List Operations

15-111
Advanced Programming

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Advantages of Linked Lists

• The advantages of linked lists include:
  – Overflow can never occur unless the memory is actually full.
  – Insertions and deletions are *easier* than for contiguous (array) lists.
  – With large records, moving pointers is easier and faster than moving the items themselves.
Disadvantage of Linked Lists

• The disadvantages of linked lists include:
  – The pointers require extra space.
  – Linked lists do not allow random access.
  – Time must be spent traversing and changing the pointers.
  – Programming is typically trickier with pointers.
Linked List Operations
List Operations

• Basic Operations on a Linked List are
  – Insertion
  – Deletion

• Other operations include
  – build list
  – Append and prepend (special cases of insert)
  – empty
  – length
  – toString
  – traversing
List Traversal
Insertion

• Two cases to consider
  – List is empty
    • Insert to the beginning of the list
  – List is non-empty
    • Locate the place to insert
    • Manipulate the references to make new links
Insert Operation

- P
- New node
Delete Operation

\[ P \rightarrow \text{Node} \]
Other Operations
Prepend

Insert to the beginning of the list
Append

Insert to the end of the list
Length

Insert to the end of the list
List Types
Doubly Linked Lists

• Typically a linked list with two pointers (next and previous) is called a doubly linked list

```java
class Node {
    Object data;
    Node next;
    Node previous;
    ..... }```

head
Inserting into a Doubly Linked List

- We have to manipulate both next and previous pointers. Insert new node \( N \) between \( P \) and \( Q \)

![Diagram showing nodes P, Q, R, and N connected in a doubly linked list]

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Deleting from a Doubly Linked List

• Write the code to delete Node Q
Building a Doubly Linked List

- Build a doubly linked list with 3 nodes (always insert to the front of the list)
- Node Head = new Node(new Integer(3), null, null);

- Node N = new Node(new Integer(4), null, null);

- Connect the two nodes
Make it a Circular Doubly Linked List

• Write the code to create a circular doubly linked list.
Multi Linked List - An Example