Flat Techniques for Fun and Performance

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‘Nested’ Data

```
N←'Alice' 'Bob' 'Charlie' 'Ben'
```

‘Nested’ Data

```
      N←'Alice' 'Bob' 'Charlie' 'Ben'
      M←↑N
      M
Alice
Bob
Charlie
Ben
```

‘Nested’ Data

```
      N←'Alice' 'Bob' 'Charlie' 'Ben'
      M←↑N
      M
Alice
Bob
Charlie
Ben
      V←';Alice;Bob;Charlie;Ben'
```

How many begin with ‘B’?

```
      +/'B'=⊃¨N
2
      +/'B'=M[;1]
2
      +/'B'=(¯1⌽V=';')/V
2
```

Performance

```
M←10000000 7⍴M
V←(2500000×⍴V)⍴V
N←10000000⍴'Alice' 'Bob' 'Charlie' 'Ben’
```

Performance

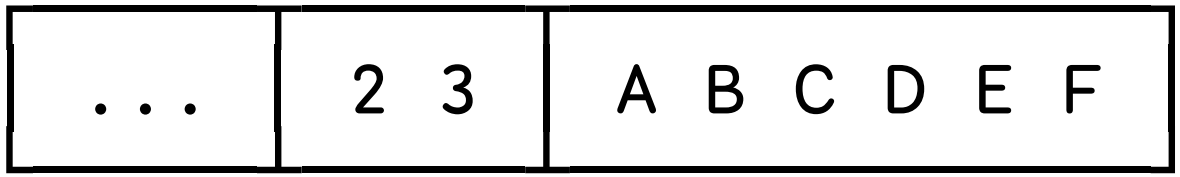
```
      M←10000000 7ρM
      V←(2500000×ρV)ρV
      N←10000000ρ'Alice' 'Bob' 'Charlie' 'Ben’

      ]Runtime -c "+/'B'=M[;1]" "+/'B'=(¯1⌽V=';')/V" "+/'B'=⊃¨N"

  +/'B'=M[;1]          → 4.1E¯3 |     0% □
  +/'B'=(¯1⌽V=';')/V → 1.2E¯2 |  +192% □□
  +/'B'=⊃¨N            → 2.8E¯1 | +6863% □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
```

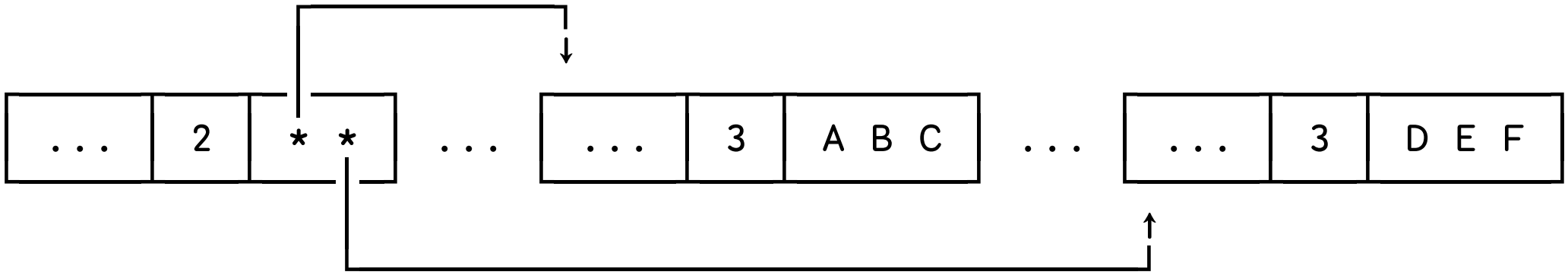
How arrays are stored

2 3⍴⍳6 looks like



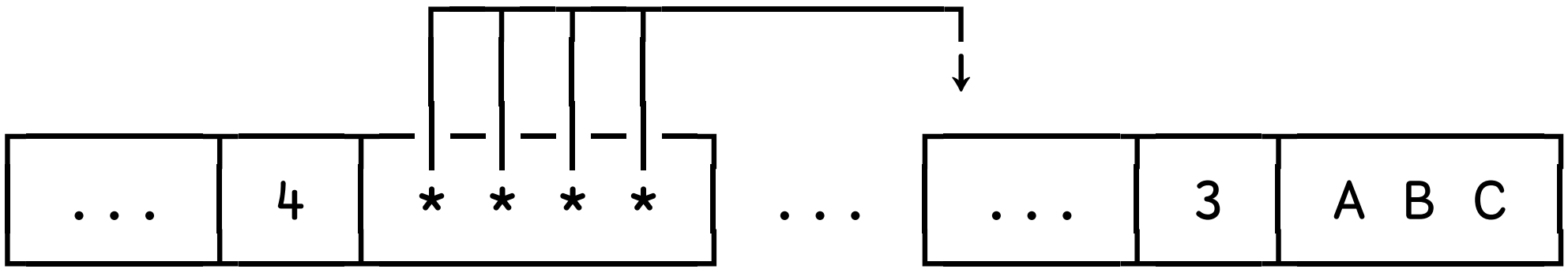
How arrays are stored

'ABC' 'DEF' looks like



Sharing data

`4⍴⊂'ABC'` looks like



Test data

```
      N←⍞C¨⊃⍞NGET'words.txt'1
      ⍴N
479823
      V←∊';',¨N
      100↑V
;1080;10-point;10th;11-point;12-point;16-point;18-
```

Finding ‘b’ words again

```
      m←V=';'
      20↑[2][V ◇ m ◇ ¯1⌽m]
; 1 0 8 0 ; 1 0 - p o i n t ; 1 0 t h ;
1 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 1
0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0
```

Finding ‘b’ words again

```
      m←V=';'
      20↑[2][V ◇ m ◇ ¯1⌽m]
; 1 0 8 0 ; 1 0 - p o i n t ; 1 0 t h ;
1 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 1
0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0

      50↑(¯1⌽m)/V
1111111122222233333344444555667788 99-aaaaaaaaaaaaaa
```

Finding ‘b’ words again

```
      +/'b'=(¯1⌽m)/V
25192
```

Finding ‘b’ words again

```
      +/'b'=(¯1⌽m)/V
25192
      +/'b'=⊃¨N
25192
```

Finding words that start with ‘con’

Finding words that start with ‘con’

```
      +/';con'⍷V
3440
```

Finding words that start with ‘con’

```
      +/';con'⊆V
3440
      +/{'con'≡3↑ω}¨N
3440
```

Finding words that start with ‘con’

```
      +/';con'⍷V
3440
      +/{'con'≡3↑⍵}¨N
3440
      ]Runtime -c "+/{'con'≡3↑⍵}¨N" "+/';con'⍷V"

  +/{'con'≡3↑⍵}¨N → 4.3E¯2 |   0% ⎕⎕⎕⎕⎕⎕⎕⎕⎕⎕⎕⎕⎕⎕⎕⎕⎕⎕⎕⎕⎕
  +/';con'⍷V       → 3.3E¯3 | -93% ⎕⎕⎕
```

How many words contain an ‘a’

```
test←';abc;xyz;banana'
```

How many words contain an ‘a’

```
      test←';abc;xyz;banana'
      [
            test
            test=';'
            +\test=';'
            test='a'
      ]
; a b c ; x y z ; b a n a n a
1 0 0 0 1 0 0 0 1 0 0 0 0 0 0
1 1 1 1 2 2 2 2 3 3 3 3 3 3 3
0 1 0 0 0 0 0 0 0 0 1 0 1 0 1
```

How many words contain an ‘a’

```
        (test='a')/+\test=';’
1  3  3  3
        ≠∪(test='a')/+\test=';’
2
```

Performance

```
      ≠∪(V='a')/+\V=';'
281193
      +/∨/¨N='a'
281193
```

Performance

```
      ≠∪(V='a')/+\V=';'
281193
      +/∨/¨N='a'
281193
      ]Runtime -c "+/∨/¨N='a'" "≠∪(V='a')/+\V=';'"

  +/∨/¨N='a'          → 5.2E¯2 |   0% ■■■■■■■■■■■■■■■■■■■■
  ≠∪(V='a')/+\V=';' → 4.6E¯3 | -91% ■■■■
```

More than one way to do it

```
      ≢∪(V=';')⍳Ö⍳V='a'
281193
      +/';a'∈V∩'a;'
281193
      +/1≠¯2-/(⍳,⎕IO+≢)';'=V∩'a;'
281193
      +/2</0,(1⍱V=';')/+\V='a'
281193
      (V=';'){+/(⍺/⍵)≥a/1⍱a←⍺/⍨⍵∨⍺}V='a'
281193
```

To check our answers

```
test←';the;quick;brown;fox'
Split←{1↓¨(⍵=';')⊂⍵}
Split test
```

the	quick	brown	fox

Selecting words that start with ‘con’

```
test←';banana;cons;conman;apple;convey'
```

Selecting words that start with ‘con’

```
      test←';banana;cons;conman;apple;convey'
      [
          test
          ';con'⊆test
          ids←+\test=';'
          ids∊(';con'⊆test)/ids
      ]
; b a n a n a ; c o n s ; c o n m a n ; a p p l e ; c o n v e y
0 0 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0
1 1 1 1 1 1 1 2 2 2 2 2 3 3 3 3 3 3 3 4 4 4 4 4 4 5 5 5 5 5 5
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 1 1 1 1 1 1
```

Selecting words that start with ‘con’

```
      test←';banana;cons;conman;apple;convey'
      [
          test
          ';con'⍷test
          ids←+\test=';'
          ids∊(';con'⍷test)/ids
      ]
; b a n a n a ; c o n s ; c o n m a n ; a p p l e ; c o n v e y
0 0 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0
1 1 1 1 1 1 1 2 2 2 2 2 3 3 3 3 3 3 3 4 4 4 4 4 4 5 5 5 5 5 5 5
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 1 1 1 1 1 1 1
      m←ids∊(';con'⍷test)/ids
      m/test
;cons;conman;convey
```

Is it correct?

```
      answer←V/⍨ids∊(';con'⍷V)/ids←+\V=';'
      (Split answer)≡{'con'≡3↑ω}¨⍛/N
1
```

Is it faster?

```
      answer←V/⍨ids∊(';con'⍷V)/ids←+\V=';'
      (Split answer)≡{'con'≡3↑⍵}¨⍛/N
1
      ]Runtime -c …
  {'con'≡3↑⍵}¨⍛/N                → 3.8E¯2 |   0% □□□□□□□□□□□□□□□
* V/⍨ids∊(';con'⍷V)/ids←+\V=';' → 1.1E¯2 | -73% □□□□□□□□□□□
```

Reversing the list

```
test←';first;second;third'
```

Reversing the list

```
      test←';first;second;third'

      ids←+\test=';'
      test[⍒ids]
;third;second;first
```

Reversing the list

```
      test←';first;second;third'

      ids←+\test=';'
      test[⍒ids]
;third;second;first

      [test ◇ ids ◇ ⍒ids ◇ test[⍒ids]]
 ;  f  i  r  s  t ; s  e  c  o  n  d ; t  h  i  r  d
 1  1  1  1  1  1 2 2  2  2  2  2  2 3  3  3  3  3  3
14 15 16 17 18 19 7 8  9 10 11 12 13 1  2  3  4  5  6
 ;  t  h  i  r  d ; s  e  c  o  n  d ; f  i  r  s  t
```

Reversing *each* word

```
      ϕtest[∀ids]
tsrif;dnoces;driht;
```

Reversing *each* word

```
      ϕtest[⍒ids]
tsrif;dnoces;driht;
      ¯1ϕϕtest[⍒ids]
;tsrif;dnoces;driht
```

```
ϕ¨‘first’ ‘second’ ‘third’
```

Reversing *each* word

```
      ϕtest[⍒ids]
tsrif;dnoces;driht;
      ¯1ϕϕtest[⍒ids]
;tsrif;dnoces;driht
      test[¯1ϕϕ⍒ids]
;tsrif;dnoces;driht
```

```
ϕ¨‘first’ ‘second’ ‘third’
```

Is it correct?

```
        (ϕN)≡Split V[∀+\V=';']
1
        (ϕ¨N)≡Split V[¯1ϕϕ∀+\V=';']
1
```

Is it fast?

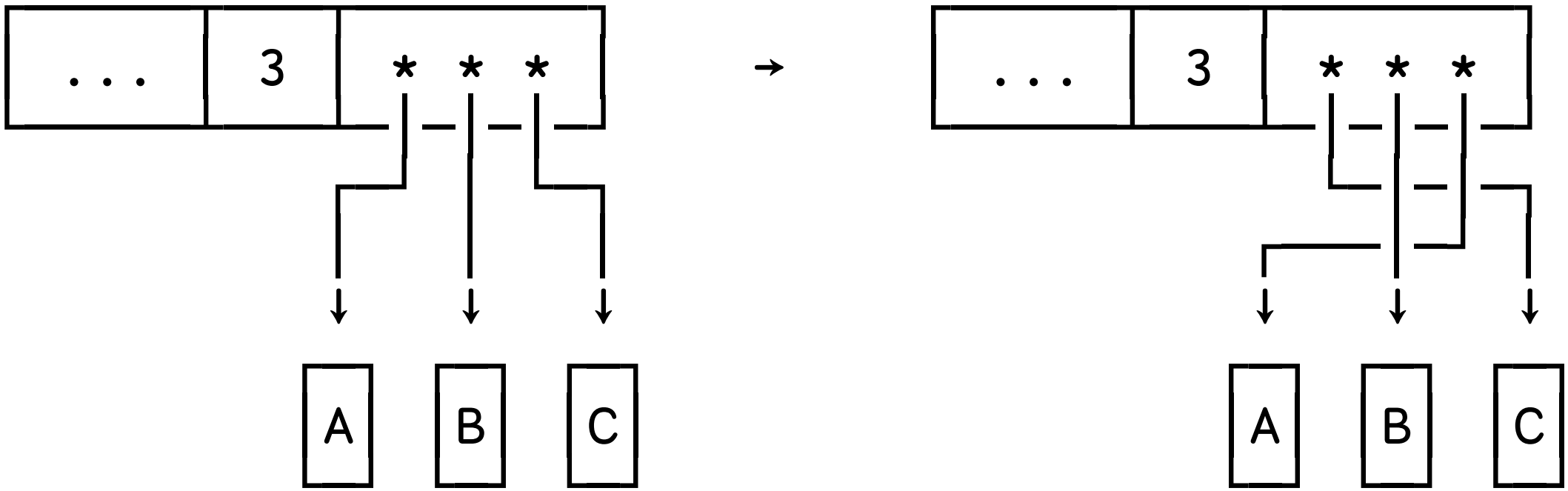
```
      ]Runtime -c "ΦN" "V[∀+\V=';']"

  ΦN              → 2.9E¯3 |     0% □□□□□□□□
* V[∀+\V=';'] → 1.5E¯2 | +419% □□□□□□□□□□□□□□□□□□□□□□□□□□□□

      ]Runtime -c "Φ¨N" "V[¯1ΦΦ∀+\V=';']"

  Φ¨N                → 1.7E¯2 |   0% □□□□□□□□□□□□□□□□□□□□□□□□□□□□
* V[¯1ΦΦ∀+\V=';'] → 1.8E¯2 |   0% □□□□□□□□□□□□□□□□□□□□□□□□□□□□
```

Nested Reversal



Flat Techniques for Fun and Performance ✅ ✅ (mostly)