

# Chapter 24: Linked lists

A linked list is a collection of nodes, each made up of a reference and a value. Nodes are strung together into a sequence using their references. Linked lists can be used to implement more complex data structures like lists, stacks, queues, and associative arrays.

## Section 24.1: Single linked list example

This example implements a linked list with many of the same methods as that of the built-in list object.

```
class Node:
    def __init__(self, val):
        self.data = val
        self.next = None

    def getData(self):
        return self.data

    def getNext(self):
        return self.next

    def setData(self, val):
        self.data = val

    def setNext(self, val):
        self.next = val

class LinkedList:
    def __init__(self):
        self.head = None

    def isEmpty(self):
        """Check if the list is empty"""
        return self.head is None

    def add(self, item):
        """Add the item to the list"""
        new_node = Node(item)
        new_node.setNext(self.head)
        self.head = new_node

    def size(self):
        """Return the length/size of the list"""
        count = 0
        current = self.head
        while current is not None:
            count += 1
            current = current.getNext()
        return count

    def search(self, item):
        """Search for item in list. If found, return True. If not found, return False"""
        current = self.head
        found = False
        while current is not None and not found:
            if current.getData() is item:
                found = True
            else:
                current = current.getNext()
```

```

    return found

def remove(self, item):
    """Remove item from list. If item is not found in list, raise ValueError"""
    current = self.head
    previous = None
    found = False
    while current is not None and not found:
        if current.getData() is item:
            found = True
        else:
            previous = current
            current = current.getNext()
    if found:
        if previous is None:
            self.head = current.getNext()
        else:
            previous.setNext(current.getNext())
    else:
        raise ValueError
    print 'Value not found.'

def insert(self, position, item):
    """
    Insert item at position specified. If position specified is
    out of bounds, raise IndexError
    """
    if position > self.size() - 1:
        raise IndexError
        print "Index out of bounds."
    current = self.head
    previous = None
    pos = 0
    if position is 0:
        self.add(item)
    else:
        new_node = Node(item)
        while pos < position:
            pos += 1
            previous = current
            current = current.getNext()
        previous.setNext(new_node)
        new_node.setNext(current)

def index(self, item):
    """
    Return the index where item is found.
    If item is not found, return None.
    """
    current = self.head
    pos = 0
    found = False
    while current is not None and not found:
        if current.getData() is item:
            found = True
        else:
            current = current.getNext()
            pos += 1
    if found:
        pass
    else:
        pos = None

```

```

    return pos

def pop(self, position = None):
    """
    If no argument is provided, return and remove the item at the head.
    If position is provided, return and remove the item at that position.
    If index is out of bounds, raise IndexError
    """
    if position > self.size():
        print 'Index out of bounds'
        raise IndexError

    current = self.head
    if position is None:
        ret = current.getData()
        self.head = current.getNext()
    else:
        pos = 0
        previous = None
        while pos < position:
            previous = current
            current = current.getNext()
            pos += 1
        ret = current.getData()
        previous.setNext(current.getNext())
    print ret
    return ret

def append(self, item):
    """Append item to the end of the list"""
    current = self.head
    previous = None
    pos = 0
    length = self.size()
    while pos < length:
        previous = current
        current = current.getNext()
        pos += 1
    new_node = Node(item)
    if previous is None:
        new_node.setNext(current)
        self.head = new_node
    else:
        previous.setNext(new_node)

def printList(self):
    """Print the list"""
    current = self.head
    while current is not None:
        print current.getData()
        current = current.getNext()

```

Usage functions much like that of the built-in list.

```

l1 = LinkedList()
l1.add('l')
l1.add('H')
l1.insert(1, 'e')
l1.append('l')
l1.append('o')
l1.printList()

```

