CSE 374 Lecture 14

More Data Structures

Structs Reminder

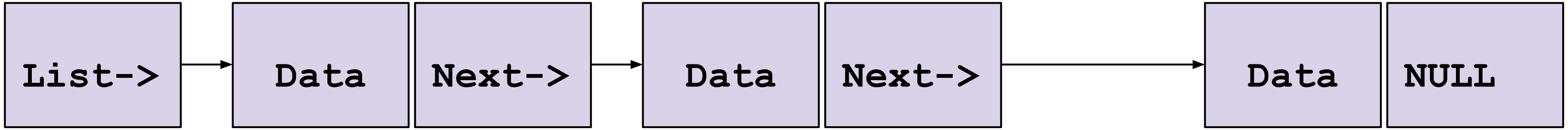
Has type struct person_info

‘Person_info’ is a struct tag, not a type

Can use typedef to rename

```
typdef struct person_info {
   char * name;
   int age;
} person_info;
```

Linked Lists



Points to
the List

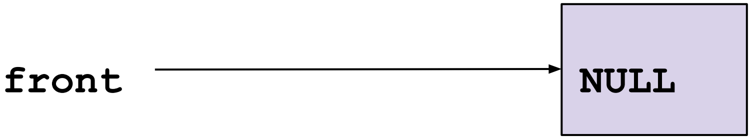
Last node doesn’t
point to next

```
// A single list node that stores an
integer as data.

typdef struct IntListNode {
  int data;
  struct IntListNode* next;
} IntListNode;
```

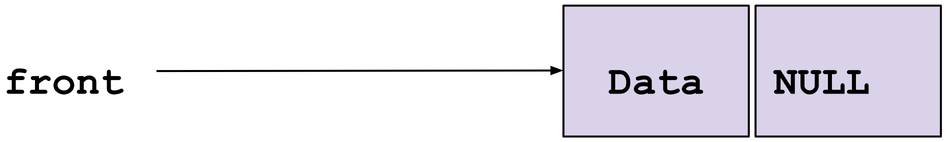
```
IntListNode* makeNode(int data, IntListNode* next) {
  IntListNode* n = (IntListNode*) malloc(sizeof(IntListNode));
  if (n) {  // malloc might return null
    n->data = data;
    n->next = next;
  }
  return n;
}
```

Linked Lists



```
IntListNode* fromArray(int* array, int length) {
  IntListNode* front = NULL;
  for (int i = length - 1; i >= 0; i--) {
    front = makeNode(array[i], front);  }
  return front;
}
```

Linked Lists



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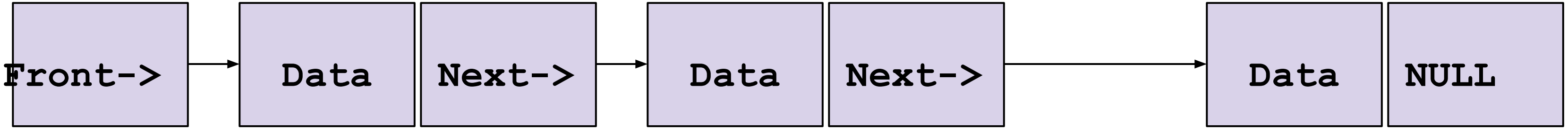

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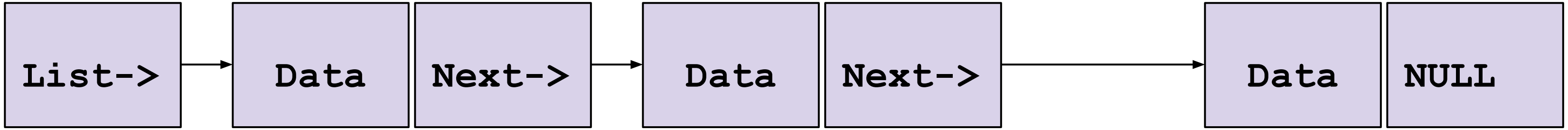
Linked Lists



List-> Data Next-> Data Next-> Data NULL

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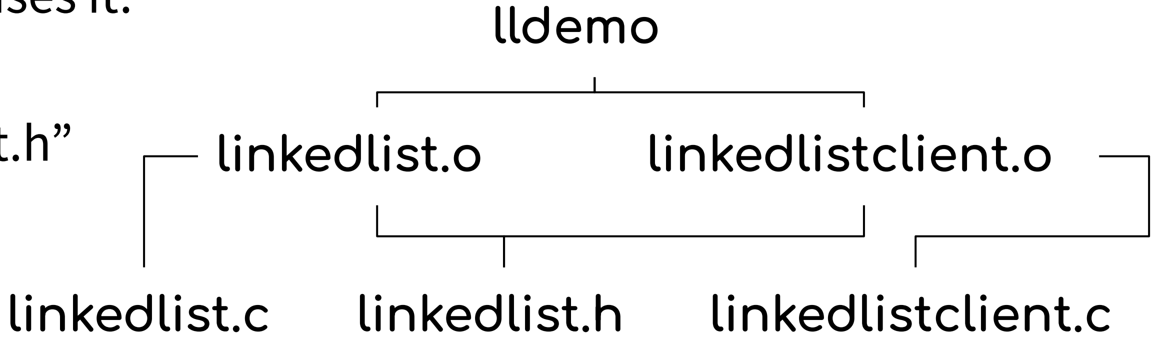
Linked List Continued

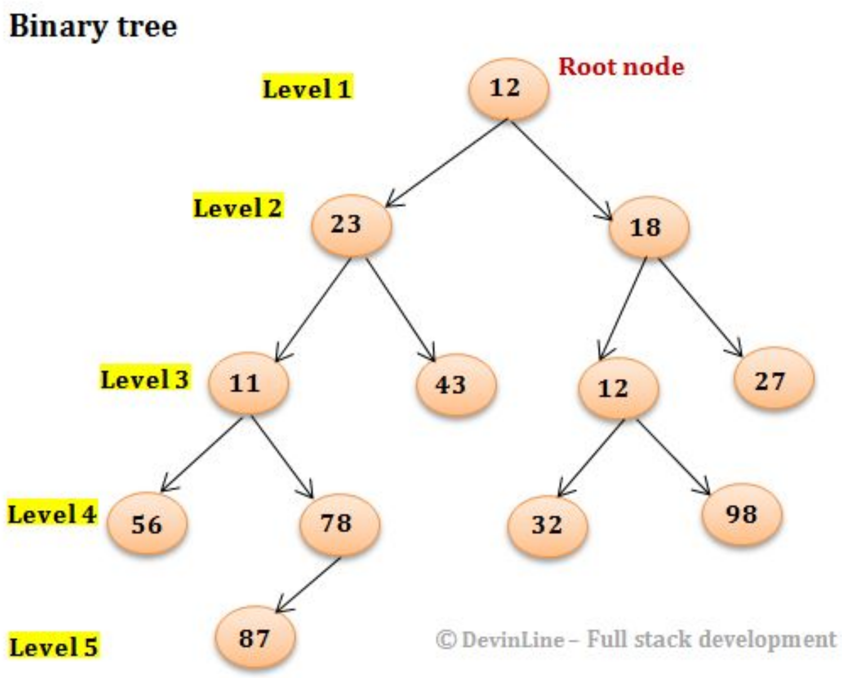
- One set of code to define linked list:
  - Linkedlist.h
  - Linkedlist.c
- Another piece of code uses it:
  - Linkedlistclient.c
  - #include “linkedlist.h”

Compile with

```
$gcc -o lldemo linkedlist.c
    linkedlistclient.c
```



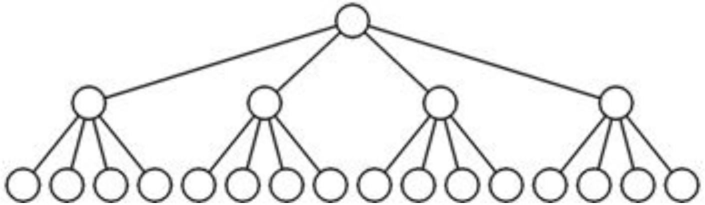
Binary Trees



```
struct BinaryTreeNode {
  int data;
  struct BinaryTreeNode* left;
  struct BinaryTreeNode* right;
}

struct BinaryTree {
  Struct BinaryTreeNode* root;
}
```

N-ary Trees



```
struct TrinaryTreeNode {
  char* data;
  struct TrinaryTreeNode* left;
  struct TrinaryTreeNode* middle;
  struct TrinaryTreeNode* right;
}
```

```
struct QuadTreeNode {
  char* data;
  struct QuadTreeNode* children[4];
}
```

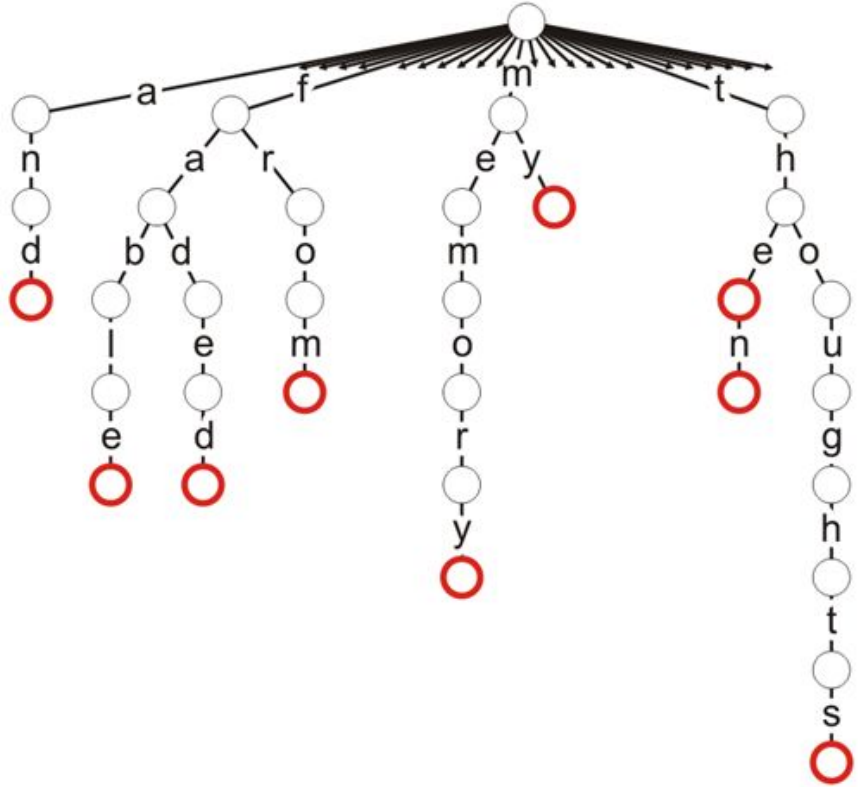
Binary trees just one form; can have any “branching number”.

Trinary trees have branching number of three.

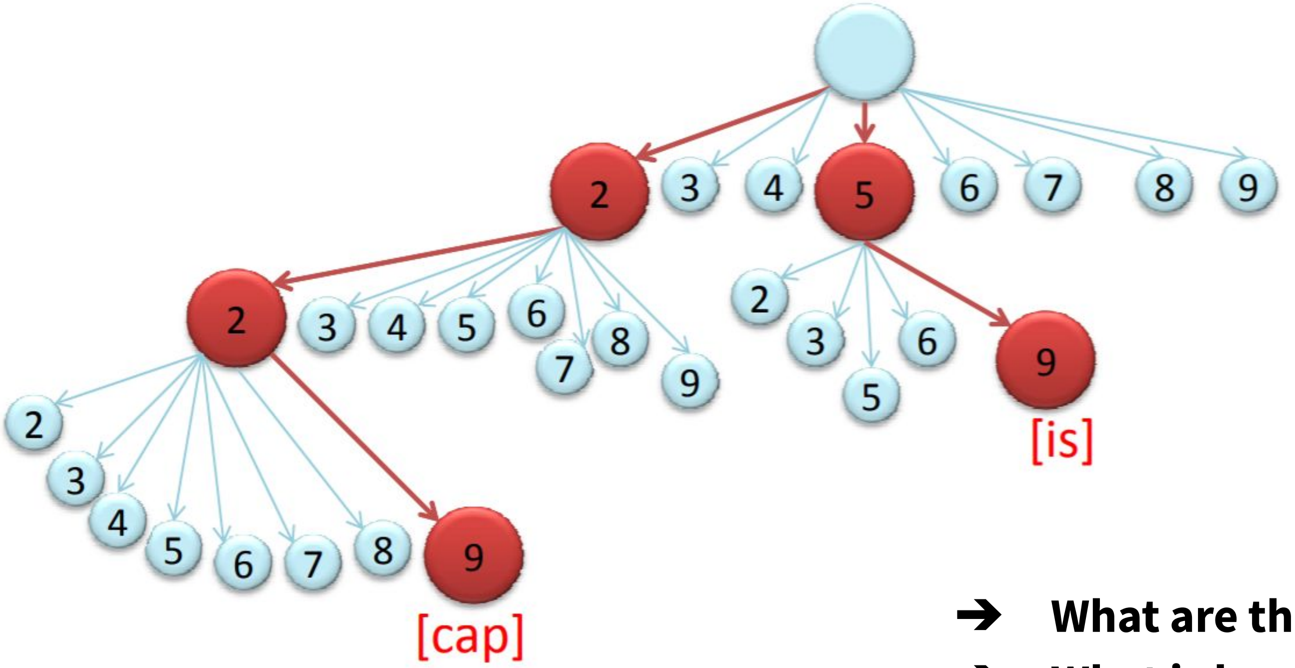
For arbitrarily large branching numbers, arrays can make more sense than lists of named pointers.

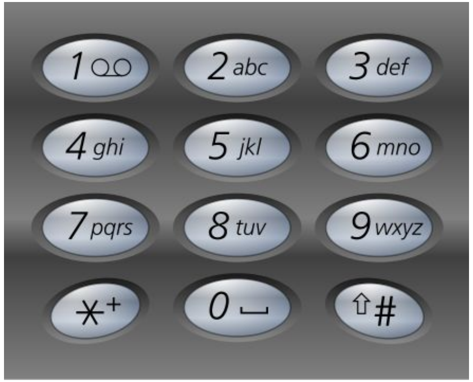
Prefix tree (Trie)

- Compact storage
  - Or generative automaton
- Key of each node defined entirely by position
- Compact data storage
- Efficient worst-case searching
- Strings often use 26-ary tree
  - Predictive text
  - Spell check



T9 Trie





- ➔ **What are the branches labeled?**
- ➔ **What is branching factor?**
- ➔ **What data is stored in each node?**