COMP0020: Functional Programming

Assignment Project Exam Help

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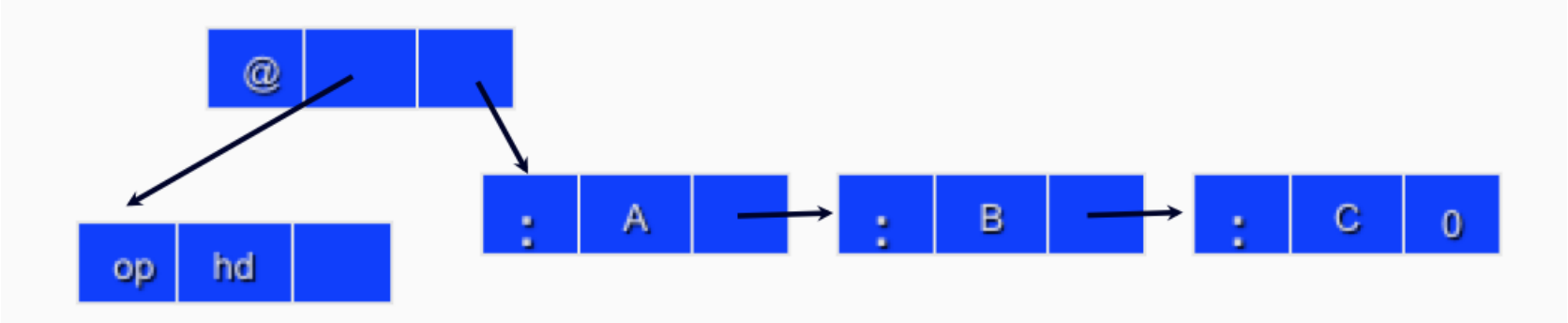
How lists are represented in memory

We cover basic mechanisms : in practice, functional language implementations (such as Miranda) may use different representations in different contexts (e.g. whether the list is a data value embedded in the program and known at compile-time, or whether it is consructed dynamically at run-time).

A very simple strategy is to manage physical memory locations in groups of three (called "cells") :

- A "tag" (indicating the kind of cell) follo
- Can be anywhere in memory


```
x = ('A' : ('B' : ('C' : [])))
main = hd x
```



Representing TREES in memory

$$
\begin{array}{lll}
exp & ::= & Const\ num \\
 & & \mid App\ exp\ op\ exp \\
 & & \mid Bracketed\ exp \\
 & & \\
op & ::= & Plus \mid Minus \mid Tim
\end{array}
$$

$x :: exp$

$x = App\ (Const\ 6)\ Plus\ (Const\ 4)$

$main = eval\ x$

Multiway branching trees

multitree * : := Empty | Node * [multitree *]
x : : multitree [char]
x = Node “hi" [(Node “mum" []), (Node “x" []), Empty, (Node “bye" [])]

Multiway branching trees

multitree * : := Empty | Node * [multitree *]
x : : multitree [char]
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```
rightmost :: mult
rightmost Empty      = error "empty tree"
rightmost (Node x [])= x
rightmost (Node x ns)= righ                ), if (ns1 ~= [])
                     = x, otherwise
                       where
                       ns1 = filter (~= Empty) ns
```

Graphs : simple source code

```
multitree *  ::=  Empty       |  Node   * [multitree *]        ||  (as before)
a  =        Node 'A'    [c, b ]
b  =        Node 'B'    [d]
c  =        Node 'C'
d  =        Node 'D'
graph ::    multitree char
graph =     a
firstlink   ::  multitree *       -> multitree *
firstlink   Empty                 =  error "firstlink of empty graph"
firstlink   (Node x [])           =  error "firstlink of node with no first link"
firstlink   (Node x (n : ns))     =  n
```

Graphs : source code using a list

```
multitree *  ::=  Empty     |  Node  *  [multitree *]        ||  (as before)
glist  ::   [multitree char]
glist  =    [ Node 'A' [ (glist !! 2), (glist !! 1) ],
              Node 'B'
              Node 'C'
              Node 'D'    []   ]
graph ::    multitree char
graph =     hd glist
firstlink    ::  multitree *     -> multitree *
firstlink    Empty              =  error "firstlink of empty graph"
firstlink    (Node x [])        =  error "firstlink of node with no first link"
firstlink    (Node x (n : ns))  =  n
```

Graphs : representation

Graphs : representation after evaluating (firstlink graph)

Graphs : representation after evaluating all links

Summary

- Representation in memory : LISTS
- Trees
  - Representation in memory
  - Multiway branching trees
- Graphs
  - Source code
  - Representation in memory