

CSE1303 Part A
Data Structures and Algorithms
Summer Semester 2003

Lecture A7 – Nodes and Linked Structures

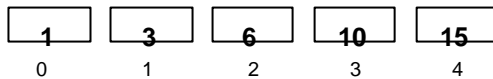
Kymberly Fergusson

Overview of Topic

- Review List Implementations. } Today's Lecture
- Nodes.
- Linked Stacks.
- Linked Queues
- Linked Lists.
- Other List Operations

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Lists



- Kept in alphabetical or numerical order
- No spaces between elements
- Simple lists are implemented in arrays

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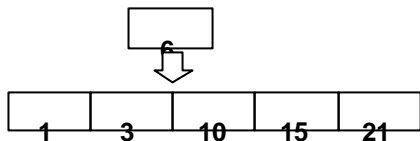
A List ADT

A sequence of elements together with these operations:

- Initialize the list.
- Determine whether the list is empty } Lists need to be able to expand
- Determine whether the list is full.
- Find the size of the list.
- Insert an item anywhere in the list.
- Delete an item anywhere in a list.
- Go to a particular position in a list.

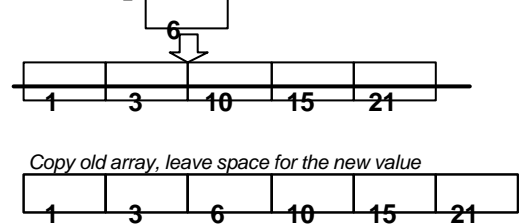
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Simple List Implementation



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**Simple List Implementation
Expansion and Insertion**



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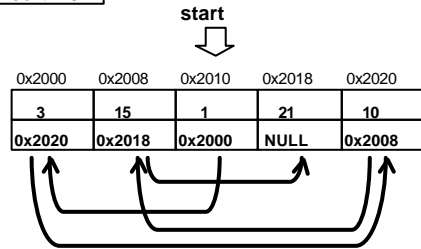
Disadvantages

- Lots of memory needs to be allocated.
- Lots of copying needs to be done.

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Linked List Implementation: Using Pointers

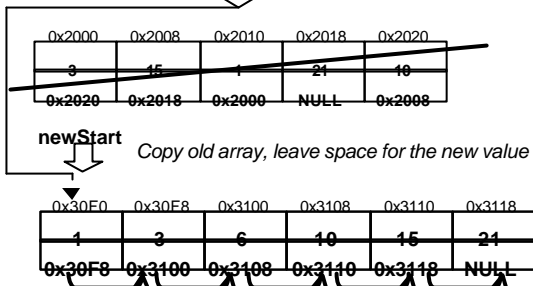
insert: 6



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Method 1

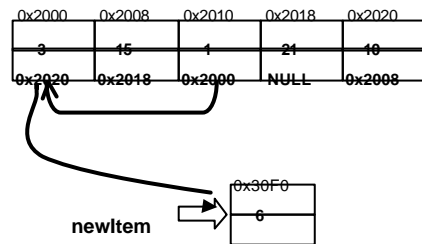
start 0x30F0 insert: 6



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Method 2

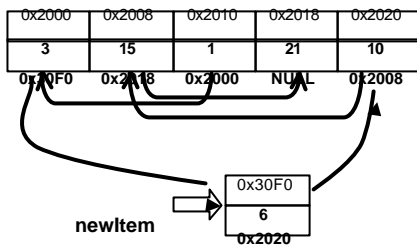
start insert: 6



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Method 2

start



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Advantages

- Only a little amount of memory needs to be allocated.
- Only a little amount of copying needs to be done.

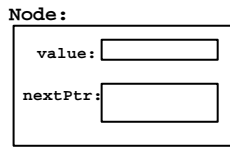
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```

struct NodeRec
{
    float value;
    struct NodeRec* nextPtr;
};

typedef struct NodeRec Node;

```



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```

#ifndef NODEH
#define NODEH

struct NodeRec
{
    float value;
    struct NodeRec* nextPtr;
};

typedef struct NodeRec Node;

Node* makeNode(float item);

#endif

```

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Make Node

- To make a new node for an item
 - take enough bytes from the heap
 - remember its address in memory
 - put the item in that location
 - set “next” link to NULL
 - return the node’s address

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```

Node* makeNode(float item)
{
    Node* newNodePtr = (Node*)malloc(sizeof(Node));

    if (newNodePtr == NULL) {
        fprintf(stderr, "Out of memory");
        exit(1);
    }
    else {
        newNodePtr->value = item;
        newNodePtr->nextPtr = NULL;
    }

    return newNodePtr;
}

```

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Insert nodes at the start of a list

```

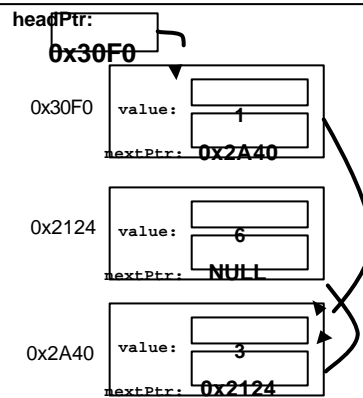
#include <stdio.h>
#include <stdlib.h>
#include "node.h"

int main()
{
    float item;
    Node* headPtr = NULL;
    Node* newNodePtr = NULL;

    while (scanf("%f", &item) != EOF){
        if (headPtr == NULL){
            headPtr = makeNode(item);
        }
        else {
            newNodePtr = makeNode(item);
            newNodePtr->nextPtr = headPtr;
            headPtr = newNodePtr;
        }
    }
}

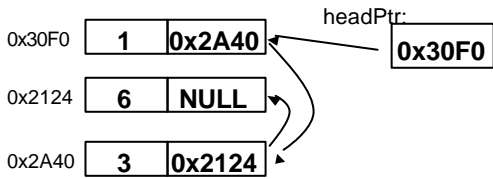
```

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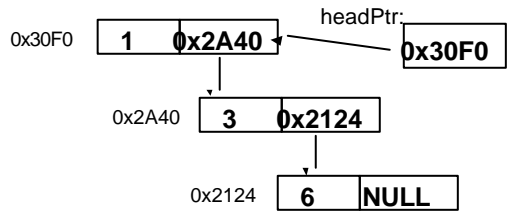
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Linked Structure



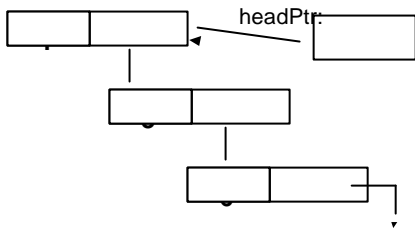
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Linked Structure



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Linked Structure



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Revision

- Node
- How to make a new Node
- Linked Structures

Revision: Reading

- Kruse 4.5

Preparation

Next lecture: *Linked Stacks and Queues*

- Read 3.1.6 in Kruse et al.

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