Boxes: Structs and Arrays

EECS 214, Fall 2018

What are data structures made of?

What are data structures made of?

Bits!

What are data structures made of?

Bits!

`01000010011010010111010001110011`

Structure gives them meaning

Bytes

```
01000010011010010111010001110011
```

Bytes

```
01000010 01101001 01110100 01110011
```

Bytes

```
25 50 44 46 2d 31 2e 35 0a 25 d0 d4 c5 d8 0a 31  %PDF-1.5.%.....1
34 20 30 20 6f 62 6a 0a 3c 3c 2f 4c 65 6e 67 74  4&0&obj.<</Lengt
68 20 32 38 38 20 20 20 20 20 20 20 2f 46 69 6c  h&288       /Fil
74 65 72 2f 46 6c 61 74 65 44 65 63 6f 64 65 3e  ter/FlateDecode>
a0 4c 20 32 54 0c 96 e3 f7 9e ad e7 d3 5d 30 88  .L&2T........]0.
65 34 c0 10 0b 4b f2 9c 48 54 e0 7c f2 cf 65 ea  e4...K..HT.|..e.
e9 be c1 55 bb cc 98 d4 21 cb 51 d9 73 31 e4 a1  ...U....!.Q.s1..
```

The big grid

	+0	+1	+2	+3	+4	+5	+6	+7
0								
8								
16								
24								
32								
40								
48								
56								
64								
72								
80								

The big grid

	+0	+1	+2	+3	+4	+5	+6	+7
0	72	101	108	108	111	0		
8								
16								
24								
32								
40								
48								
56								
64								
72								
80								

The big grid

	+0	+1	+2	+3	+4	+5	+6	+7
0	72	101	108	108	111	0		
8								
16	9 387 002							
24								
32								
40								
48								
56								
64								
72								
80								

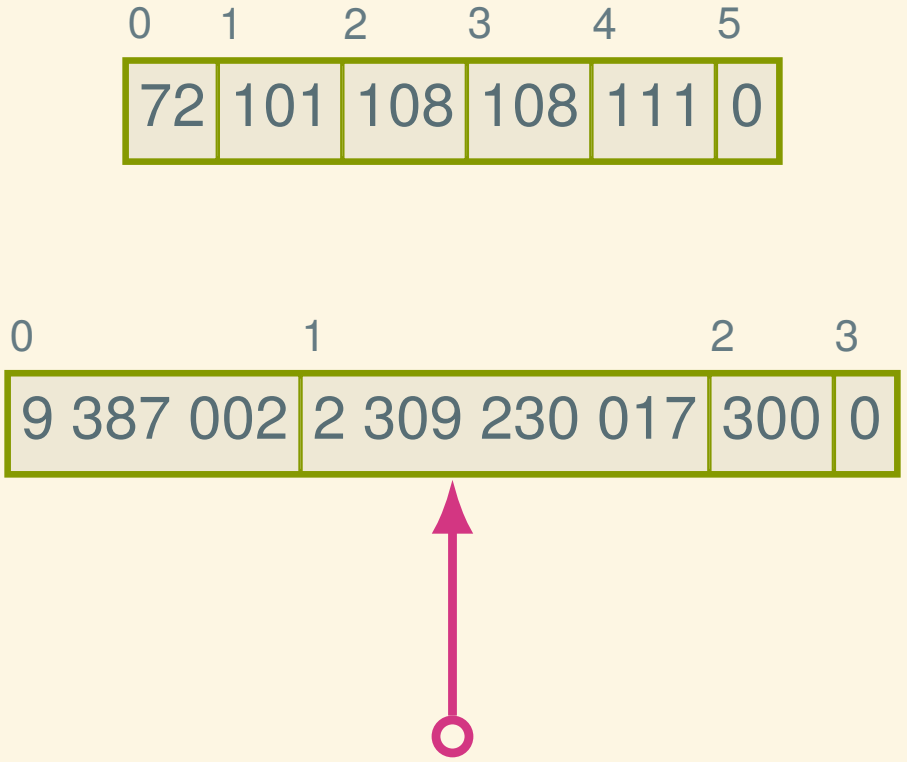
The big grid

	+0	+1	+2	+3	+4	+5	+6	+7
0	72	101	108	108	111	0		
8								
16	9 387 002				2 309 230 017			
24	300				0			
32								
40								
48								
56								
64								
72								
80								

The big grid

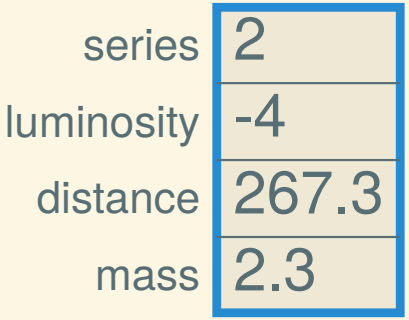
	+0	+1	+2	+3	+4	+5	+6	+7
0	72	101	108	108	111	0		
8								
16	9 387 002				2 309 230 017			
24	300				0			
32								
40	16							
48								
56								
64								
72								
80								

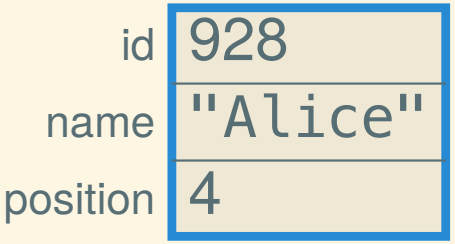
Boxes and arrows



Structs

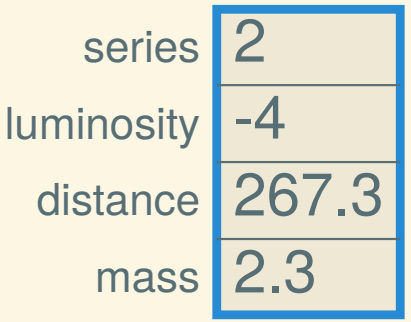

x
3
y
5

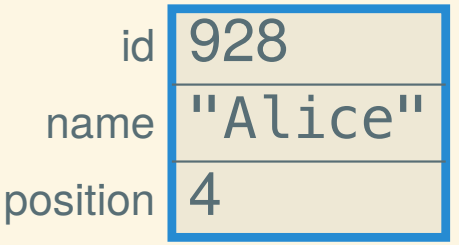

series
2
luminosity
-4
distance
267.3
mass
2.3

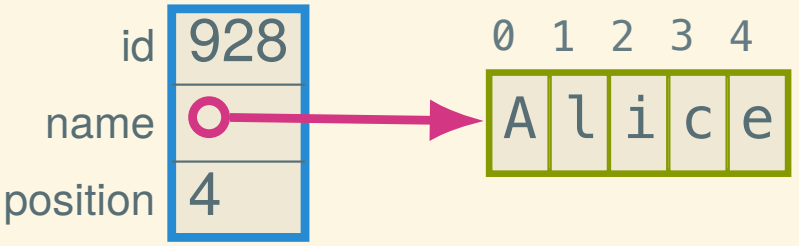

id
928
name
"Alice"
position
4

Structs

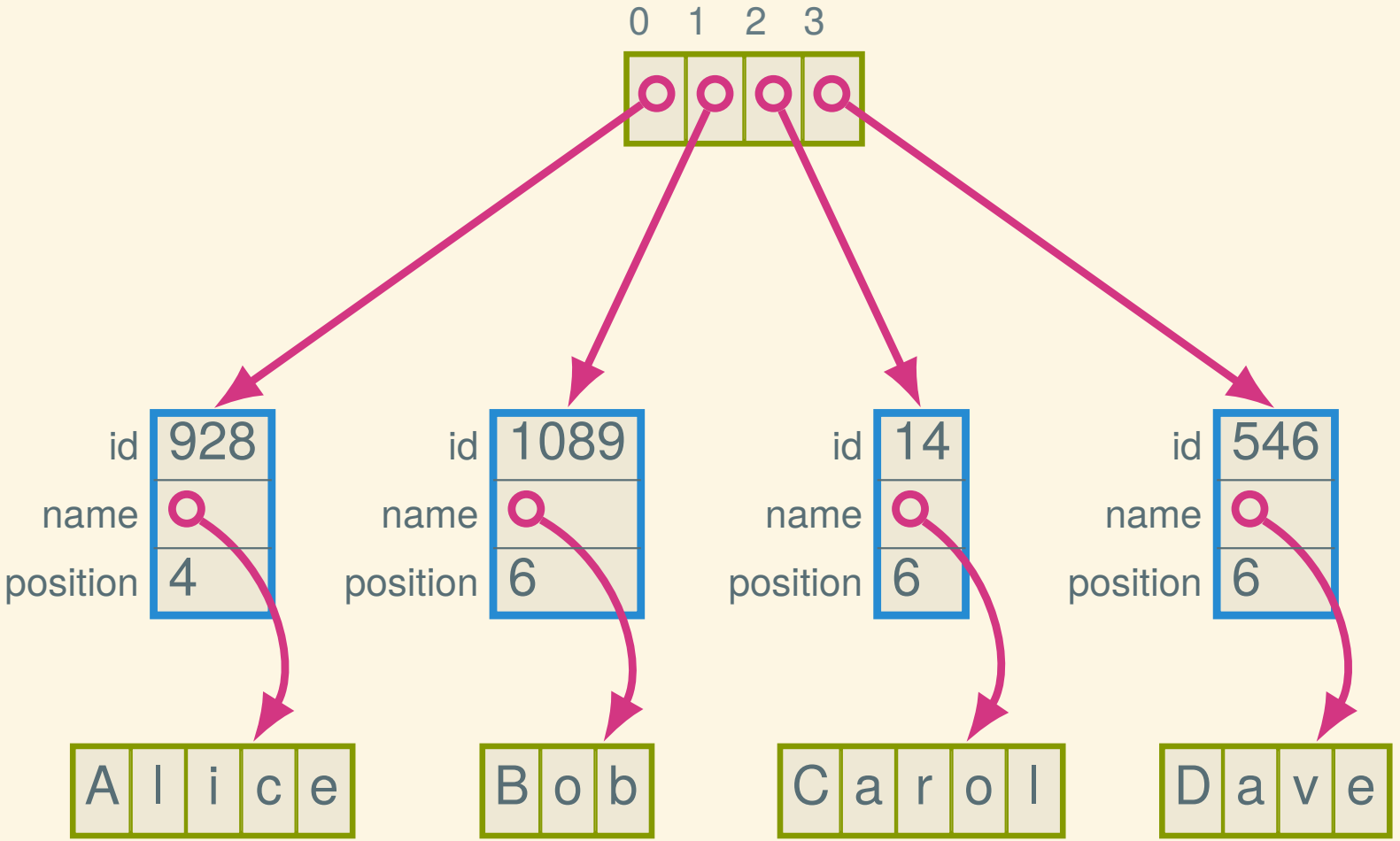

x
3
y
5


series
2
luminosity
-4
distance
267.3
mass
2.3


id
928
name
"Alice"
position
4

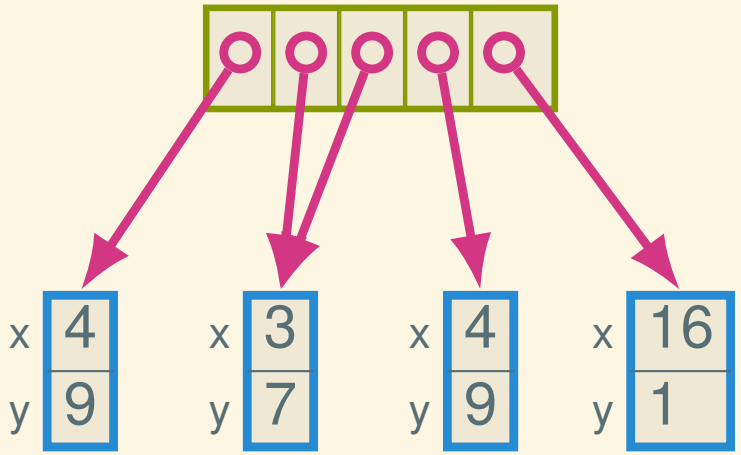

id
928
name
position
4
0 1 2 3 4
A l i c e

Structs and arrays



Box identity

Boxes have *identity* and can be *aliased*:



Very important fact about efficiency

The time that it takes to index an array (or struct) does not depend on the size of the array (or struct), nor on the index.

Very important fact about efficiency

The time that it takes to index an array (or struct) does not depend on the size of the array (or struct), nor on the index.

That is, these three things should all take the same amount of time:

- getting the first/last element of a 1-element array,
- getting the first element of a 100,000,000-element array, and
- getting the last element of a 100,000,000-element array.

Very important fact about efficiency

The time that it takes to index an array (or struct) does not depend on the size of the array (or struct), nor on the index.

That is, these three things should all take the same amount of time:

- getting the first/last element of a 1-element array,
- getting the first element of a 100,000,000-element array, and
- getting the last element of a 100,000,000-element array.

(for any value of 100,000,000)

How to choose between a struct and an array

- Have a fixed number of fields that you can name?

  Use a struct

- How many elements you'll have depends on the size of the data?

  Use an array

Next time: structs, arrays, and classes in DSSL2