## SSN College of Engineering, Kalavakkam

## Department of Computer Science and Engineering

## III Semester - CSE 'A ',’B’ & ‘C’

## UCS 1312 Data Structures Lab Laboratory

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## Exercise 3: Polynomial manipulation using linked list

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**//prototype.h**

node\* CreateList();

void display(node \*a,int l);

node\* add(node \*a,node \*b,int l);

node\* multiply(node \*a,node \*b);

**//functions.h**

typedef struct mynode

{

int coeff,pow;

struct mynode \*next;

}node;

node\* CreateList()

{

node \*head,\*new;

int ch;

head=(node \*)malloc(sizeof(node));

new=(node \*)malloc(sizeof(node));

head->next=NULL;

printf("Enter the coeff : ");

scanf("%d",&new->coeff);

printf("Enter its power: ");

scanf("%d",&new->pow);

new->next=NULL;

head->next=new;

printf("Continue(1.yes/2.no):");

scanf("%d",&ch);

while(ch==1)

{

node \*temp;

temp=(node \*)malloc(sizeof(node));

printf("Enter the coeff : ");

scanf("%d",&temp->coeff);

printf("Enter its power: ");

scanf("%d",&temp->pow);

temp->next=NULL;

new->next=temp;

new=temp;

printf("Continue(1.yes/2.no):");

scanf("%d",&ch);

}

return head;

}

void display(node \*a,int l)

{

node \*d;

if(a->next==NULL)

{

printf("-List is empty!\n");

}

for(int i=l;i>=0;i--)

{

for(d=a->next;d!=NULL;d=d->next)

{

if(d->pow==i)

{

if(d->coeff>0)

{

printf("+");

}

printf("%dx^%d ",d->coeff,d->pow);

}

}

}

printf("\n");

}

node\* add(node \*a,node \*b,int l)

{

int s1=0,s2=0,t1;

node \*p,\*q,\*r,\*new,\*temp;

r=(node \*)malloc(sizeof(node));

r->next=NULL;

temp=r;

for(p=a->next;p!=NULL;p=p->next)

{

if(p->pow>l)

{

l=p->pow;

}

}

for(q=b->next;q!=NULL;q=q->next)

{

if(q->pow>l)

{

l=q->pow;

}

}

for(int i=l;i >= 0;i--)

{

for(p=a->next;p!=NULL;p=p->next)

{

s1=0;

if(p->pow==i)

{

s1=1;

for(q=b->next;q!=NULL;q=q->next)

{

s2=0;

if(q->pow==i)

{

s2=1;

t1=p->coeff+q->coeff;

if(t1==0)

{

break;

}

else

{

new=(node \*)malloc(sizeof(node));

new->coeff=p->coeff+q->coeff;

new->pow=i;

new->next=NULL;

temp->next=new;

temp=new;

break;

}

}

}

if(s2==0)

{

new=(node \*)malloc(sizeof(node));

new->coeff=p->coeff;

new->pow=i;

new->next=NULL;

temp->next=new;

temp=new;

break;

}

break;

}

}

if(s1==0)

{

for(q=b->next;q!=NULL;q=q->next)

{

if(q->pow==i)

{

new=(node \*)malloc(sizeof(node));

new->coeff=q->coeff;

new->pow=i;

new->next=NULL;

temp->next=new;

temp=new;

break;

}

}

}

}

return r;

}

node\* multiply(node \*a,node \*b)

{

node \*r,\*x,\*y,\*new,\*temp;

int t,t1=0,t2=0;

r=(node \*)malloc(sizeof(node));

r->next=NULL;

temp=r;

for(x=a->next;x!=NULL;x=x->next)

{

for(y=b->next;y!=NULL;y=y->next)

{

new=(node \*)malloc(sizeof(node));

new->coeff=x->coeff\*y->coeff;

new->pow=x->pow+y->pow;

new->next=NULL;

temp->next=new;

temp=new;

}

}

for(x=a->next;x!=NULL;x=x->next)

{

if(x->pow>t1)

{

t1=x->pow;

}

}

for(x=b->next;x!=NULL;x=x->next)

{

if(x->pow>t2)

{

t2=x->pow;

}

}

t=t1+t2;

for(int i=0;i<t;i++)

{

for(x=r->next;x->next!=NULL;x=x->next)

{

for(y=x->next;y!=NULL;y=y->next)

{

if(x->pow==y->pow)

{

x->coeff=x->coeff+y->coeff;

if(y->next!=NULL)

{

x->next=x->next->next;

}

else

{

x->next=NULL;

}

}

}

}

}

return r;

}

**//polynomial.c**

#include<stdio.h>

#include<stdlib.h>

#include"functions.h"

#include"prototype.h"

int main()

{

node \*a,\*b,\*sum,\*mul,\*x;

int l,t,t1=0,t2=0,ch;

printf("Enter the 1st polynomial list:\n");

a=CreateList();

printf("Enter the 2nd polynomial list:\n");

b=CreateList();

for(x=a->next;x!=NULL;x=x->next)

{

if(x->pow>l)

{

l=x->pow;

}

}

for(x=b->next;x!=NULL;x=x->next)

{

if(x->pow>l)

{

l=x->pow;

}

}

printf("Displaying 1st polynomial list!\n");

display(a,l);

printf("Displaying 2nd polynomial list!\n");

display(b,l);

printf("Press\n1.Add two polynomial equations.\n2.Multiply two polynomial equation.\n3.Exit.\n");

printf("Enter your choice:");

scanf("%d",&ch);

while(ch!=3)

{

switch(ch)

{

case 1:sum=add(a,b,l);

printf("Displaying the sum polynomial list!\n");

display(sum,l);break;

case 2:

{

mul=multiply(a,b);

for(x=a->next;x!=NULL;x=x->next)

{

if(x->pow>t1)

{

t1=x->pow;

}

}

for(x=b->next;x!=NULL;x=x->next)

{

if(x->pow>t2)

{

t2=x->pow;

}

}

t=t1+t2;

printf("Displaying the multiply list!\n");

display(mul,t);

break;

}

case 3:return 0;

default:printf("Invalid Input!\n");

}

printf("Press\n1.Add two polynomial equations.\n2.Multiply two polynomial equation.\n3.Exit.\n");

printf("Enter your choice:");

scanf("%d",&ch);

}

}

**Sample I/P O/P:**

Enter the 1st polynomial list:

Enter the coeff : 3

Enter its power: 12

Continue(1.yes/2.no):1

Enter the coeff : 8

Enter its power: 8

Continue(1.yes/2.no):1

Enter the coeff : -22

Enter its power: 4

Continue(1.yes/2.no):1

Enter the coeff : 3

Enter its power: 1

Continue(1.yes/2.no):1

Enter the coeff : -7

Enter its power: 0

Continue(1.yes/2.no):2

Enter the 2nd polynomial list:

Enter the coeff : 7

Enter its power: 14

Continue(1.yes/2.no):1

Enter the coeff : -10

Enter its power: 9

Continue(1.yes/2.no):1

Enter the coeff : -8

Enter its power: 8

Continue(1.yes/2.no):1

Enter the coeff : 6

Enter its power: 5

Continue(1.yes/2.no):1

Enter the coeff : -9

Enter its power: 1

Continue(1.yes/2.no):2

Displaying 1st polynomial list!

+3x^12 +8x^8 -22x^4 +3x^1 -7x^0

Displaying 2nd polynomial list!

+7x^14 -10x^9 -8x^8 +6x^5 -9x^1

Press

1.Add two polynomial equations.

2.Multiply two polynomial equation.

3.Exit.

Enter your choice:1

Displaying the sum polynomial list!

+7x^14 +3x^12 -10x^9 +6x^5 -22x^4 -6x^1 -7x^0

Press

1.Add two polynomial equations.

2.Multiply two polynomial equation.

3.Exit.

Enter your choice:2

Displaying the multiply list!

+21x^26 -30x^21 -24x^20 -222x^17 -64x^16 +708x^13 +176x^12 +240x^9 +56x^8 -42x^5 +63x^1

Press

1.Add two polynomial equations.

2.Multiply two polynomial equation.

3.Exit.

Enter your choice:3