CS261 Data Structures

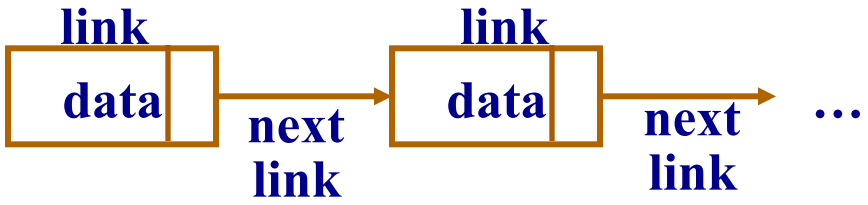
Linked Lists - Introduction

Dynamic Arrays Revisited

- Dynamic array can sometimes be slow
  - When?
  - Why?

Linked Lists - Characteristics

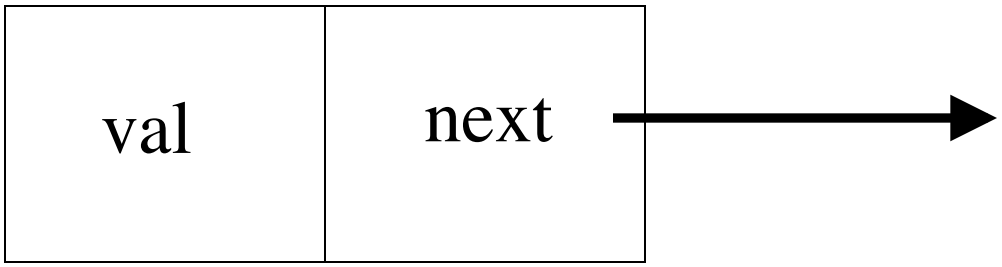
- Data elements held in structures called "links"
- Like a chain: each link is tied to the next



- Links are 1 – 1 with elements, allocated and released as necessary
- Each link points to next link in sequence, sometimes to previous link
- Not contiguously stored!!!

Typical Link Structure (Singly Linked)

```
struct Link {      /* Single link. */
    TYPE    val;   /* Data contained by this link. */
    struct Link *next;  /* Pointer to next link. */
};
```



Linked List Variations

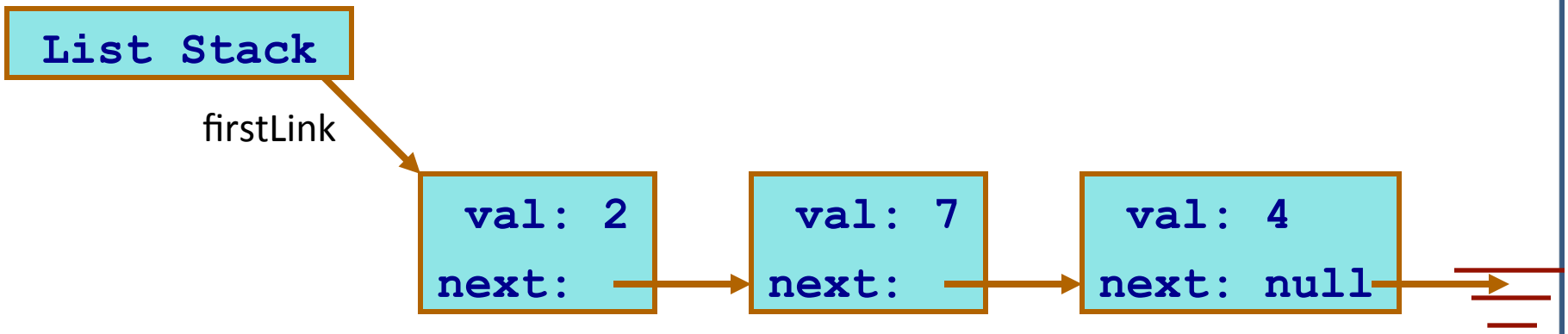
All linked lists consists of links … but there are other design decisions:

- Header (special value to point to start) or no header?
- Use null as terminator, or special value (sentinel) for end?
- Use single or double links?
- Pointer to first element only, or pointer to first and last?

Linked List Stack

Implementing a stack interface with a linked list:

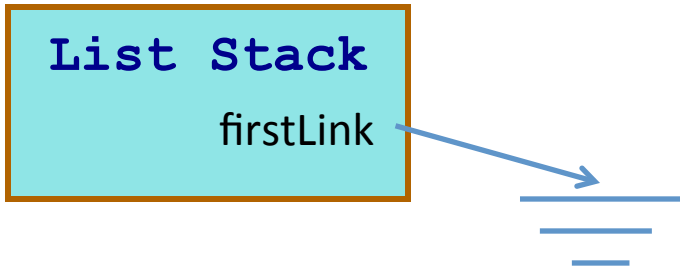
- Header with head reference only: null if empty
- Null terminated
- Singly linked
- Elements added or removed from front (why?)
- Only access first element



Linked List Stack

```
struct linkedListStack {
   struct Link *firstLink;  /* Initialize routine sets to zero/NULL.
   */
};

void linkedListStackInit (structlinkedListStack s) {
   s->firstLink = 0;
}
```



Linked List Stack

```
void pushListStack(struct ListStack *s, TYPE d) {
   /* You are going to write this:
        1. Allocate (malloc) a new link (check that it works!).
        2. Set data fields in the new link.
        3. Change head to point to new link. */
}
```

Linked List Tips…

- Draw the diagram!
- Go through the steps visually, labeling each step
- Convert each step to C code
- Try our the boundary cases:
  - Empty list?
  - List with one item?
  - List with several items?

Other Linked List Operations

- How do you tell if stack is empty?
- How do you return first element (i.e., **firstLink**)?
- How do you remove an element?

Your Turn

- Complete Worksheet 17: Linked List Introduction, List Stack