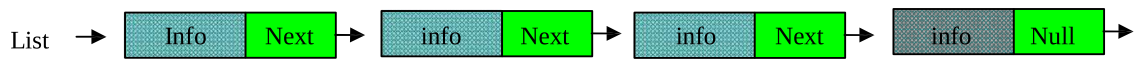
LINKED LISTS

A linked list is comprised of a series of nodes, each node containing a data element, and a pointer to the next node, e.g.,



A structure which contains a data element and a pointer to the next node is created by,

```
        struct list {
                int   value;
                struct list  *next;
        };
```

This defines a new data structure called *list* (actually the definition of a node), which contains two members. The first is an integer called *value*. The second is called *next*, which is a pointer to another list structure (or node). Suppose that we declare two structures to be of the same type as list, e.g.,

```
        struct list  n1, n2;
```

The next pointer of structure *n1* may be set to point to the *n2* structure by
/* assign address of first element in n2 to the pointer next of the n1 structure */

```
        n1.next = &n2;
```

which creates a link between the two structures.

```
/* LLIST.C    Program to illustrate linked lists */
        #include <stdio.h>

        struct list {
                int        value;
                struct list *next;
        };
        main()
        {
                struct list n1, n2, n3;
                int    i;
                n1.value  =  100;
                n2.value  =  200;
                n3.value  =  300;
                n1.next  =  &n2;
                n2.next = &n3;
                i = n1.next->value;
                printf("%d\n", n2.next->value);
        }
```

Not only this, but consider the following

```
        n1.next = n2.next;          /* removes n2 from the list */
        n2_3.next = n2.next;        /* adds struct n2_3 */
        n2.next = &n2_3;
```

In using linked list structures, it is common to assign the value of 0 to the last pointer in the list, to indicate that there are no more nodes in the list, e.g.,

```
        n3.next = 0;
```

Traversing a linked list

This program uses a pointer called *list_pointer* to cycle through the linked list.

```
        /* Program to illustrate traversing a list */
        #include <stdio.h>
        struct list {
                int     value;
                struct list *next;
        };
        main()
        {
                struct list n1, n2, n3, n4;
                struct list *list_pointer = &n1;
                n1.value  =  100;
                n1.next  =  &n2;
                n2.value  =  200;
                n2.next  =  &n3;
                n3.value  =  300;
                n3.next  =  &n4;
                n4.value  =  400;
                n4.next = 0;
                while( list_pointer != 0 )  {
                        printf("%d\n", list_pointer->value);
                        list_pointer = list_pointer->next;}
}
```

Lab Work

Compile and run the following program and understand how it works. Enter some data and see the results.

```
#include<stdio.h>
#include<string.h>
#include<stdlib.h>
#define RECORDS 6

struct student{
        char name[25];
        long  id_num;
        float GPA;
        struct student *next;
};
```

```
student* getnode(void);
void freenode(student*);
student* addstudent(student *,char [],long ,float );
void printlist(student *);
void freelist(student *);
void main()
{
        char name[25];
        float GPA;
        long id_num;
        student *start;
        start=NULL;
        for (int i=0;i<RECORDS;i++){
                printf("Enter Students name ");
                scanf("%s",&name);
                printf("\n Enter Students id number ");
                scanf("%ld",&id_num);
                printf("\n Enter Students GPA ");
                scanf("%f",&GPA);
                start=addstudent(start,name,id_num,GPA);
        }
        printlist(start);
        freelist(start);
}
student* getnode(void)
{
student *p;
p=(student*)malloc(sizeof(student));
return p;
}

student *addstudent(student *p,char name[],long id_num,float GPA){
        student *newElm,*Elm;
        newElm=getnode();
        strcpy(newElm->name,name);
        newElm->id_num=id_num;
        newElm->GPA=GPA;
        newElm->next=NULL;
        if(p==NULL)
                return newElm;
        else{
                Elm=p;
                while(Elm->next!=NULL)
                        Elm=Elm->next;
        Elm->next=newElm;
        return p;
        }
}
void printlist(student *p){
```

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```
student *q;
q = getnode();
q = p;
do {
        printf("%s\t",q->name);
        printf("%ld\t",q->id_num);
        printf("%f\n",q->GPA);
        q=q->next;
}while(q!=NULL);
}
void freelist(student *p){
student *q,*s;
q=p;
do{
s=q->next;
        free(q);
        q=s;
}while (s!=NULL);
}
```

Homework 6 (due one week):

Write a C program for a library automation which gets the ISBN number, name, author and publication year of the books in the library. The status will be filled by the program as follows: if publication year before 1985 the *status is reference* else *status is available*. The information about the books should be stored inside a linked list. The program should have a menu and the user inserts, displays, and deletes the elements from the menu by selecting options. The following data structure should be used.

```
struct list{    char ISBN[ 20 ];
                char NAME[ 20 ];
                char AUTHOR[ 20 ];
                int   YEAR;
                char STATUS[20];
                struct list *next;
                }INFO;
```

The following menu should be used in the program.

Press 1. to insert a book
Press 2. to display the book list
Press 3. to delete a book from list

Hint: use **strcpy** to fill STATUS.

NOTES:

1) Please Send your Homework in the following Emails, but remember ***who is your lab instructor***

emu.clab2@gmail.com *for* ***Pouya's*** *Student*

eenglab212@gmail.com *for* ***Mohamad****'s Student*

2) Subject of email Should include student Number + Homework Number
For Example: "St. 15000012 Homework #1"

3) Your homework should be saved with your student number and attached as notepad.
For Example 15000012.txt