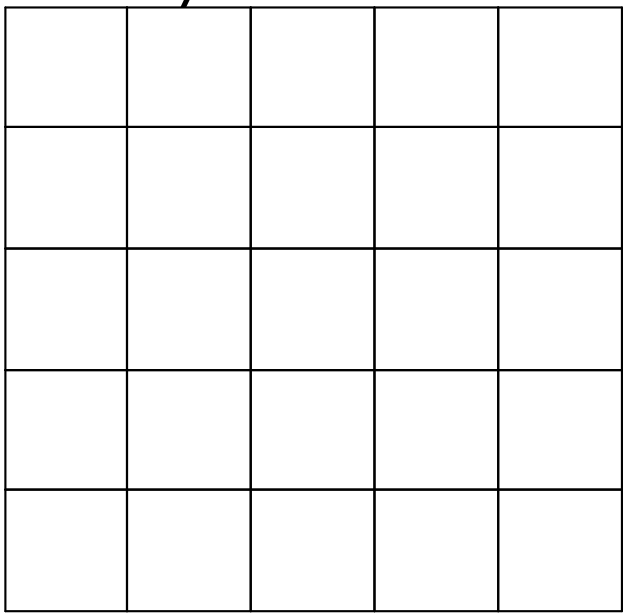
Louis XIV

AKA: State (Part II)

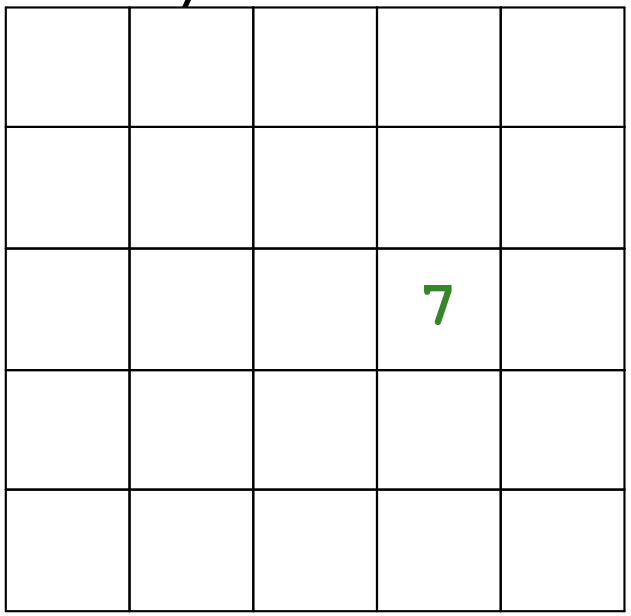
Boxes and Memory

```
{with {b {newbox 7}}     ⇒    ...
      ...}
```

Memory:



Memory:



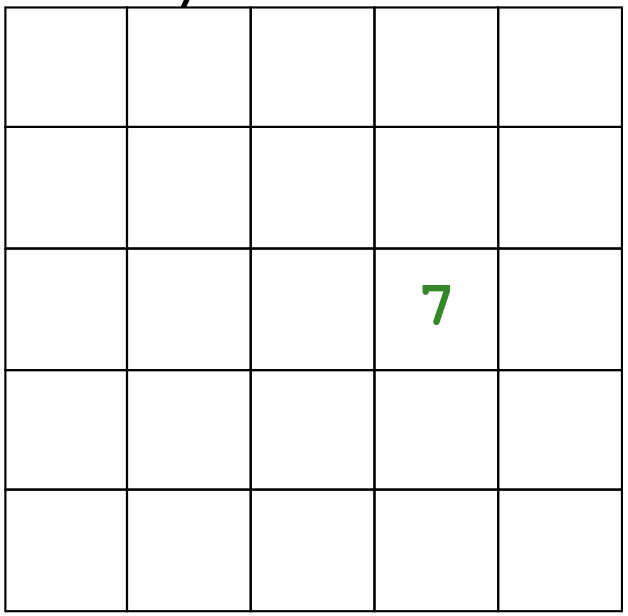
Boxes and Memory

```
... {setbox b 10}
...
```

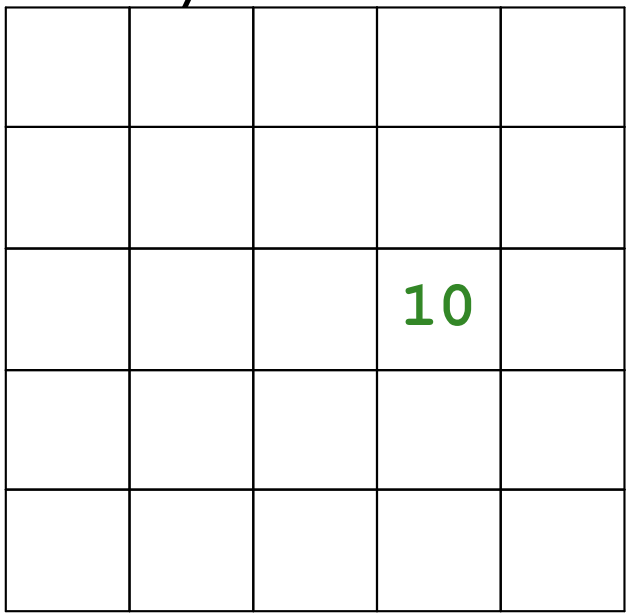
⇒

```
...
...
```

Memory:



Memory:

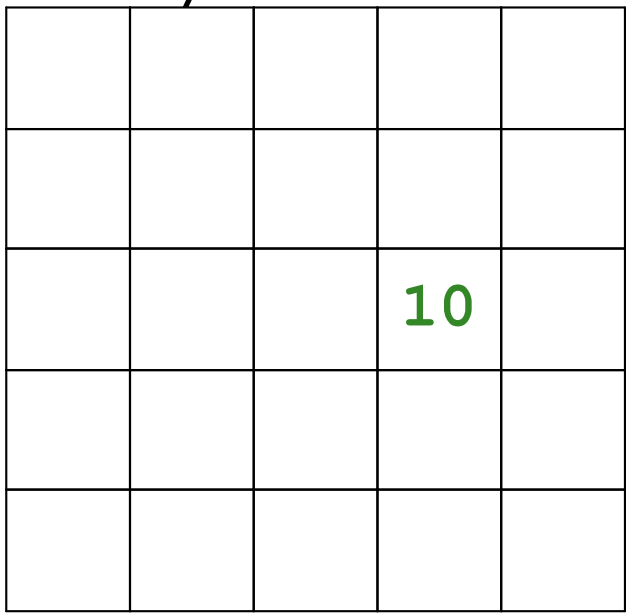


The Store

We represent memory with a ***store***:

```
(define-type Store
  [mtSto]
  [aSto (address integer?)
        (value BFAE-Value?)
        (rest Store?)])
```

Memory:




```
(aSto 13
      (numV 10)
      (mtSto))
```

Implementing Boxes without State

```
; interp : BFAE? DefSub? Store? -> Value*Store?

(define-type BFAE-Value
  [numV (n number?)]
  [closureV (param-name symbol?)
            (body BFAE?)
            (ds DefSub?)]
  [boxV (address integer?)])

(define-type Value*Store
  [v*s (value BFAE-Value?)
       (store Store?)])
```

Implementing Boxes without State

```
; interp : BFAE? DefSub? Store? -> Value*Store?
(define (interp a-bfae ds st)
  ...
  [newbox (val-expr)
          (type-case Value*Store (interp val-expr ds st)
            [v*s (val st)
                 (local [(define a (malloc st))]
                   (v*s (boxV a)
                        (aSto a val st)))])]
  ...)

; malloc : Store? -> integer?
```

Implementing Boxes without State

```
; malloc : Store? -> integer?
(define (malloc st)
  (+ 1 (max-address st)))

; max-address : Store? -> integer?
(define (max-address st)
  (type-case Store st
    [mtSto () 0]
    [aSto (n v st)
          (max n (max-address st))]))
```

Implementing Boxes without State

```
; interp : BFAE? DefSub? Store? -> Value*Store?
(define (interp a-bfae ds st)
  ...
  [openbox (box-expr)
           (type-case Value*Store (interp box-expr ds st)
             [v*s (box-val st)
                  (v*s (store-lookup (boxV-address box-val)
                                     st)
                       st)])]
  ...)
```

Implementing Boxes without State

```
; interp : BFAE? DefSub? Store? -> Value*Store?
(define (interp a-bfae ds st)
  ...
  [setbox (box-expr val-expr)
          ... (interp box-expr ds st) ...
          ... (interp val-expr ds st)
          ...]
  ...)
```

```
{with {b {newbox 10}}
      {setbox {seqn {setbox b 12} b}
              {openbox b}}}
```

should put `12` in `b`, not `10`

Implementing Boxes without State

```
; interp : BFAE? DefSub? Store? -> Value*Store?
(define (interp a-bfae ds st)
  ...
  [setbox (box-expr val-expr)
          (type-case Value*Store (interp box-expr ds st)
            [v*s (box-val st2)
                 (type-case Value*Store (interp val-expr ds st2)
                   [v*s (val st3)
                        (v*s val
                             (aSto (boxV-address box-val)
                                   val
                                   st3))])])]
  ...)
```

seqn, **add**, **sub**, and **app** will need the same sort of sequencing

Implementing Boxes without State

```
; interp-two : (BFAE? BFAE? DefSub? Store?
;                (Value? Value? Store? -> Value*Store?)
;                -> Value*Store?)
(define (interp-two a-bfae1 a-bfae2 ds st finish)
  (type-case Value*Store (interp a-bfae1 ds st)
    [v*s (val1 st2)
         (type-case Value*Store (interp a-bfae2 ds st2)
           [v*s (val2 st3)
                (finish val1 val2 st3)])]))
```

Implementing Boxes without State

```
; interp : BFAE? DefSub? Store? -> Value*Store?
(define (interp a-bfae ds st)
  ...
  [add (r l) (interp-two r l ds st
                         (lambda (v1 v2 st)
                           (v*s (num+ v1 v2) st)))]
  ...
  [seqn (a b) (interp-two a b ds st
                          (lambda (v1 v2 st)
                            (v*s v2 st)))]
  ...
  [setbox (box-expr val-expr)
          (interp-two box-expr val-expr ds st
                      (lambda (box-val val st3)
                        (v*s val
                             (aSto (boxV-address box-val)
                                   val
                                   st3)))))]
  ...)
```