

CS1101S T03D

SESSION 4

Data Abstraction

Why data abstraction?

Data Structures

pair, list, tuples, etc...

Data Abstraction

Why data abstraction?

Combines data objects into Compound Data.
Ensures proper manipulations beyond primitive operations.

Pair (Formerly)

$(x, y) \Rightarrow f \Rightarrow f(x, y)$

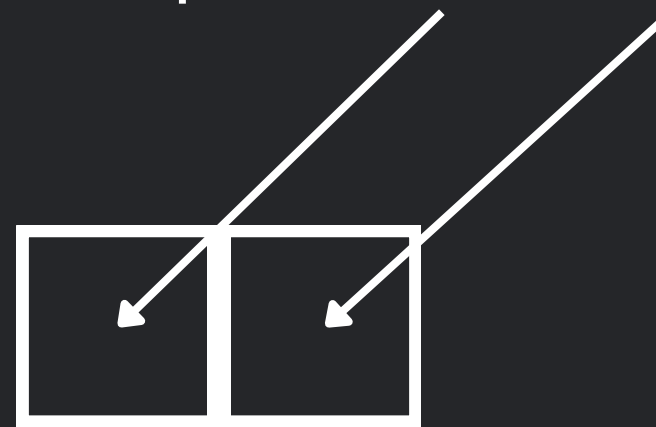
Head: $p \Rightarrow p((x, y) \Rightarrow x)$

Tail: $p \Rightarrow p((x, y) \Rightarrow y)$



Pair

A box with 2 space: head & tail



Rational Number

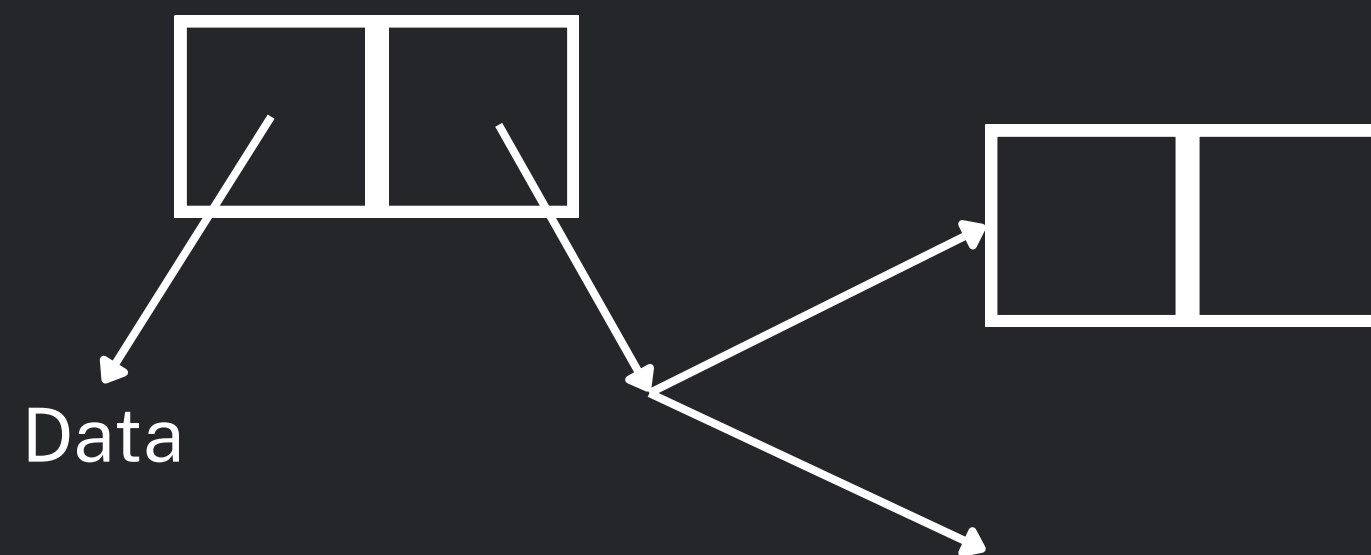
n/d represented as `pair(n, d)`

Rational Number Operations?

`add_rat(x, y)`, `multiply(x, y)`, `equal_rat(x, y)`...

List

null or a pair where:
head - contains the value
tail - contains next list or null



Studio Sheets

Studio Sheet: Practise understanding pairs / lists

In-Class Studio Sheet: Programming with pairs / lists

Studio Sheet

Art class in SoC

In-Class Studio

studio-S5-in-class.pdf

Midterm 2425

Qn 1

(1) [4 marks] (MCQ)

What is the result of evaluating the following Source program in **box notation**?

```
const lst = list(list(1), 2);  
pair( is_list(head(lst)) ? tail(lst) : null,  
      is_pair(tail(lst)) ? head(lst) : 2 );
```

A.	[null, 2]
B.	[2, 1]
C.	[2, [1, null]]
D.	[[2, null], 2]
E.	[[2, null], 1]
F.	[[2, null], [1, null]]
G.	[[1, null], [2, null]]
H.	The program leads to an error.

Midterm 2425

Qn 4

(4) [5 marks]

Draw the **box-and-pointer diagram** for the value of `x` after the evaluation of the following program. Clearly show where `x` is pointing to.

```
function rev(xs) {  
  return is_null(xs)  
    ? null  
    : pair(rev(tail(xs)), list(head(xs)));  
}  
const x = rev(list(1, 2, 3));
```

Midterm 2425

Qn 2

(2) [4 marks] (MCQ)

What is the result of evaluating the following Source program in **list notation**?

```
function skipper(xs) {  
    return is_null(xs) || is_null(tail(xs))  
        ? xs  
        : pair(skipper(tail(xs)), skipper(tail(tail(xs))));  
}  
skipper(list(1, 2, 3, 4));
```

A.	list(list(4))
B.	list(list(list(list(4)), 4), list(4))
C.	list(list(list(null)), 4)
D.	list(list(list(4)), 4)
E.	list(list(list(null)), null)
F.	list(list(list(list(4),4), list(4),4), list(list(4),4), list(4),4)
G.	list(4)
H.	The program leads to an error.