

CSE 374 Lecture 14

More Data Structures



Administrative Notes

Exam Friday
Pencil and paper
No notes

Exam review Thursday
4:30- 6pm, SIG 134
Bring Questions

HW 4 due tonight

HW 5 has been posted, due 5/13

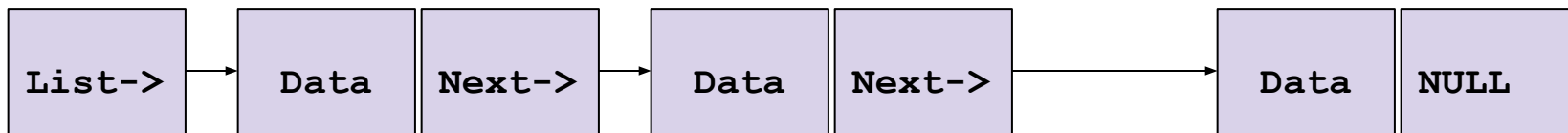
HW 6 is a team project, please
consider who you would like as a
partner

Malloc

- malloc is used in a specific way: `(T*) malloc (e * sizeof (T))`
 - User doesn't need to know `sizeof (T)` - use `sizeof` instead of '16'.
- Returns a pointer to memory large enough to hold an array of length `e` with elements of type `T`
- malloc returns an untyped pointer `(void*)`; the cast `(T*)` tells C to treat it as a pointer to a block of type `T`

While there is some discussion of the topic, CSE 374 staff and surveyed industry professionals all use the explicit cast for malloc. For this course you, too, should explicitly cast to the correct type.

Linked Lists



Points to
the List

Last node doesn't
point to next

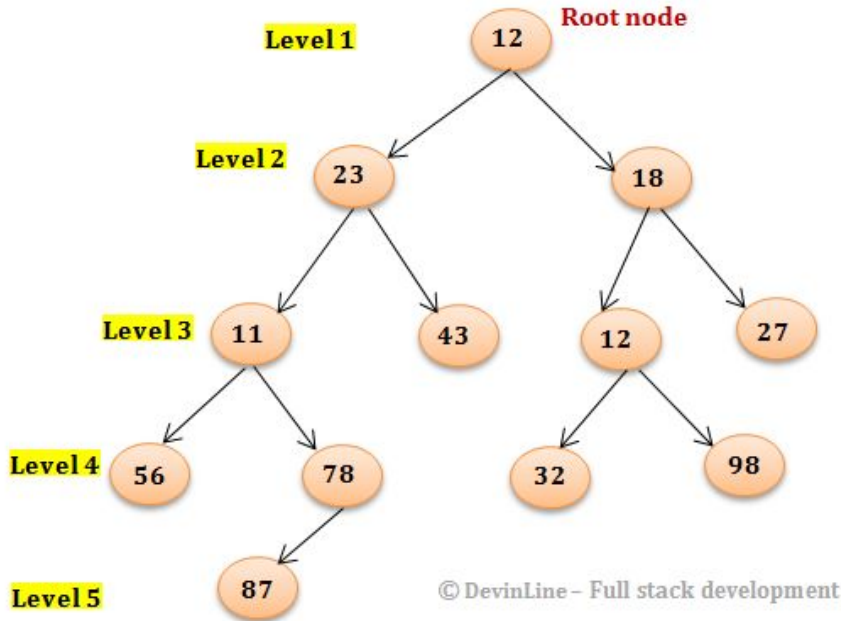
// A single list node that stores an integer as data.

```
typedef 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;  
}
```

Binary Trees

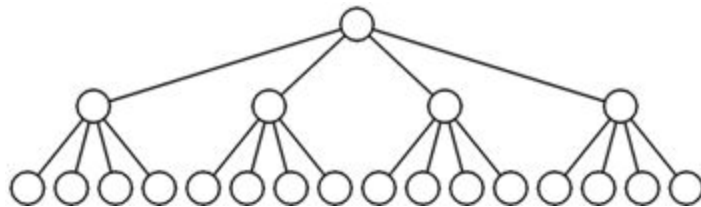
Binary tree



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

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

N-ary Trees



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

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

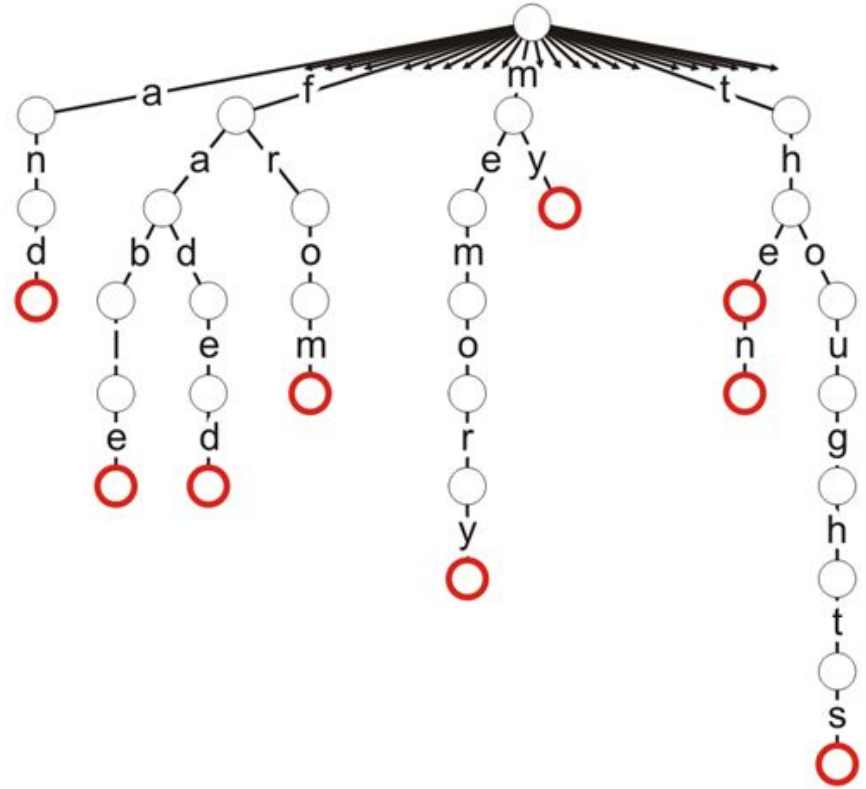
Binary trees just one form; can have any “branching number”.

Trinary trees have branching number of three.

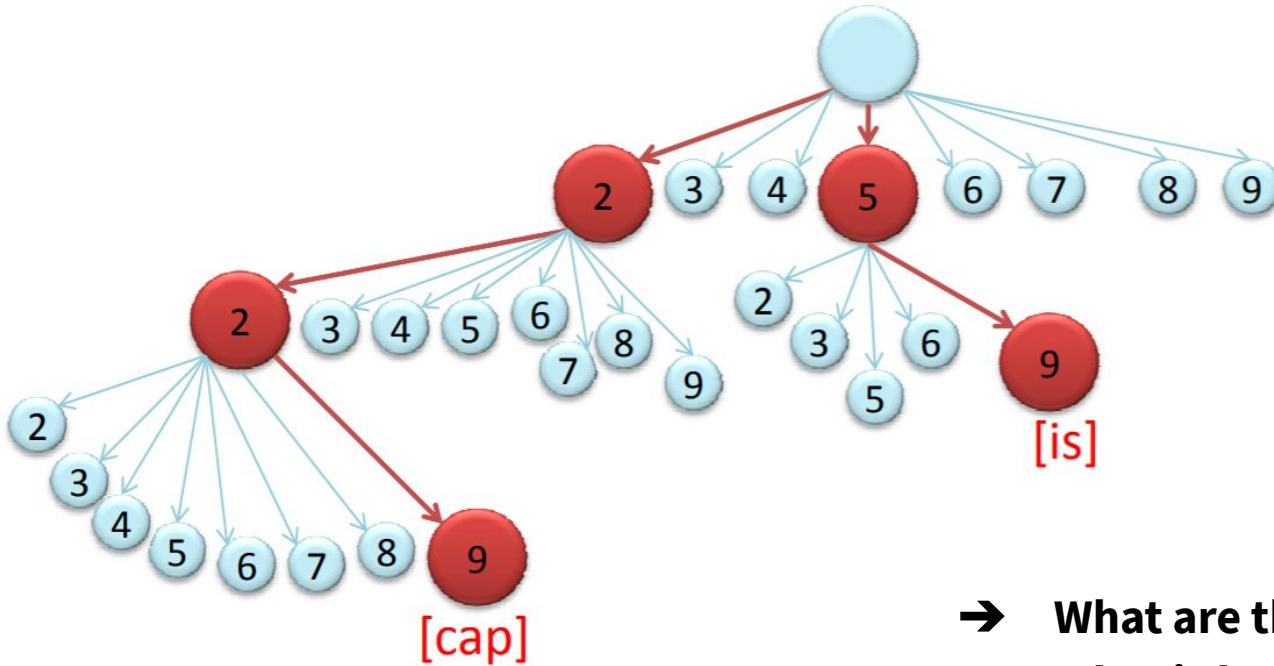
For arbitrarily large branching numbers, arrays can make more sense than lists of named pointers.

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?