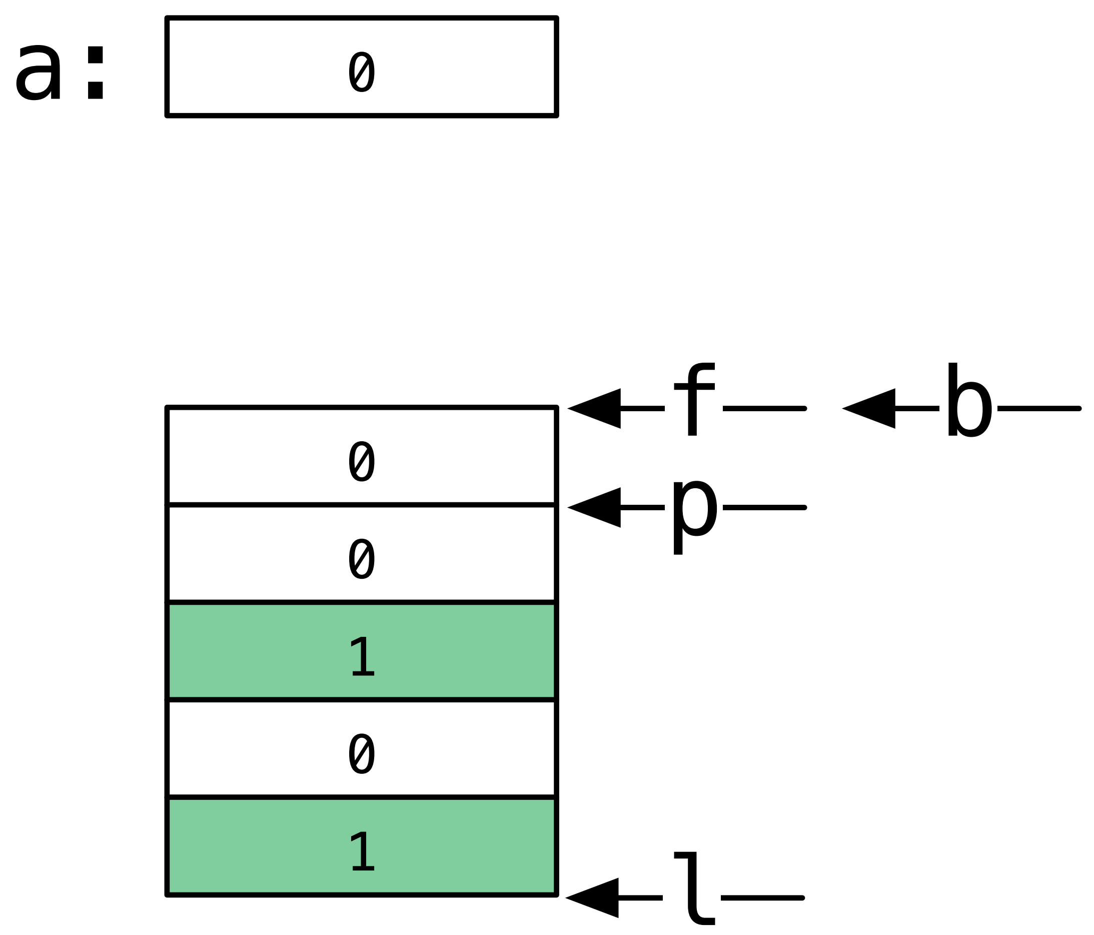

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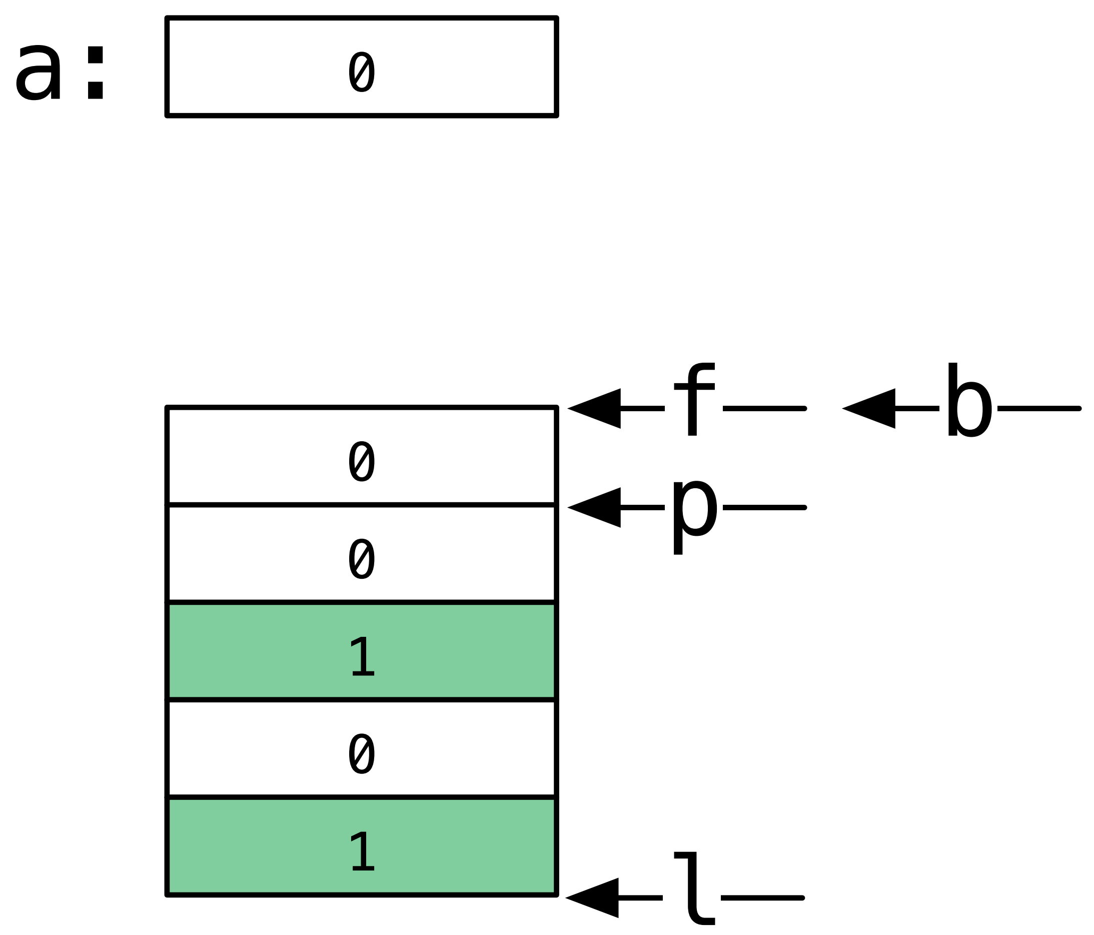

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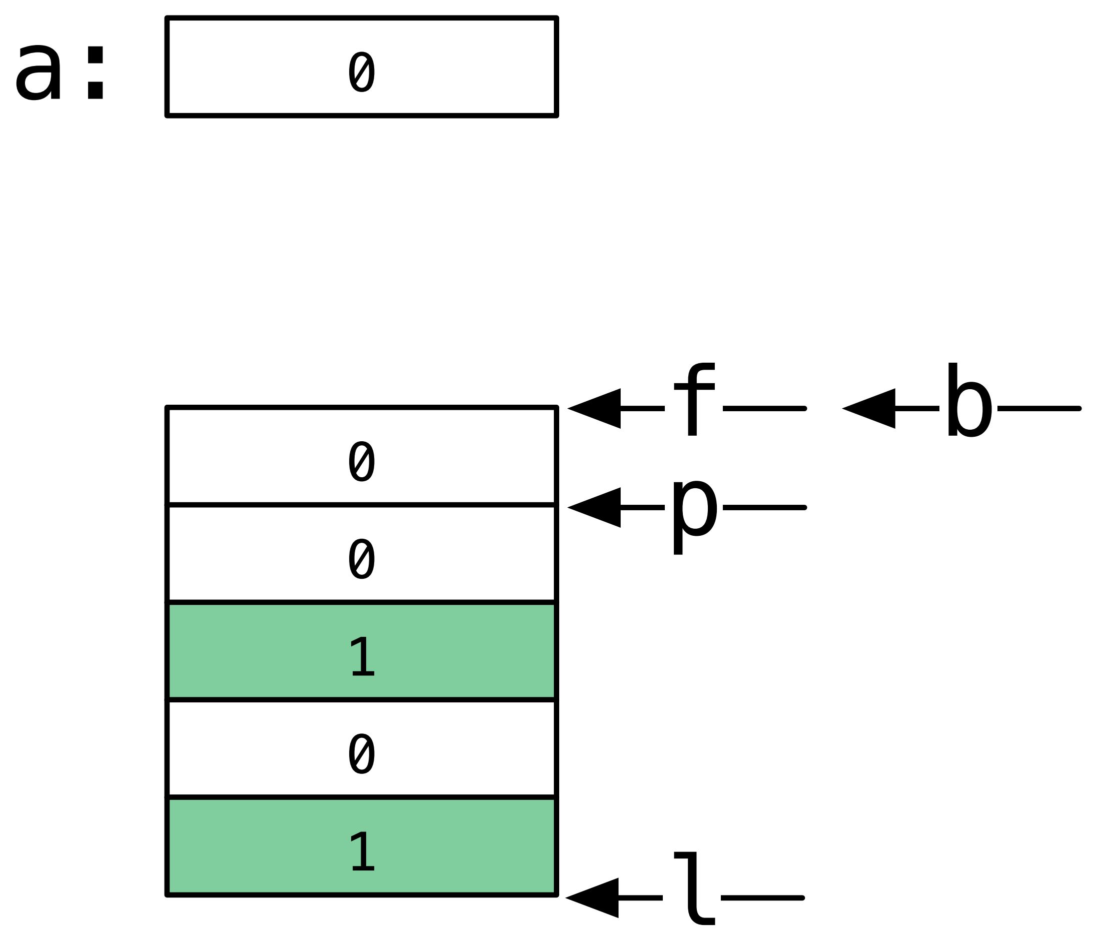

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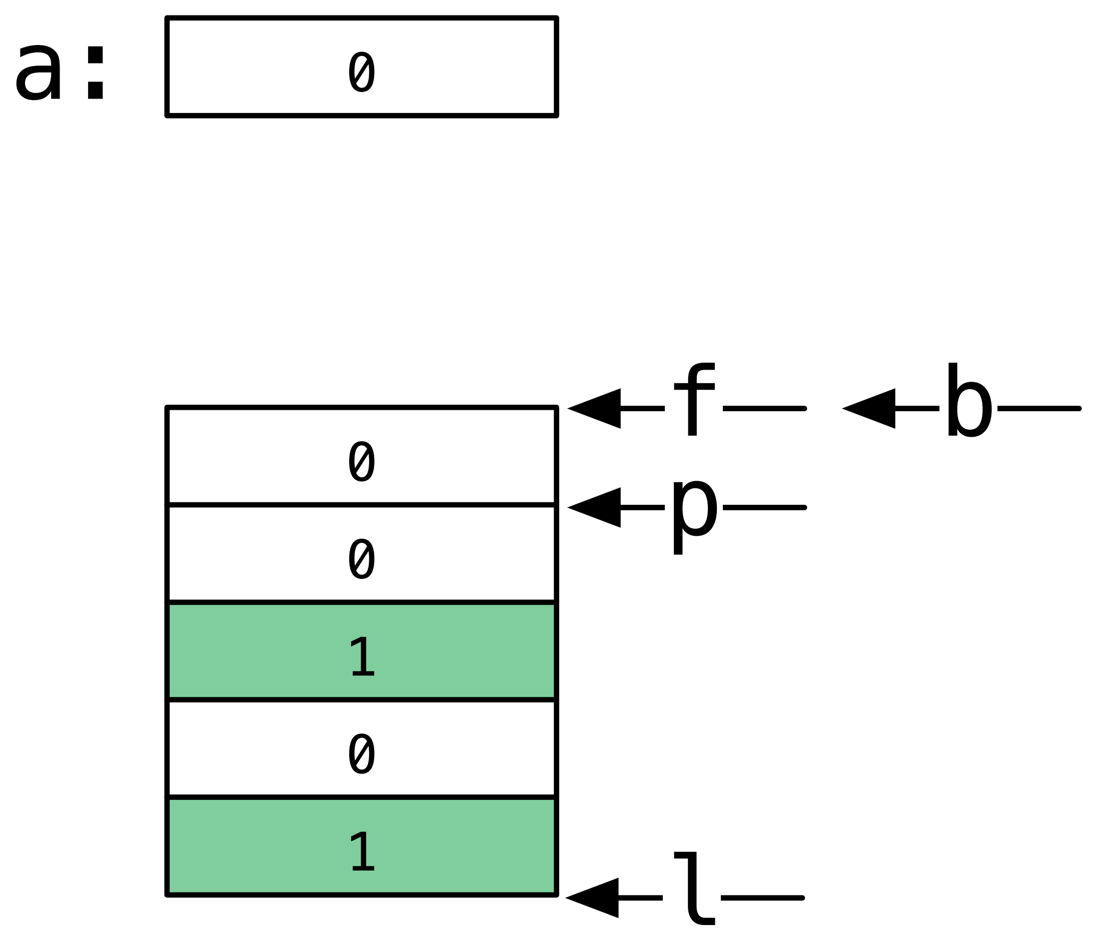

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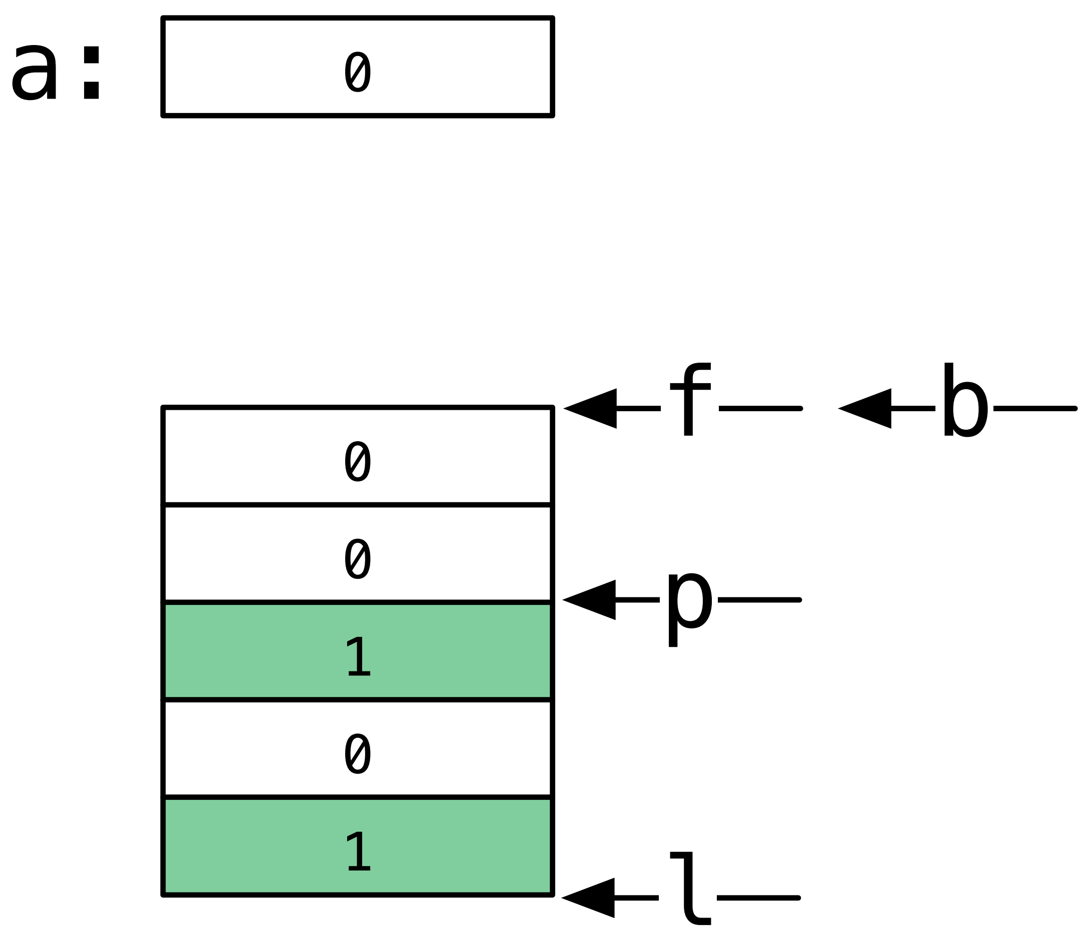

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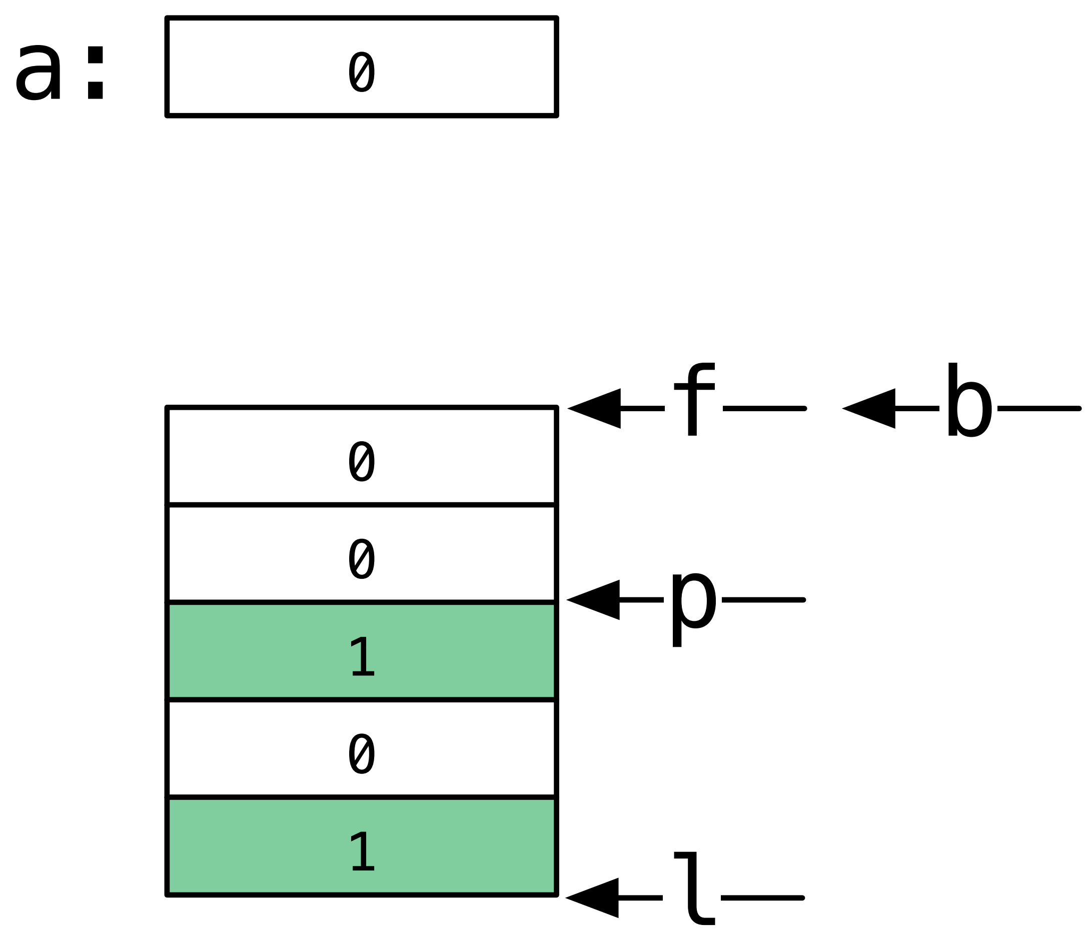

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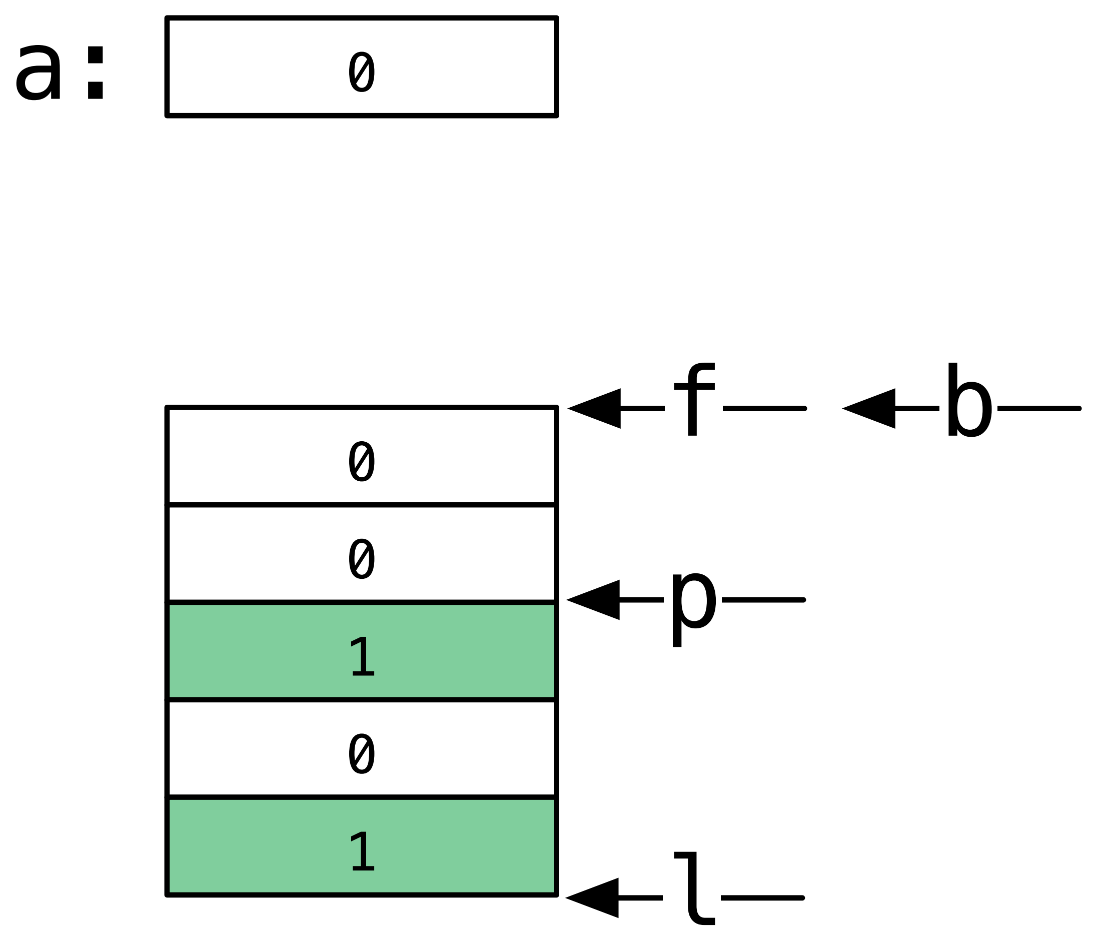

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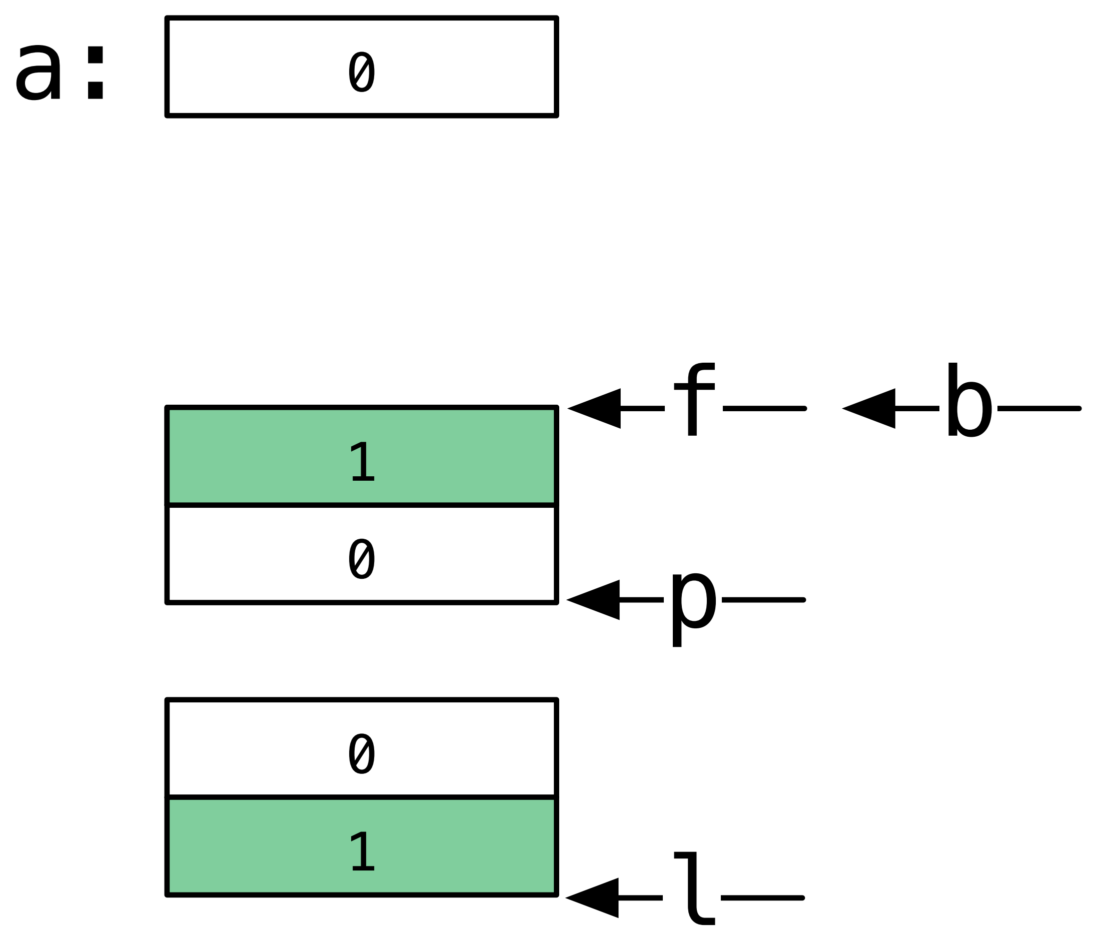

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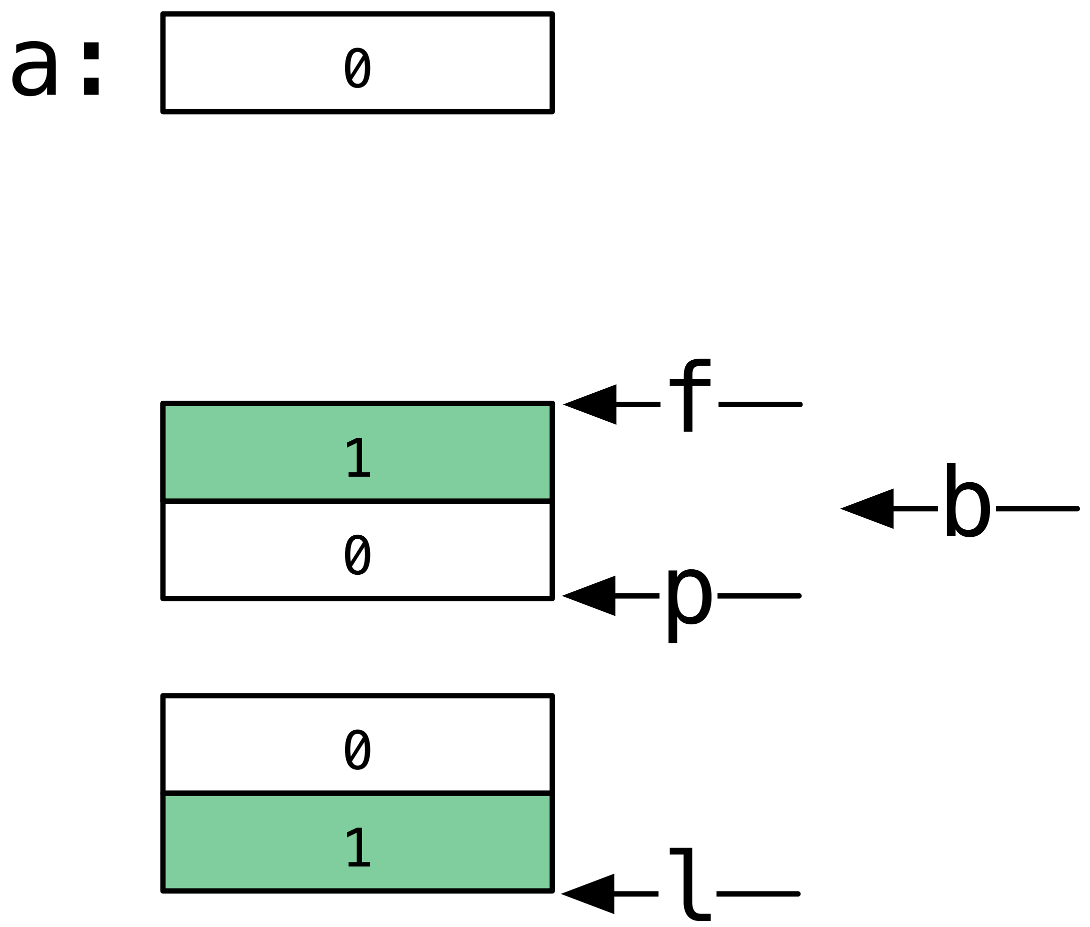

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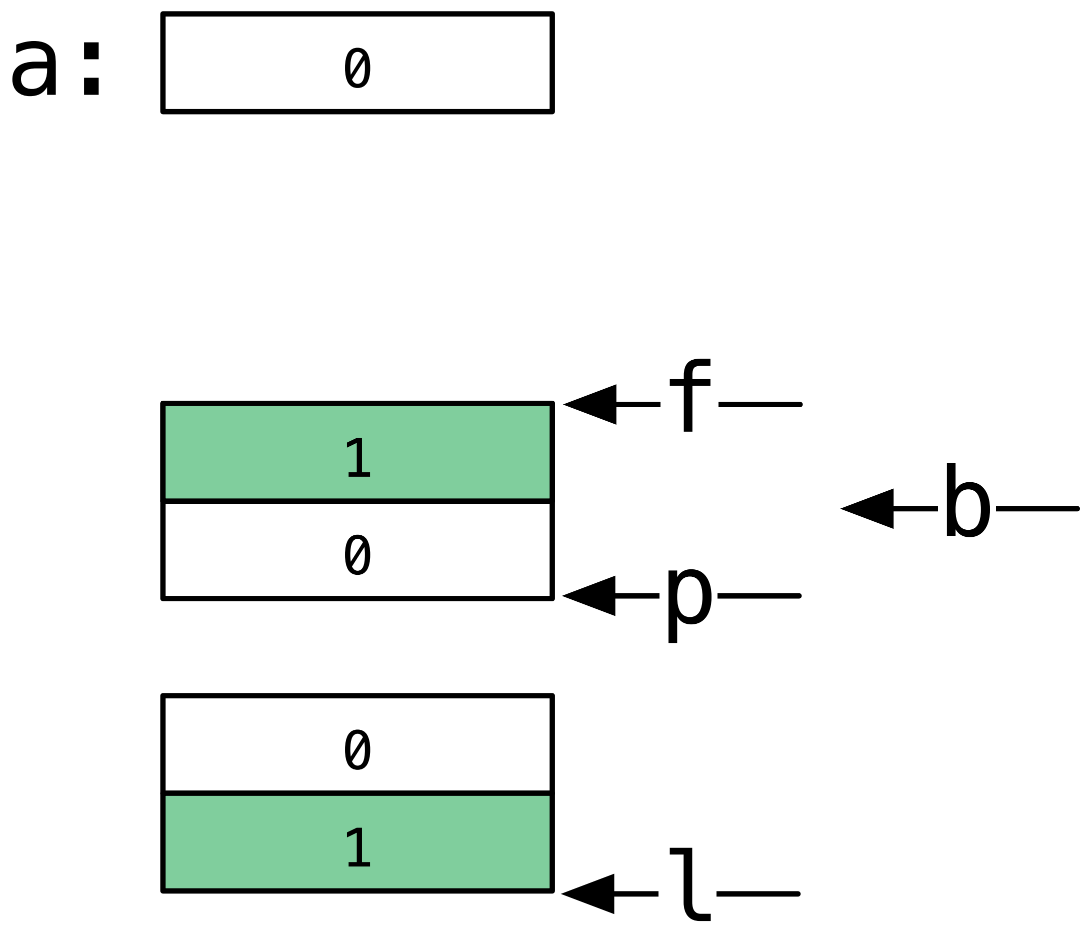

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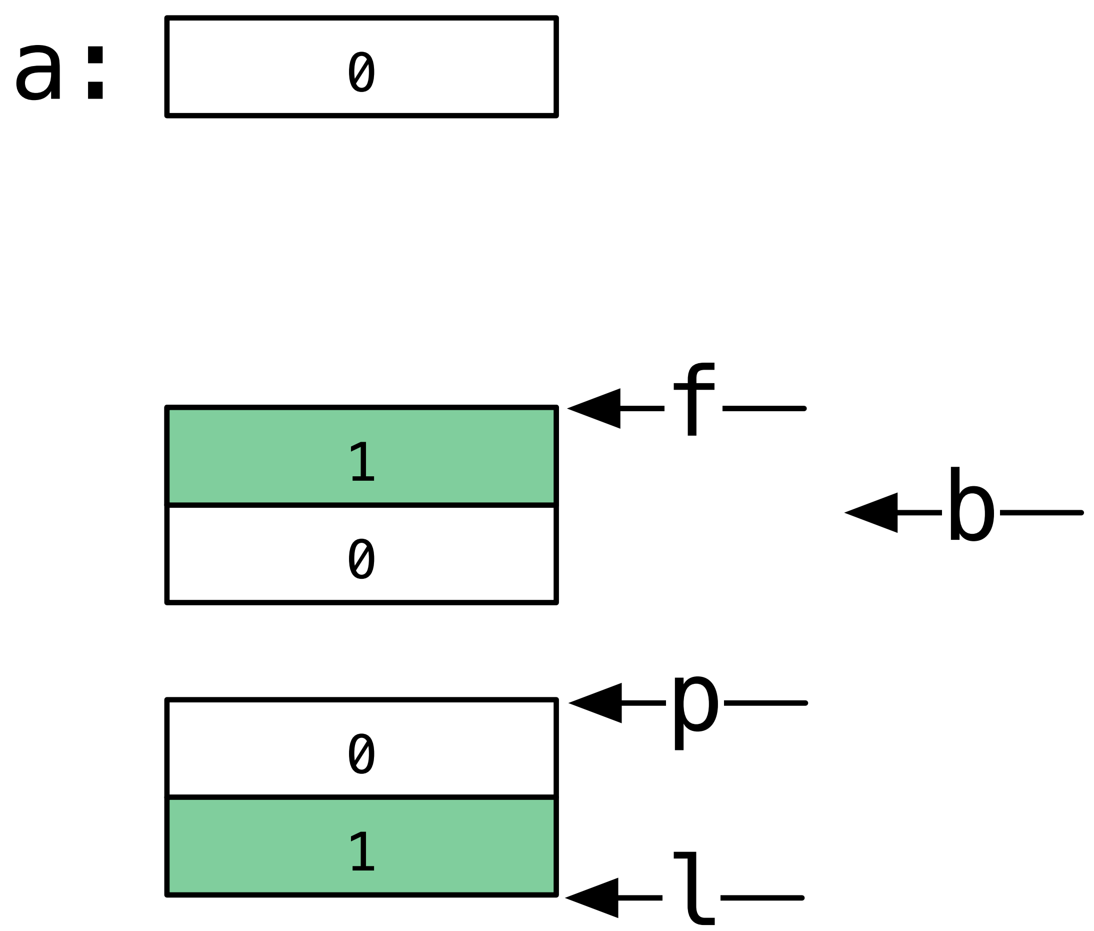

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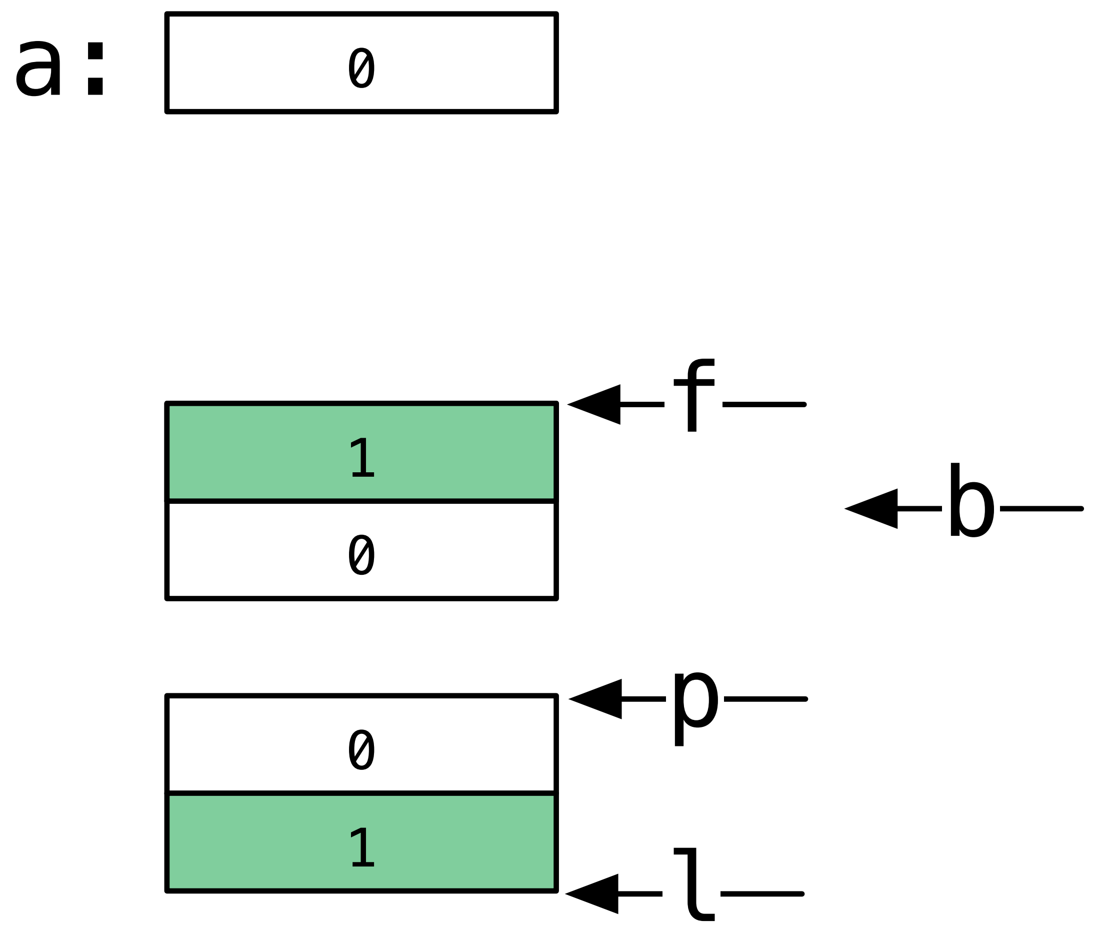

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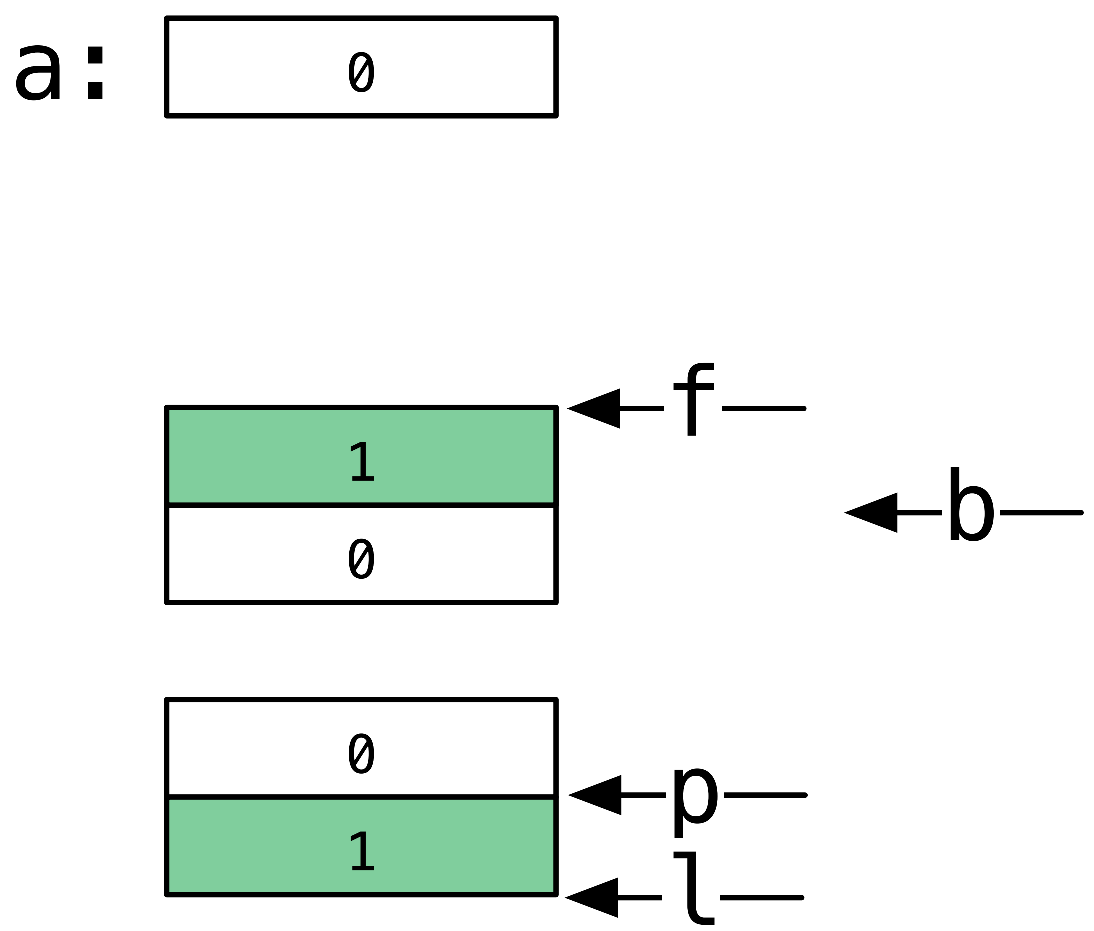

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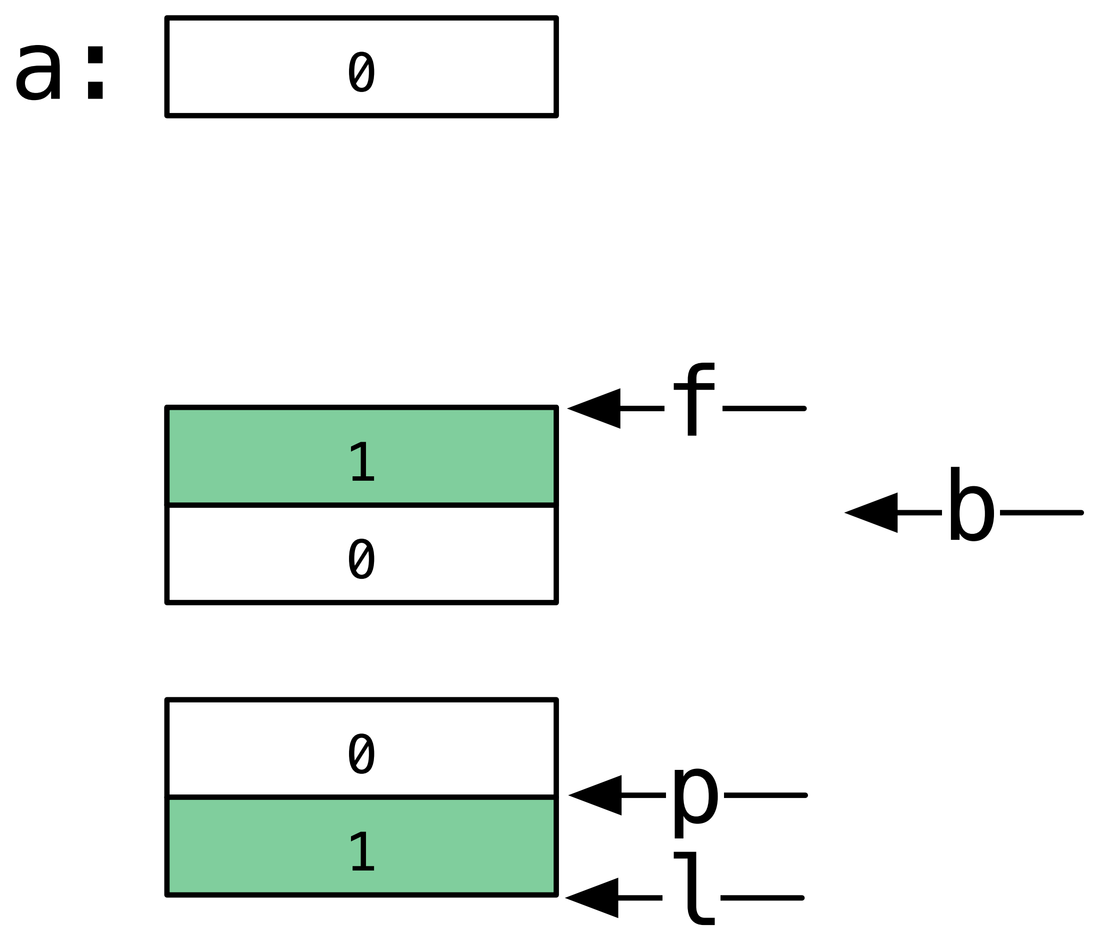

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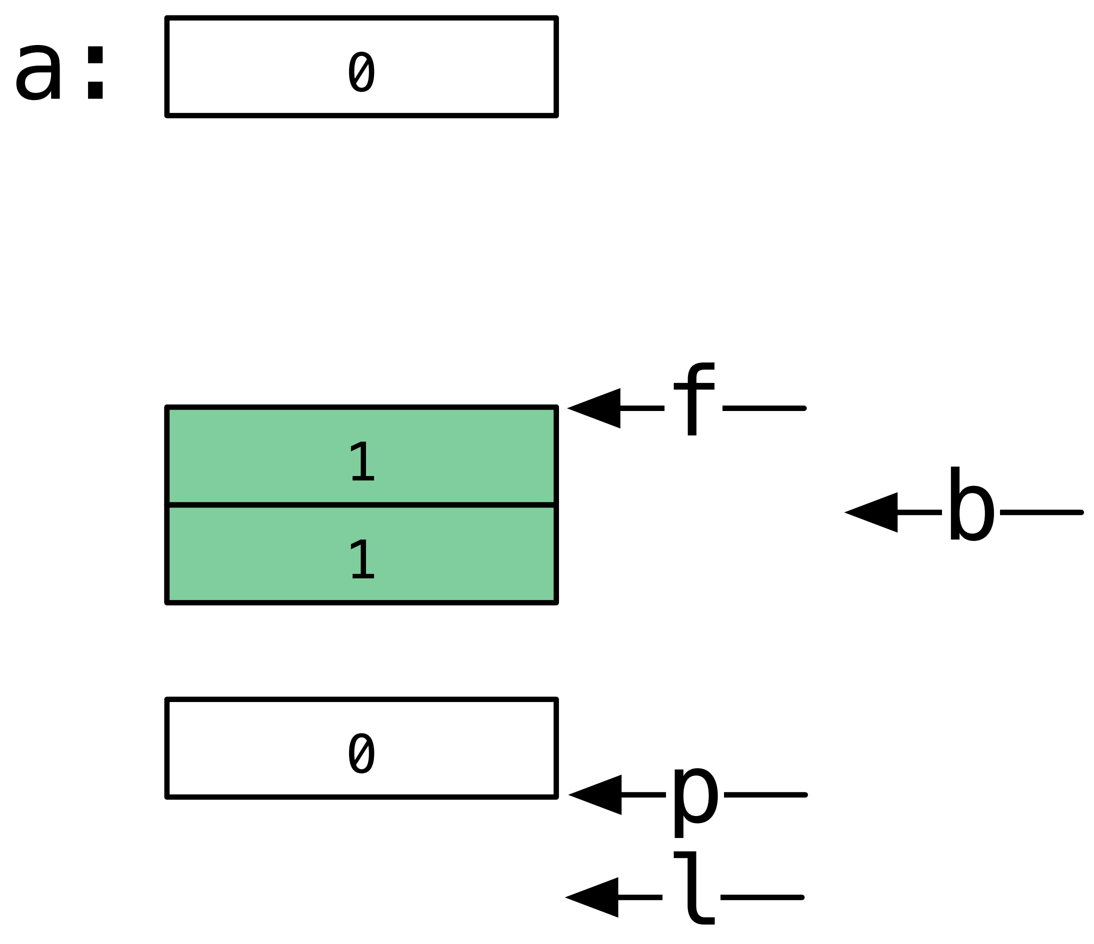

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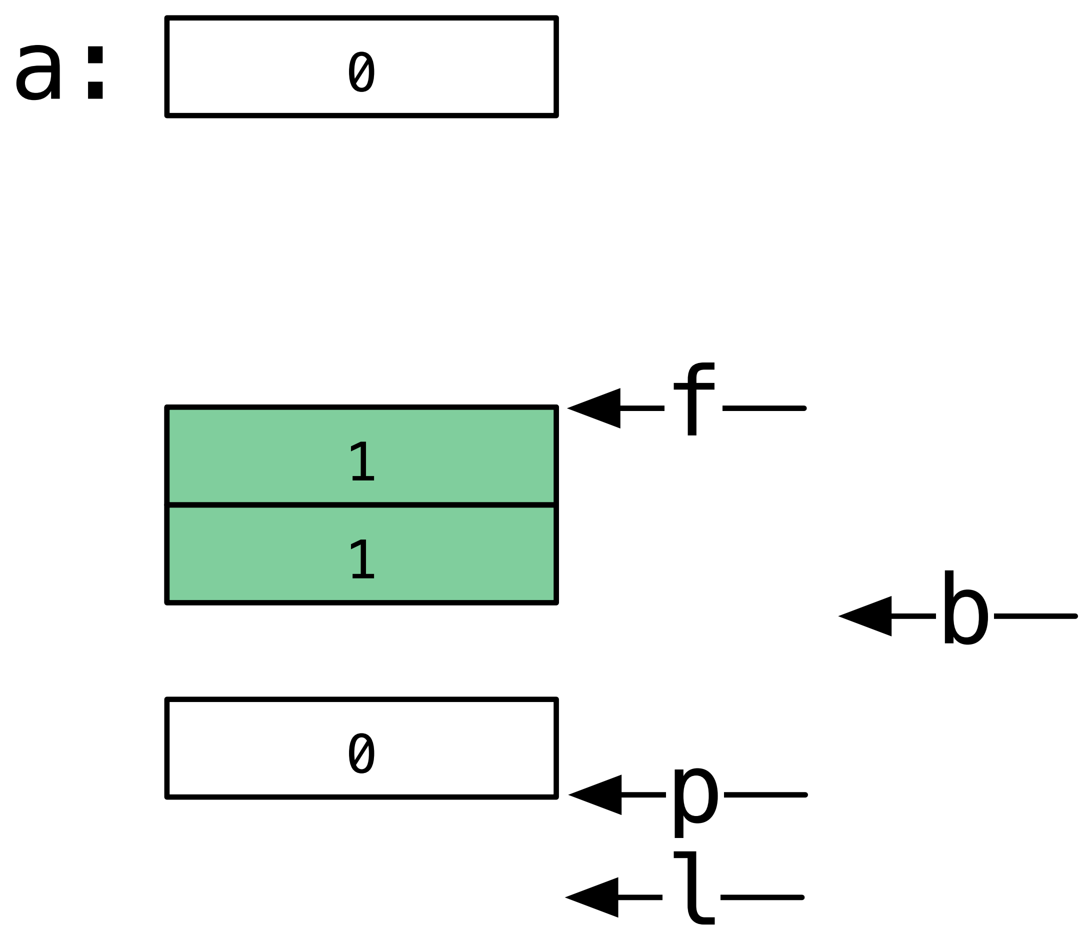

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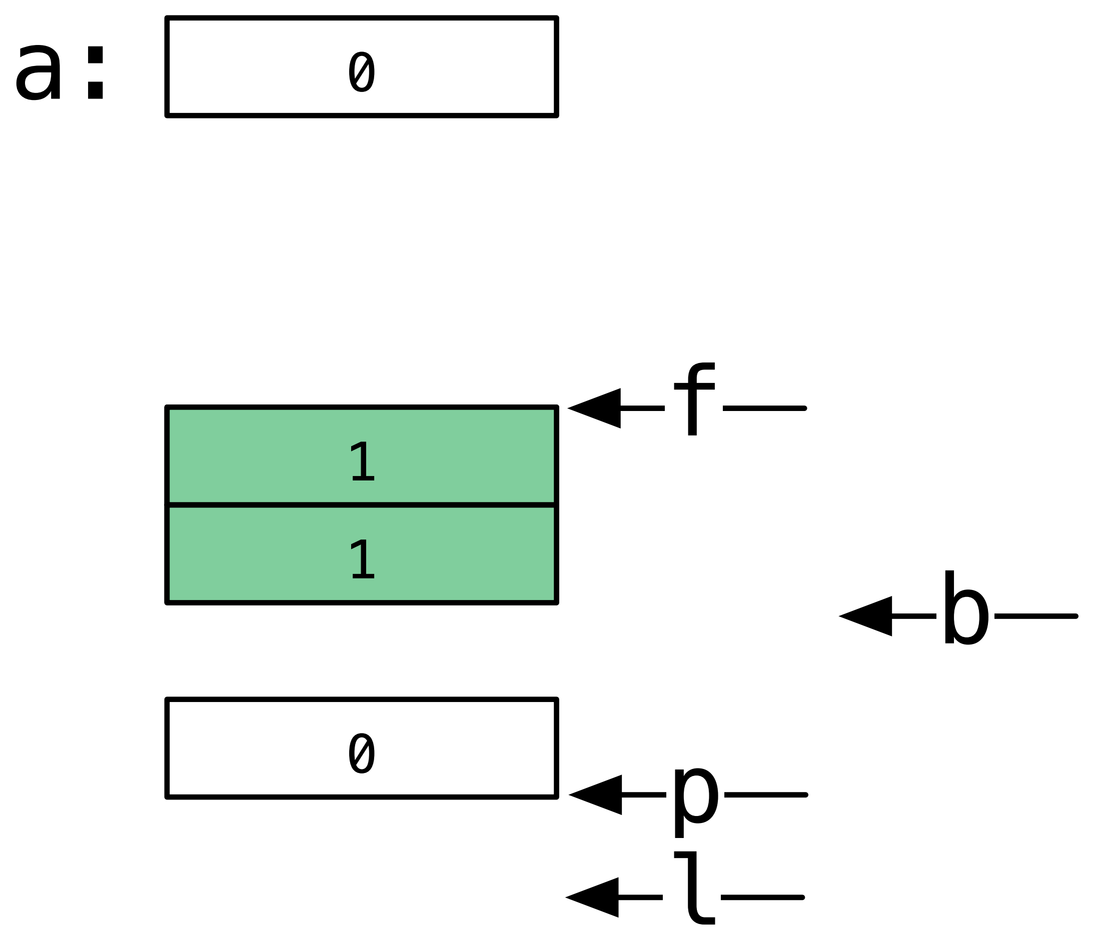

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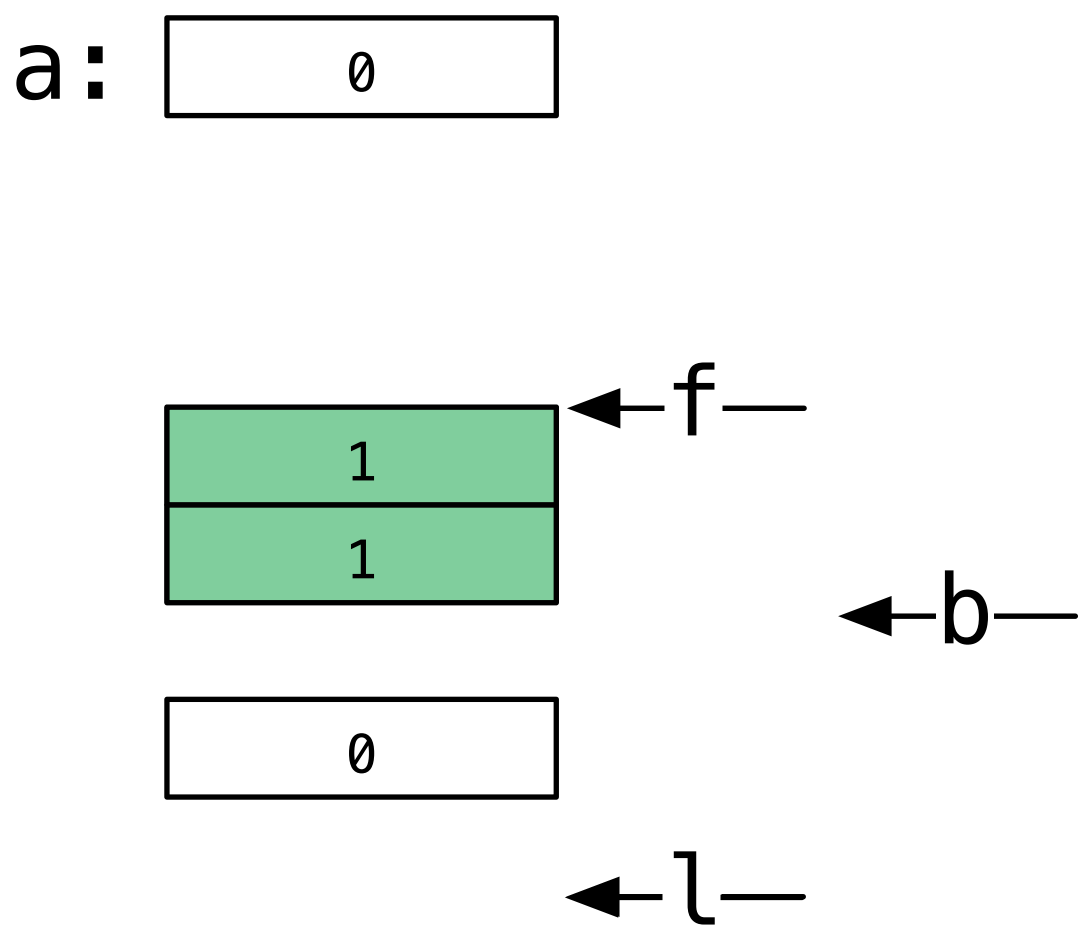

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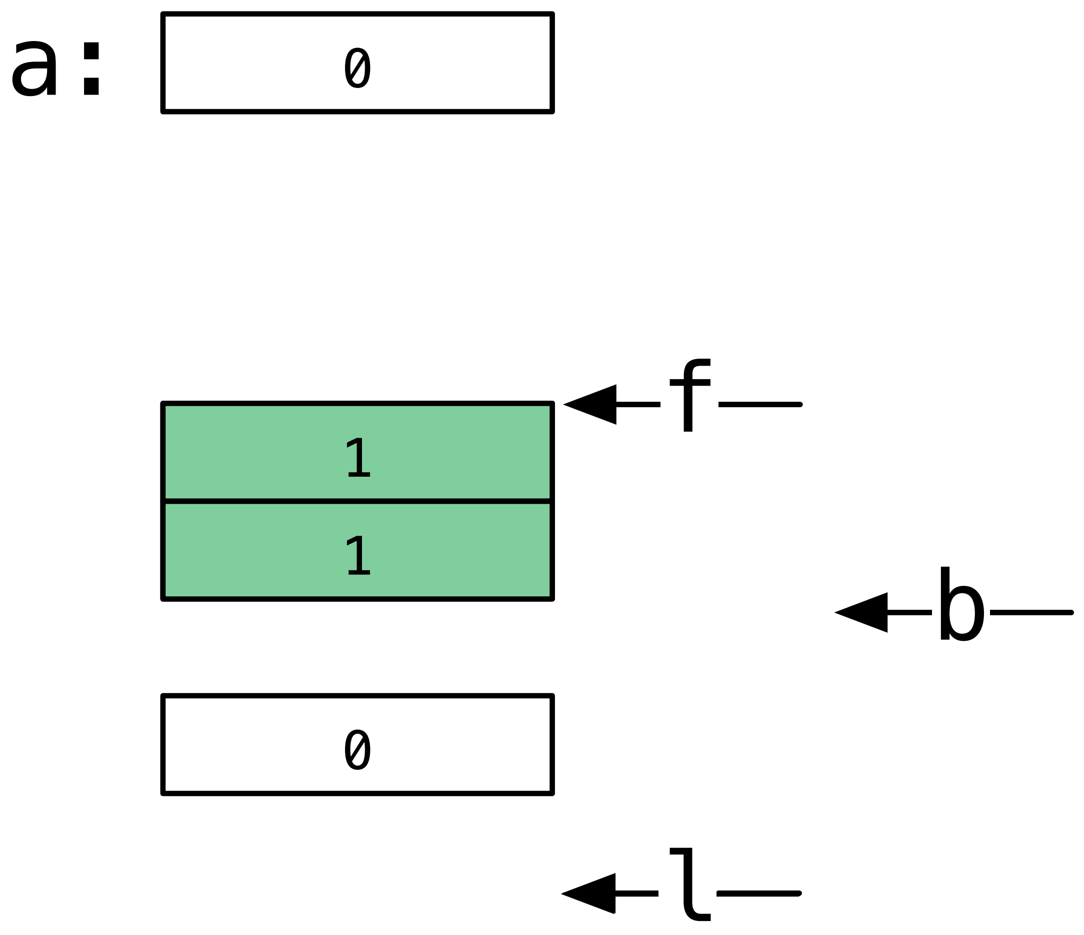

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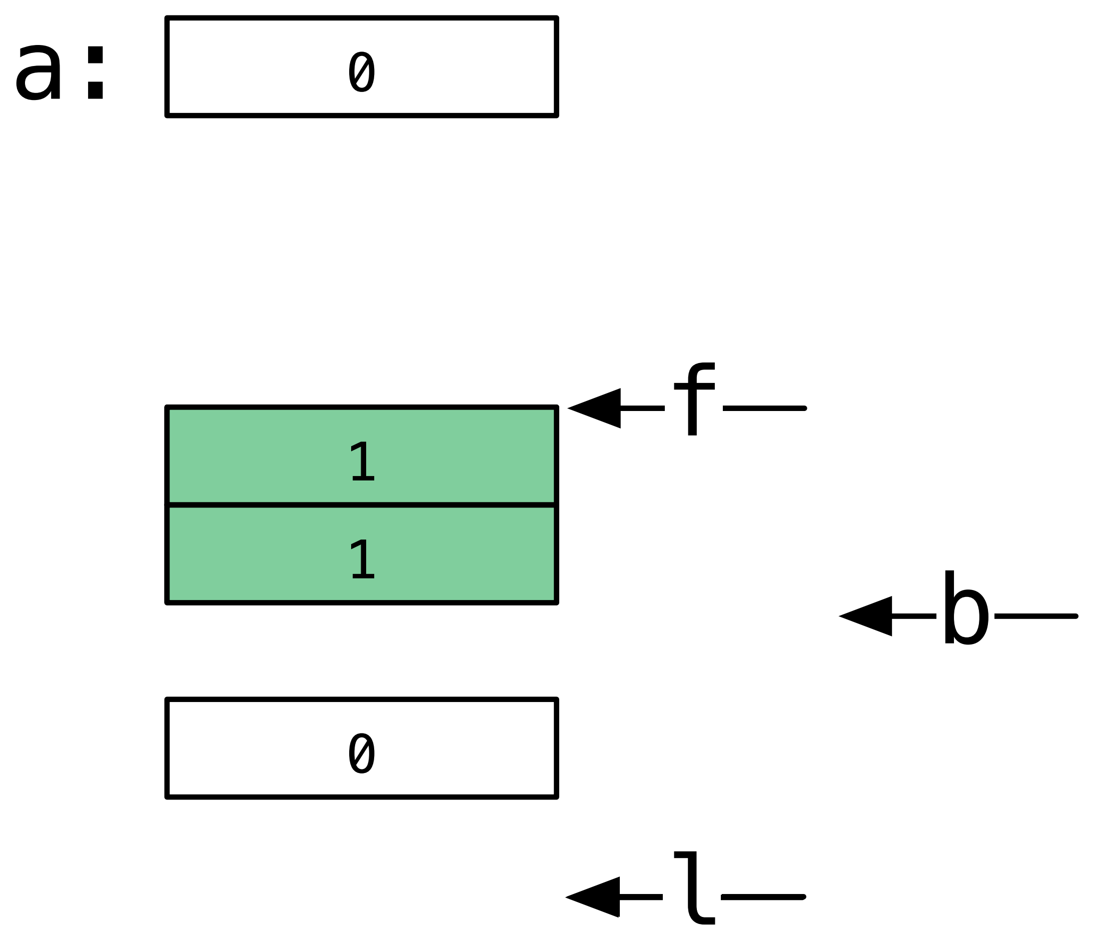

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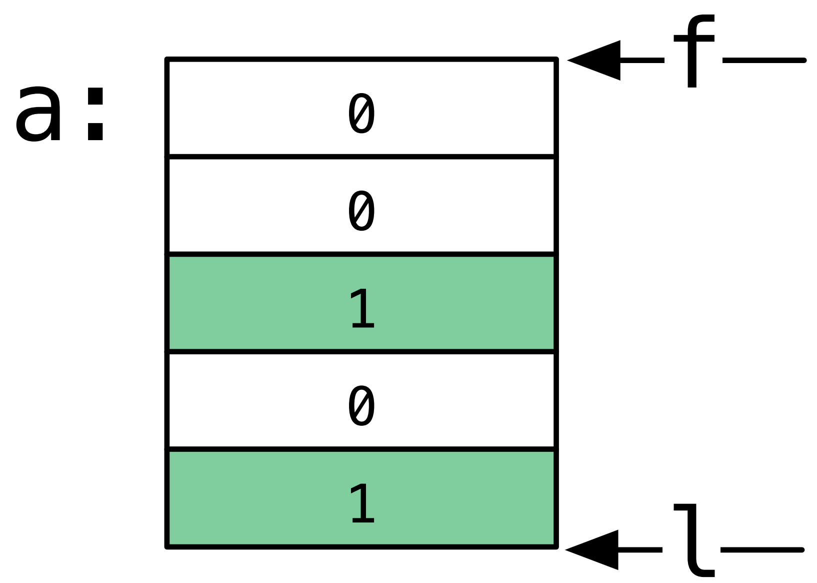

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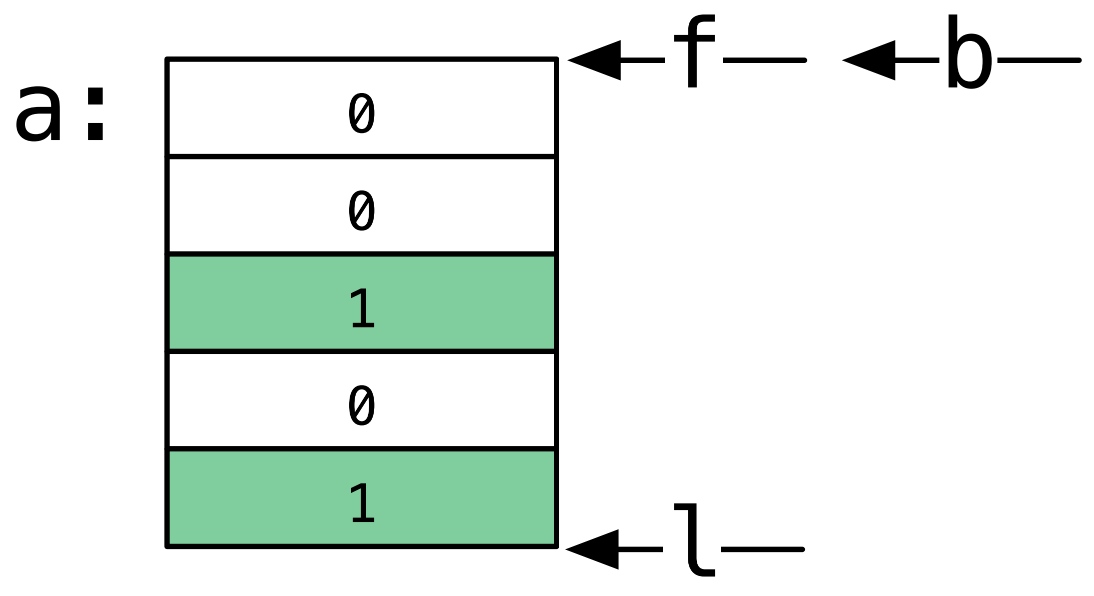

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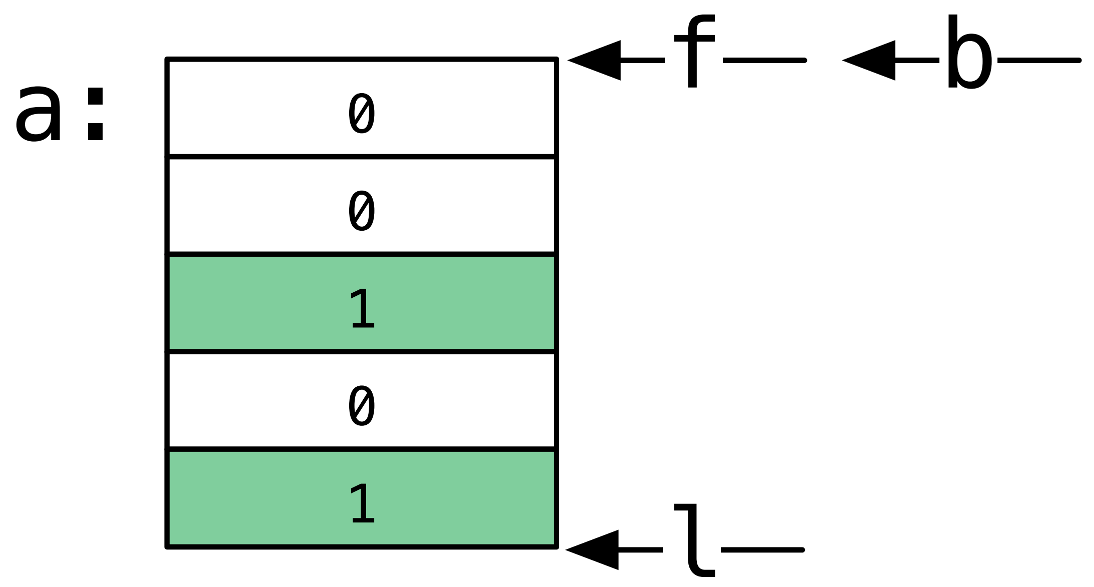

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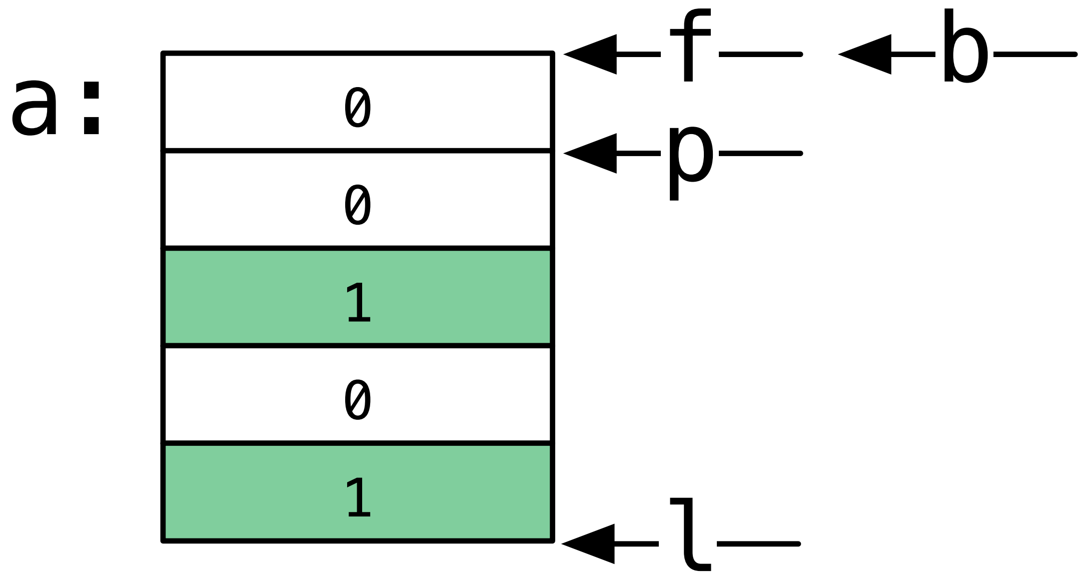
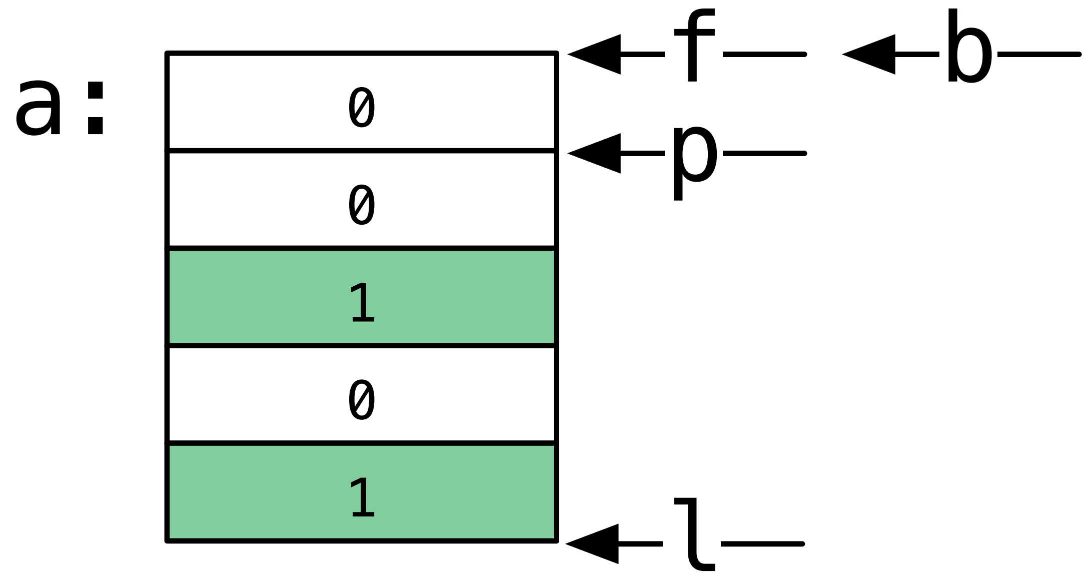


Remove



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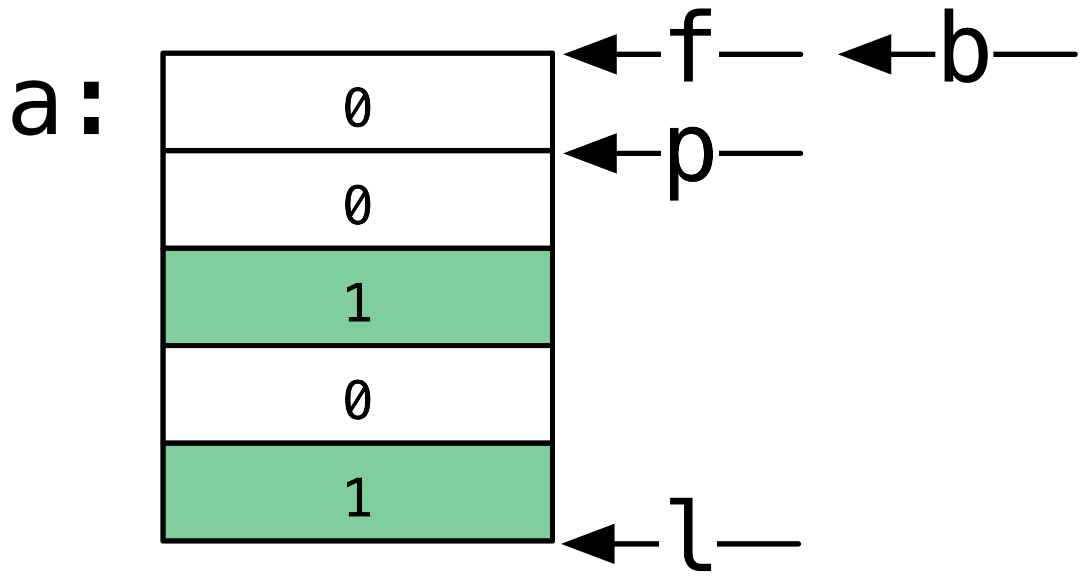

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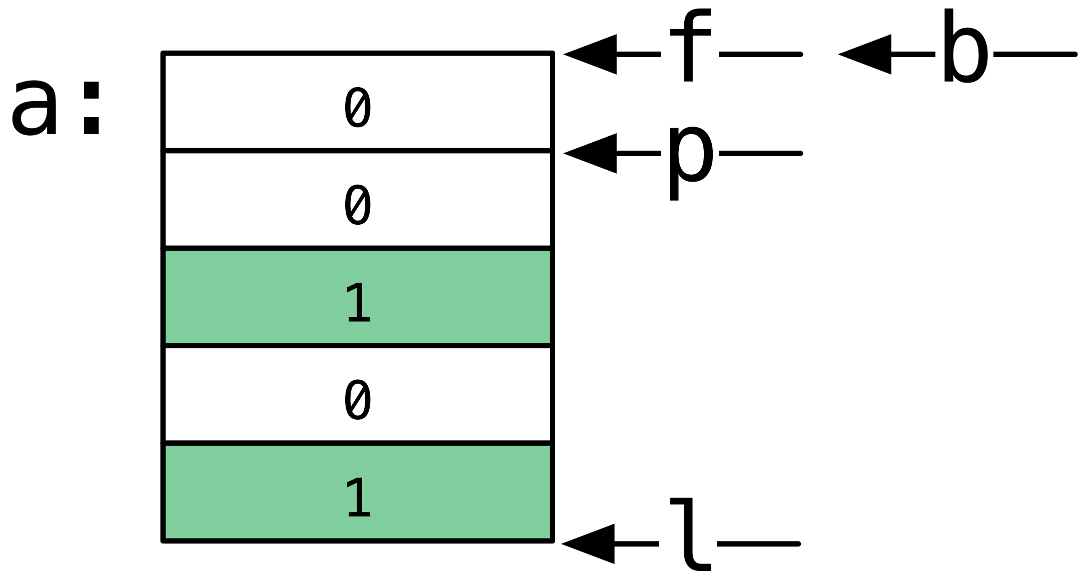

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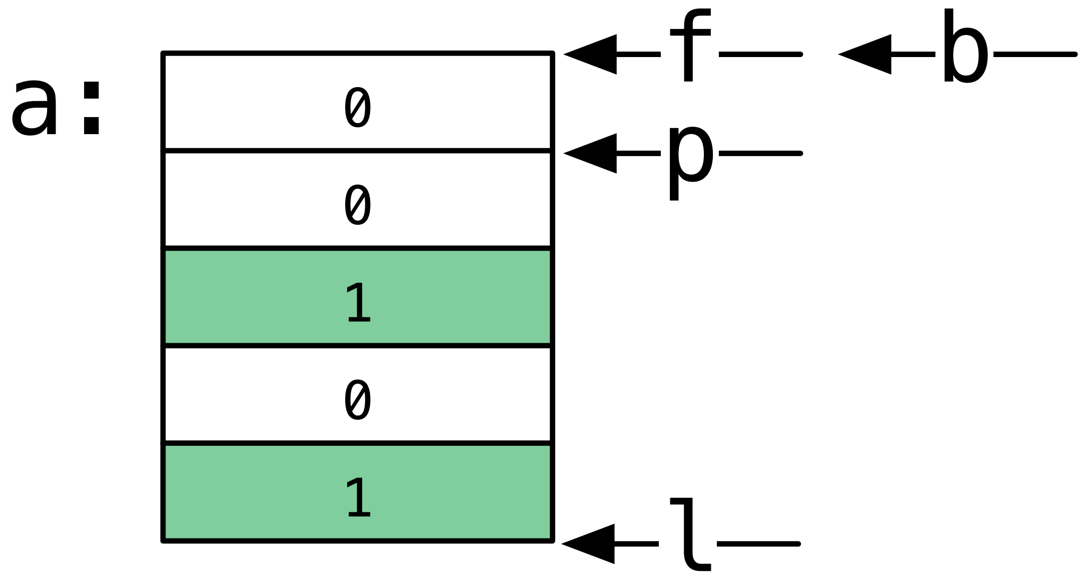

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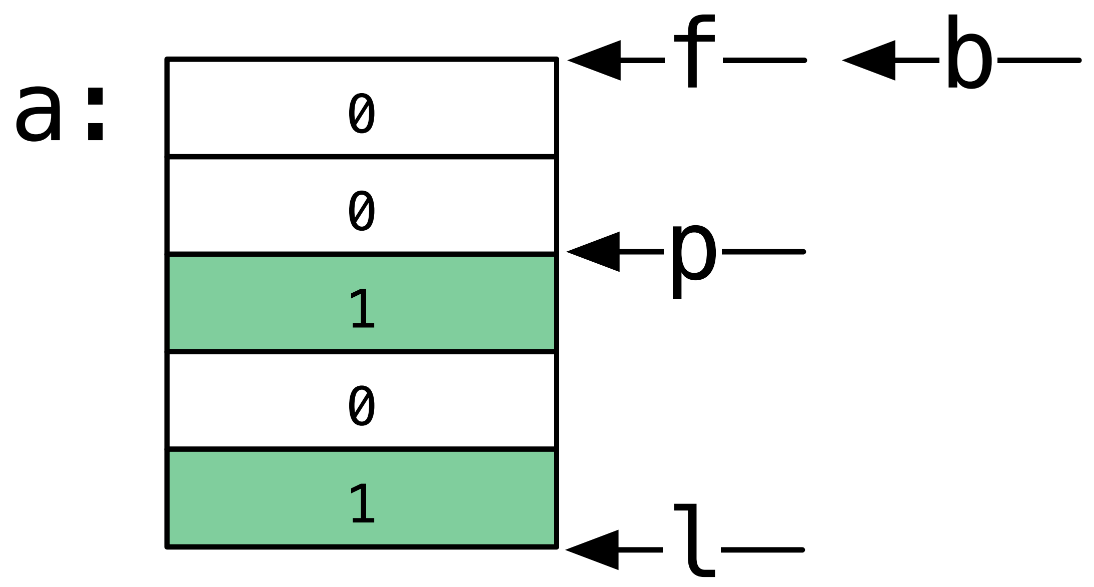

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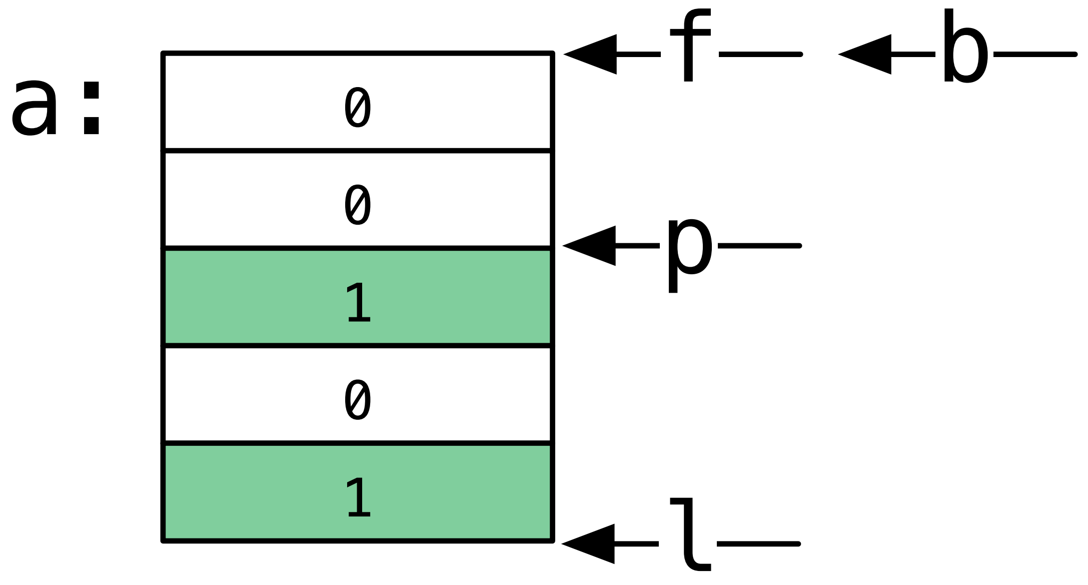

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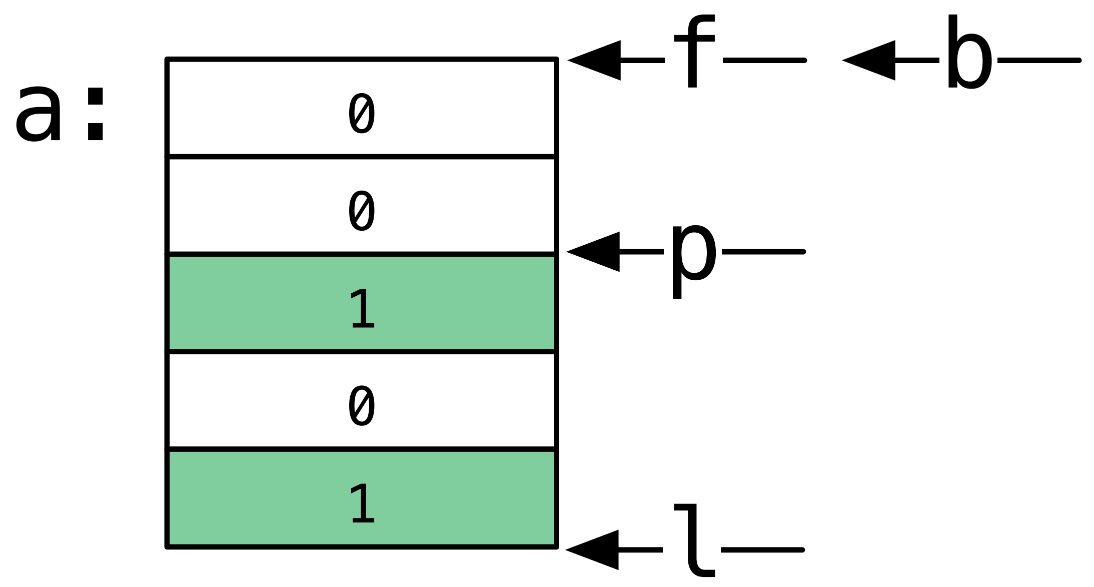

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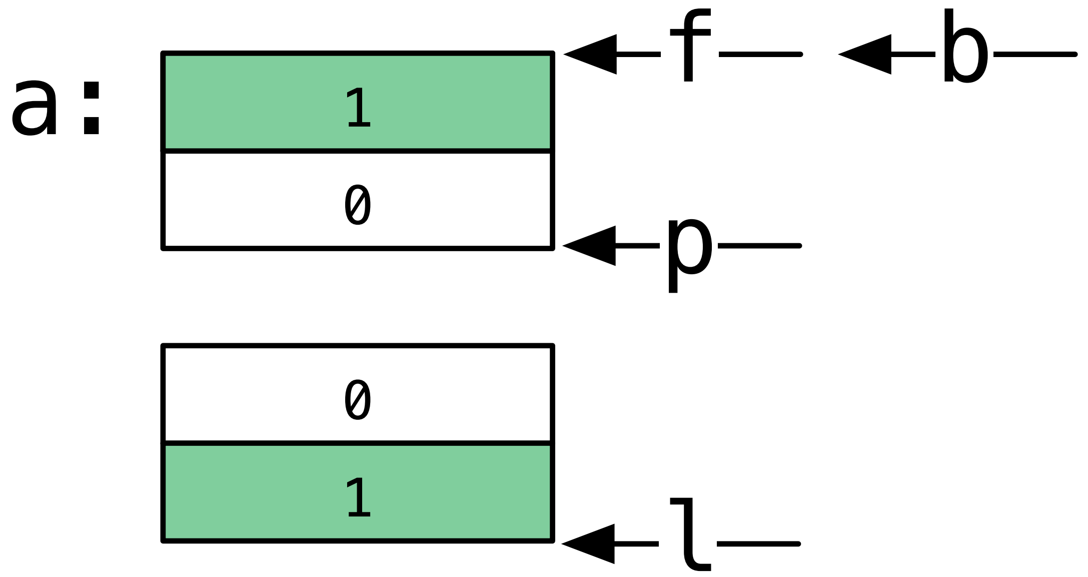

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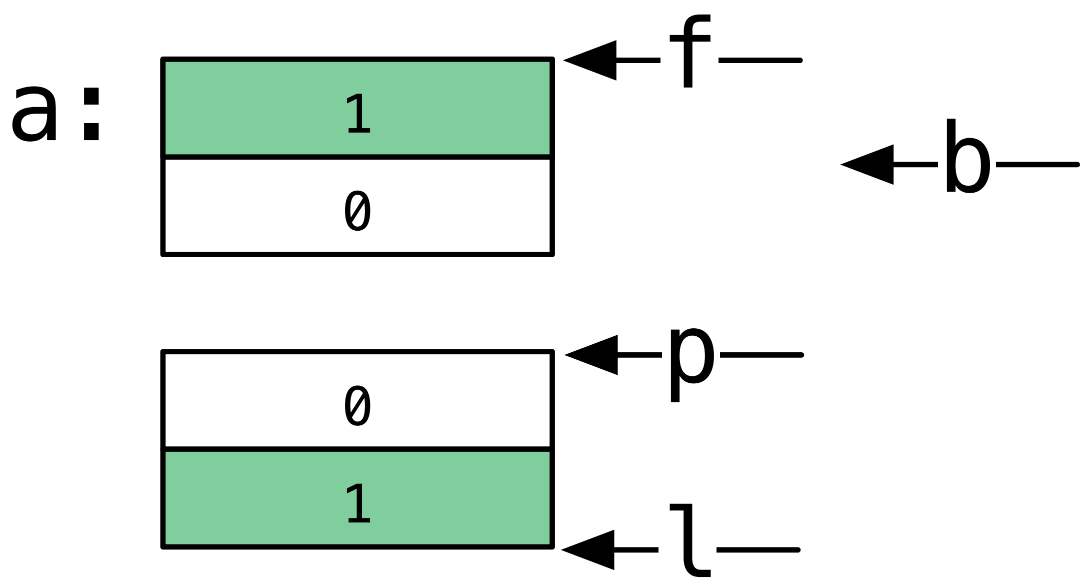

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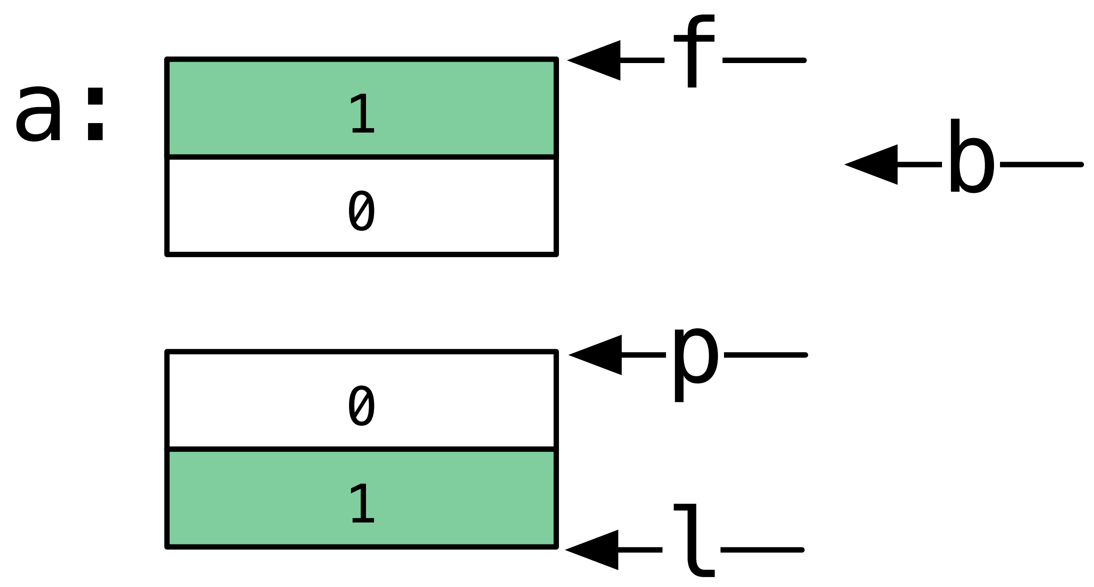

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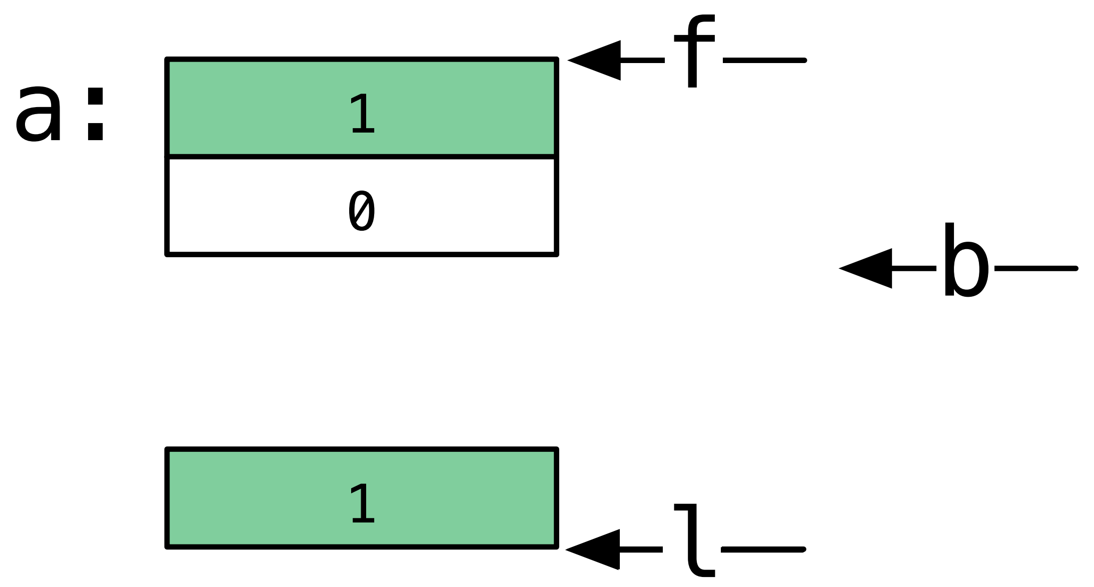

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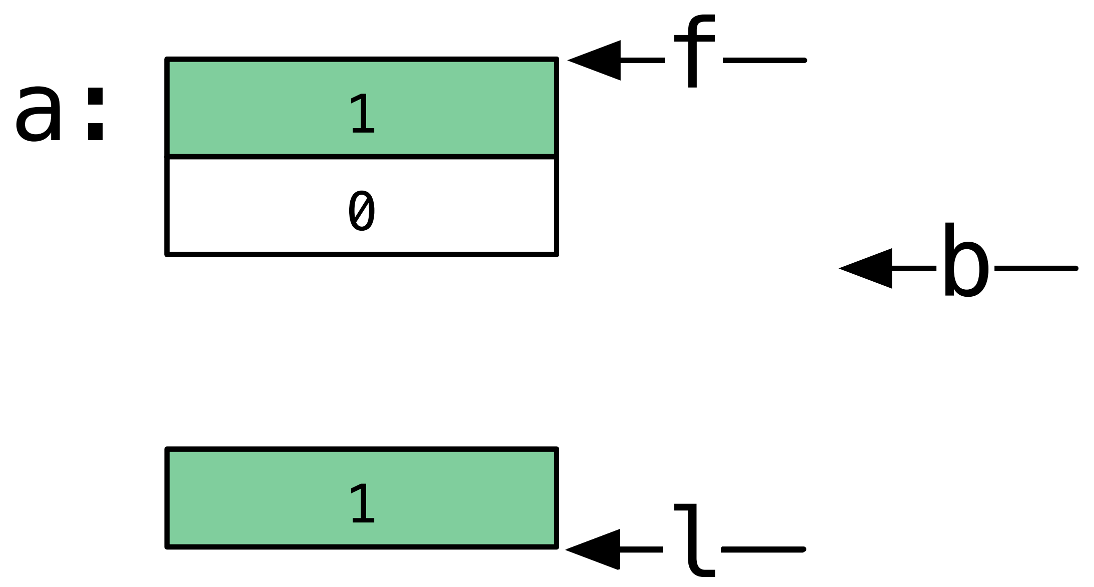

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For a sequence of *n* elements, there are *n + 1* positions

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Ways to represent a range of elements

- Closed interval [f, l]
- Open interval (f, l)
- Half-open interval [f, l)
  - By strong convention, open on the right

Half-Open Intervals

[p, p) represents an empty range at position p

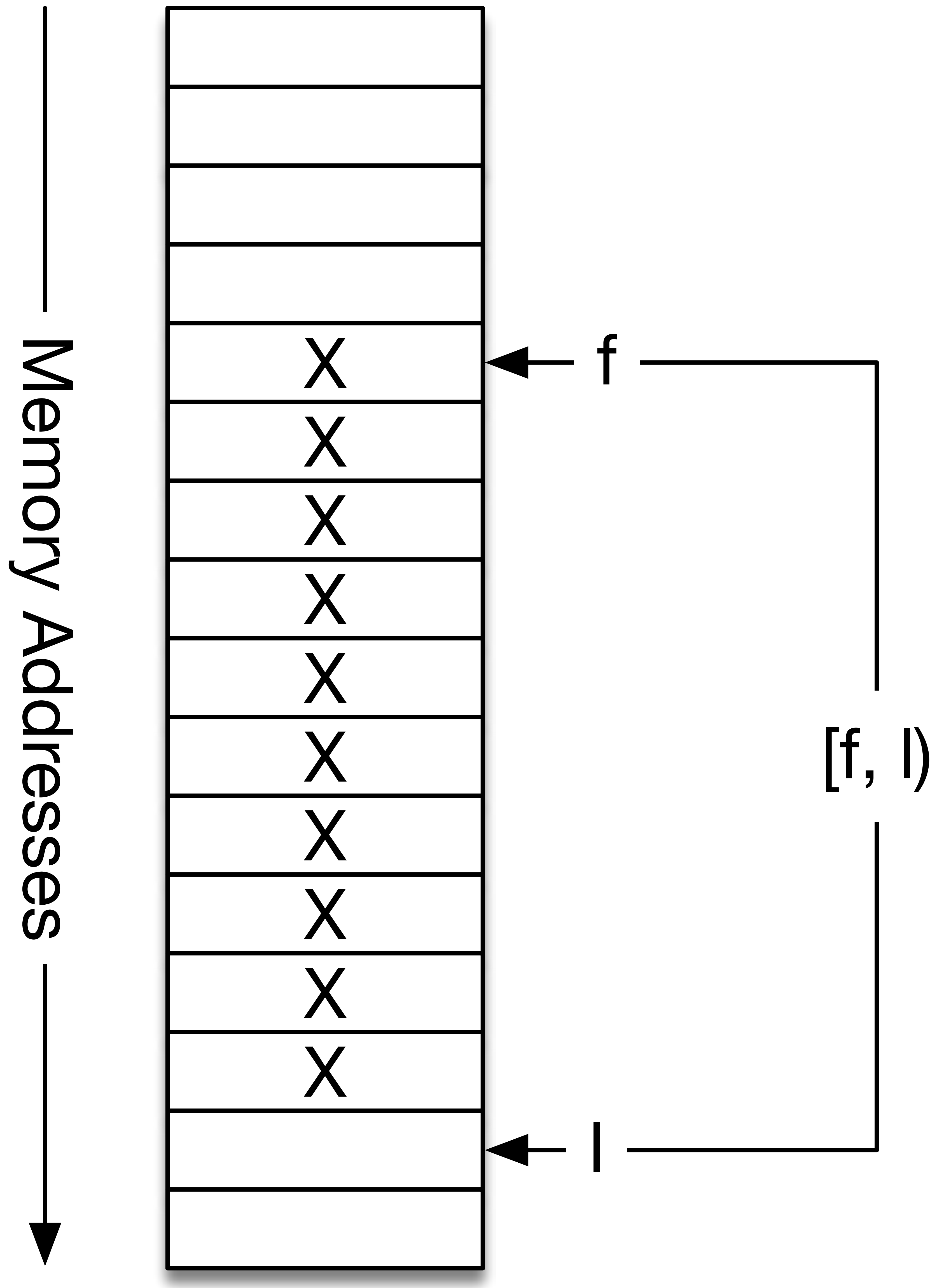
- All empty ranges are not equal

  Cannot express the last item in a set with positions of the same set type

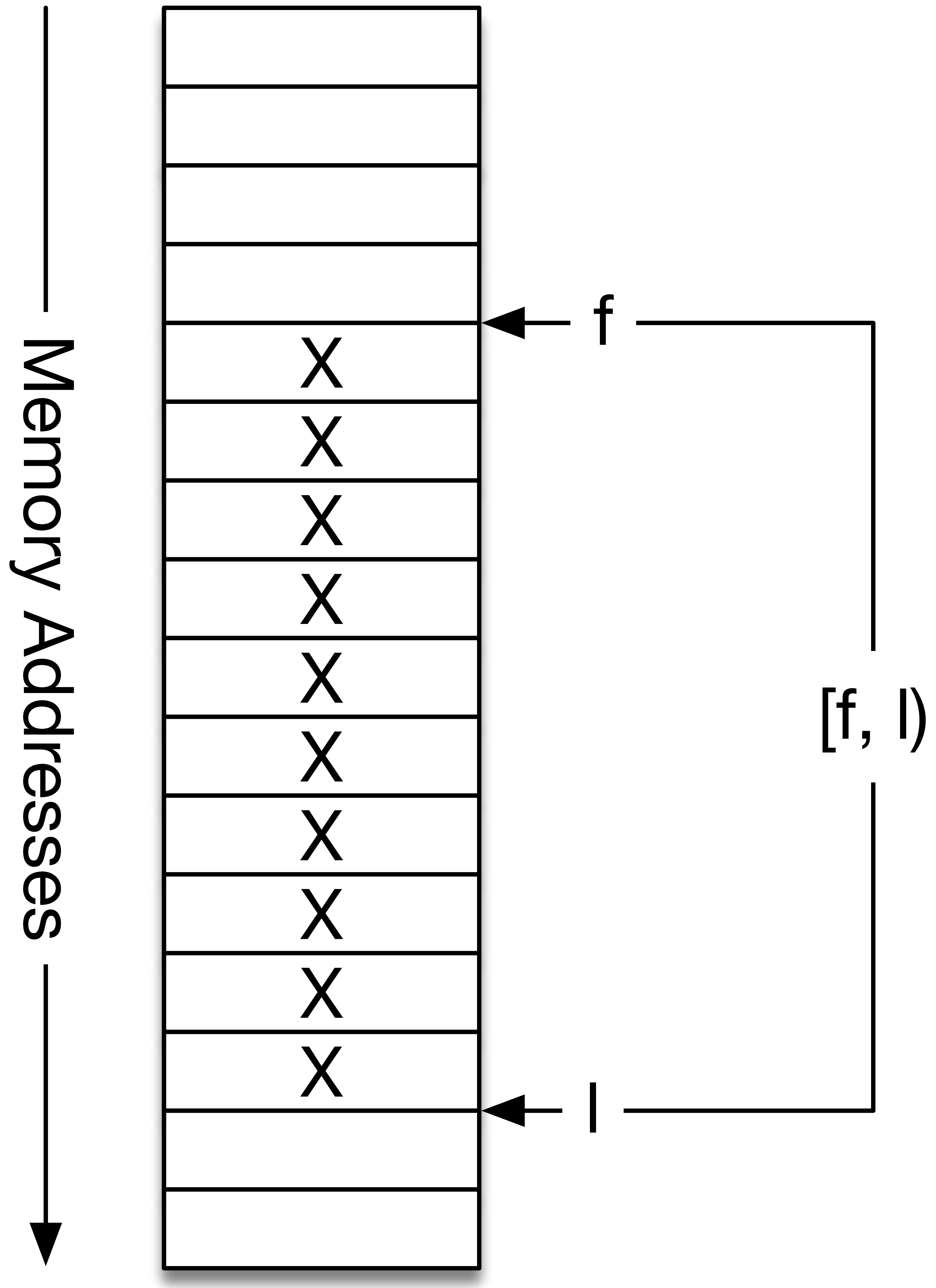
- i.e., `[INT_MIN, INT_MAX]` is not expressible as a half-open interval with type `int`

  Think of the positions as the lines between the elements

Half-Open Intervals



Half-Open Intervals



Half-Open Intervals

In this model, there is a symmetry with reverse ranges *(l, f]*

- The dereference operation is asymmetric. dereferencing at a position *p* is the value in *[p, p + 1)*

Half-open intervals avoid off-by-one errors and confusion about *before* or *after*

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Much More

Composing Algorithms

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Complexity and efficiency

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∅ Patents

Q & A

About the artist

Dan Zucco

London-based 3D art and motion director Dan Zucco creates repeating 2D patterns and brings them to life as 3D animated loops. Inspired by architecture, music, modern art, and generative design, he often starts in Adobe Illustrator and builds his animations using Adobe After Effects and Cinema 4D. Zucco's objective for this piece was to create a geometric design that felt like it could have an infinite number of arrangements.

Made with

Ai **Adobe Illustrator** Ae **Adobe After Effects**

Adobe

Artwork by **Dan Zucco**