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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_week 1_CY

Attempt : 1
Total Mark : 30
Marks Obtained : 30

Section 1 : Coding

1. Problem Statement

Akila is a tech enthusiast and wants to write a program to add two polynomials. Each polynomial is represented as a linked list, where each node in the list represents a term in the polynomial.

A term in the polynomial is represented in the format ax^b, where a is the coefficient and b is the exponent.

Akila needs your help to implement a program that takes two polynomials as input, adds them, and stores the result in ascending order in a new polynomial-linked list. Write a program to help her.

Input Format

The input consists of lines containing pairs of integers representing the

coefficients and exponents of polynomial terms.

Each line represents a single term, with the coefficient and exponent separated by a space.

The input for each polynomial ends with a line containing "0 0".

Output Format

The output consists of three lines representing the first, second, and resulting polynomial after the addition operation, with terms sorted in ascending order of exponents.

Each line contains terms of the polynomial in the format "coefficientx^exponent", separated by " + ".

If the resulting polynomial is zero, the output is "0".

Refer to the sample output for the formatting specifications.

Sample Test Case

Input: 3 4
2 3
1 2
0 0
1 2
2 3
3 4
0 0

Output: 1x^2 + 2x^3 + 3x^4
1x^2 + 2x^3 + 3x^4
2x^2 + 4x^3 + 6x^4

Answer

```
// You are using GCC
#include<stdio.h>
#include<stdlib.h>
typedef struct node{
    int coe;
    int expo;
```

```
    struct node* next;
};Node;
Node* createNode(int coe,int expo){
    Node* newNode=(Node*)malloc(sizeof(Node));
    newNode->coe=coe;
    newNode->expo=expo;
    newNode->next=NULL;
    return newNode;
}
void insertTerm(Node** head,int coe,int expo){
    if(coe==0){
        return;
    }
    Node* newNode=createNode(coe,expo);
    if(*head==NULL || expo < (*head)->expo){
        newNode->next=*head;
        *head=newNode;
        return;
    }
    Node* current=*head;
    while(current->next!=NULL && current->next->expo<expo){
        current=current->next;
    }
    if(current->next!=NULL && current->next->expo==expo){
        current->next->coe+= coe;
        if(current->next->coe==0){
            Node* temp= current->next;
            current->next=current->next->next;
            free(temp);
        }
        free(newNode);
    }else{
        newNode->next=current->next;
        current->next=newNode;
    }
}
Node* addPoly(Node* poly1,Node* poly2){
    Node* result=NULL;
    while(poly1!=NULL || poly2!=NULL){
        int coe,expo;
        if(poly1==NULL){
            coe=poly2->coe;
```

```
            expo=poly2->expo;
            poly2=poly2->next;
        }
        else if(poly2==NULL){
            coe=poly1->coe;
            expo=poly1->expo;
            poly1=poly1->next;
        }else if(poly1->expo<poly2->expo){
            coe=poly1->coe;
            expo=poly1->expo;
            poly1=poly1->next;
        }else if(poly1->expo>poly2->expo){
            coe=poly2->coe;
            expo=poly2->expo;
            poly2=poly2->next;
        }else{
            coe= poly1->coe+poly2->coe;
            expo=poly1->expo;
            poly1=poly1->next;
            poly2=poly2->next;
        }
        insertTerm(&result,coe,expo);
    }
    return result;
}
void printpoly(Node* head){
    if(head==NULL){
        printf("0\n");
        return;
    }
    Node* current=head;
    while(current!=NULL){
        printf("%dx^%d ",current->coe,current->expo);
        if(current->next!=NULL){
            printf(" + ");
        }
        current=current->next;
    }
    printf("\n");
}
void freelist(Node* head){
    while(head!=NULL){
```

```
        Node* temp=head;
        head=head->next;
        free(temp);
    }
}
int main(){
    Node* poly1=NULL;
    Node* poly2=NULL;
    int coe,expo;
    while(1){
        scanf("%d %d",&coe,&expo);
        if(coe==0 && expo==0){
            break;
        }
        insertTerm(&poly1,coe,expo);
    }
    while(1){
        scanf("%d %d",&coe,&expo);
        if(coe==0 && expo==0){
            break;
        }
        insertTerm(&poly2,coe,expo);
    }
    printpoly(poly1);
    printpoly(poly2);
    Node* result=addPoly(poly1,poly2);
    printpoly(result);
    freelist(poly1);
    freelist(poly2);
    freelist(result);
    return 0;
}
```

Status : Correct **Marks : 10/10**

2. Problem Statement

Rani is studying polynomials in her class. She has learned about polynomial multiplication and is eager to try it out on her own. However, she finds the process of manually multiplying polynomials quite tedious. To make her task easier, she decides to write a program to multiply two

polynomials represented as linked lists.

Help Rani by designing a program that takes two polynomials as input and outputs their product polynomial. Each polynomial is represented by a linked list of terms, where each term has a coefficient and an exponent. The terms are entered in descending order of exponents.

Input Format

The first line of input consists of an integer n, representing the number of terms in the first polynomial.

The following n lines of input consist of two integers each: the coefficient and the exponent of the term in the first polynomial.

The next line of input consists of an integer m, representing the number of terms in the second polynomial.

The following m lines of input consist of two integers each: the coefficient and the exponent of the term in the second polynomial.

Output Format

The first line of output prints the first polynomial.

The second line of output prints the second polynomial.

The third line of output prints the resulting polynomial after multiplying the given polynomials.

The polynomials should be displayed in the format, where each term is represented as ax^b, where a is the coefficient and b is the exponent.

Refer to the sample output for the exact format.

Sample Test Case

Input: 2
2 3
3 2
2

3 2
2 1
Output: 2x^3 + 3x^2
3x^2 + 2x
6x^5 + 13x^4 + 6x^3

Answer

```
// You are using GCC
#include<stdio.h>
#include<stdlib.h>
typedef struct poly{
    int cof;
    int exp;
    struct poly*next;
}node;

node*newnode(int cof,int exp){
    node*temp=(node*)malloc(sizeof(node));
    temp->cof=cof;
    temp->exp=exp;
    temp->next=NULL;
    return temp;
}

void insert(node**head,int cof,int exp){
    if(cof==0) return;

    node*temp=*head;
    node*prev=NULL;

    while(temp!=NULL&&temp->exp>exp){
        prev=temp;
        temp=temp->next;
    }

    if(temp!=NULL&&temp->exp==exp)
    {
        temp->cof+=cof;
        if(temp->cof==0){

            if(prev==NULL){
                *head=temp->next;
```

```
        }else{
            prev->next=temp->next;
        }
        free(temp);
    }
    return;
}

node*newterm=newnode(cof,exp);
if(prev==NULL){
    newterm->next=*head;
    *head=newterm;
}else{
    newterm->next=prev->next;
    prev->next=newterm;
}
}
void printpoly(node*head){
if(head==NULL){
    printf("0\n");
    return;
}
int first=1;
while(head!=NULL){
    if(!first){
        if(head->cof>0)
        printf(" + ");
        else
        printf(" - ");
    } else if(head->cof<0){
        printf("-");
    }

    printf("%d",abs(head->cof));
    if(head->exp!=0){
        printf("x");
        if(head->exp!=1)
        printf("^%d",head->exp);
    }
    first=0;
    head=head->next;}
    printf("\n");
```

```
}
node*multiply(node*poly1,node*poly2){
    node*result=NULL;
    for(node*p1=poly1;p1!=NULL;p1=p1->next){
        for(node*p2=poly2;p2!=NULL;p2=p2->next){
            int cof=p1->cof*p2->cof;
            int exp=p1->exp+p2->exp;
            insert(&result,cof,exp);
        }
    }
    return result;
}

void freelist(node*head){
    node*temp;
    while(head!=NULL){
        temp=head;
        head=head->next;
        free(temp);
    }
}

int main()
{
    int n,m,cof,exp;
    node*poly1=NULL;
    node*poly2=NULL;

    scanf("%d",&n);
    for(int i=0;i<n;i++){
        scanf("%d %d",&cof,&exp);
        insert(&poly1,cof,exp);
    }

    scanf("%d",&m);
    for(int i=0;i<m;i++){
        scanf("%d %d",&cof,&exp);
        insert(&poly2,cof,exp);
    }

    printpoly(poly1);
```

```
    printpoly(poly2);

    node*result=multiply(poly1,poly2);
    printpoly(result);

    freelist(poly1);
    freelist(poly2);
    freelist(result);

}
```

Status : Correct **Marks : 10/10**

3. Problem Statement

Lisa is studying polynomials in her class. She is learning about the multiplication of polynomials.

To practice her understanding, she wants to write a program that multiplies two polynomials and displays the result. Each polynomial is represented as a linked list, where each node contains the coefficient and exponent of a term.

Example

Input:

4 3

y

3 1

y

1 0

n

2 2

y

3 1

y

2 0

n

Output:

8x^5 + 12x^4 + 14x^3 + 11x^2 + 9x + 2

Explanation

1. Poly1: 4x^3 + 3x + 1
2. Poly2: 2x^2 + 3x + 2

Multiplication Steps:

1. Multiply 4x^3 by Poly2:
   -> 4x^3 * 2x^2 = 8x^5
   -> 4x^3 * 3x = 12x^4
   -> 4x^3 * 2 = 8x^3

2. Multiply 3x by Poly2:
   -> 3x * 2x^2 = 6x^3
   -> 3x * 3x = 9x^2
   -> 3x * 2 = 6x

3. Multiply 1 by Poly2:
   -> 1 * 2x^2 = 2x^2
   -> 1 * 3x = 3x
   -> 1 * 2 = 2

Combine the results: 8x^5 + 12x^4 + (8x^3 + 6x^3) + (9x^2 + 2x^2) + (6x + 3x) + 2

The combined polynomial is: 8x^5 + 12x^4 + 14x^3 + 11x^2 + 9x + 2

Input Format

The input consists of two sets of polynomial terms.

Each polynomial term is represented by two integers separated by a space:

- The first integer represents the coefficient of the term.
- The second integer represents the exponent of the term.

After entering a polynomial term, the user is prompted to input a character indicating whether to continue adding more terms to the polynomial.

If the user inputs 'y' or 'Y', the program continues to accept more terms.

If the user inputs 'n' or 'N', the program moves on to the next polynomial.

Output Format

The output consists of a single line representing the resulting polynomial after multiplying the two input polynomials.

Each term of the resulting polynomial is formatted as follows:

- The coefficient and exponent are separated by 'x^' if the exponent is greater than 1.
- If the exponent is 1, only 'x' is displayed without the exponent.
- If the exponent is 0, only the coefficient is displayed.

Refer to the sample output for the formatting specifications.

Sample Test Case

Input: 4 3

y
3 1
y
1 0
n
2 2
y
3 1
y
2 0
n

Output: 8x^5 + 12x^4 + 14x^3 + 11x^2 + 9x + 2

Answer

```
// You are using GCC
#include<stdio.h>
#include<stdlib.h>

struct node{
    int c;
    int e;
    struct node* n;
};

struct node* cn(int c,int e){

    struct node* a=(struct node *)malloc(sizeof(struct node));
    a->c=c;
    a->e=e;
    a->n=NULL;
    return a;
}

void insert(struct node ** l,int c,int e){
    if(*l==NULL)
    {
        struct node* el=cn(c,e);
        *l=el;
    }else{
        struct node* cu=*l;
        while(cu!=NULL && cu->e!=e){
            cu=cu->n;
```

```
        }
        if(cu!=NULL){
            cu->c+=c;
        }else{
            cu=*l;
            struct node* el =cn(c,e);
            while(cu->n!=NULL){
                cu=cu->n;
            }
            cu->n=el;
        }
    }
}

struct node* mul(struct node** l1,struct node** l2){
    struct node *p1=*l1;
    struct node *p2=*l2;
    struct node *r=NULL;
    while(p1!=NULL){
        p2=*l2;
        while(p2!=NULL){
            int ve=(p1->e)+(p2->e);
            int vc=(p1->c)*(p2->c);
            insert(&r,vc,ve);
            p2=p2->n;
        }
        p1=p1->n;
    }
    return r;
}
void print(struct node** r){
    struct node *p1=*r;
    if(p1->e==0){
        printf("%d",p1->c);
    }else if(p1->e==1){
        printf("%dx",p1->c);
    }else{
        printf("%dx^%d",p1->c,p1->e);
    }
    p1=p1->n;
    while(p1!=NULL){
        if(p1->e==0){
```

```
            printf(" + %d",p1->c);
        }
        else if(p1->e==1){
            printf(" + %dx",p1->c);
        }else{
            printf(" + %dx^%d",p1->c,p1->e);
        }
        p1=p1->n;
    }
}

int main()
{
    struct node* p1=NULL;
    struct node* p2=NULL;

    while(1){
        int t1,t2;
        char c;
        scanf("%d %d\n",&t1,&t2);
        insert(&p1,t1,t2);
        scanf("%c",&c);

        if(c=='n' || c=='N'){
            break;
        }
    }
    while(1){
        int t1,t2;
        char c;
        scanf("%d %d\n",&t1,&t2);
        insert(&p2,t1,t2);
        scanf("%c",&c);

        if(c=='n' || c=='N'){
            break;
        }
    }
    struct node* r=mul(&p1,&p2);
    print(&r);
}
```

Status : Correct *Marks : 10/10*