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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_week 1_CY

Attempt : 1
Total Mark : 30
Marks Obtained : 15

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 c;
 int e;
 struct node* next;

}Node;
void insert(Node** list,int co,int ex){
 Node* temp=*list;
 Node* prev= NULL;
 while(temp!=NULL)
 {
 prev=temp;
 temp=temp -> next;
 }
 if(temp!= NULL && temp ->e ==ex){
 temp->c +=co;
 return;
 }
 Node* newNode = (Node*)malloc(sizeof(Node));
 newNode -> c=co;
 newNode -> e=ex;
 newNode -> next =temp;
 if(prev==NULL){
 *list = newNode;
 }
 else{
 prev -> next = newNode;
 }
}
void print_poly(Node*list)
{
 int f=1;
 Node* temp=list;
 int h=0;
 while(temp != NULL)
 {
 if(temp ->c !=0)
 {
 if(!f)
 printf(" + ");
 if(temp -> e >1)
 printf("%dx^%d",temp -> c,temp -> e);
 else if(temp -> e ==1)
 printf("%dx",temp -> c);
 else
 printf("%d",temp -> c);
 f=0;
 h=1;

 }
 temp = temp -> next;
 }
 if(!h)
 printf("0");
}
int main()
{
 Node* poly1 = NULL;
 Node* poly2 = NULL;

 int n,m,c,e;
 scanf("%d",&n);
 for(int i=0;i<n;i++)
 {
 scanf("%d %d",&c,&e);
 insert(&poly1,c,e);
 }
 scanf("%d",&m);
 for(int i=0;i<m;i++)
 {
 scanf("%d %d",&c,&e);
 insert(&poly2,c,e);
 }
 print_poly(poly1);
 printf("\n");
 print_poly(poly2);
};
```

Status : Wrong ***Marks : 0/10***

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>
struct Term {
 int coeff;
 int exp;
 struct Term* next;
};
// Function to create a new term
struct Term* createTerm(int coeff, int exp) {
 struct Term* newTerm = (struct Term*)malloc(sizeof(struct Term));
 newTerm->coeff = coeff;
 newTerm->exp = exp;
 newTerm->next = NULL;

 return newTerm;
}
// Function to insert a term at the end
void insertTerm(struct Term** head, int coeff, int exp) {
 struct Term* newTerm = createTerm(coeff, exp);
 if (*head == NULL) {
 *head = newTerm;
 return;
 }
 struct Term* temp = *head;
 while (temp->next != NULL)
 temp = temp->next;
 temp->next = newTerm;
}
// Function to add a term to result (combine like terms)
void addTerm(struct Term** result, int coeff, int exp) {
 if (coeff == 0) return; // Skip zero coeffcient terms
 struct Term* temp = *result;
 struct Term* prev = NULL;
 // Insert in descending order of exponents
 while (temp && temp->exp > exp) {
 prev = temp;
 temp = temp->next;
 }
 if (temp && temp->exp == exp) {
 temp->coeff += coeff;
 } else {
 struct Term* newTerm = createTerm(coeff, exp);
 if (prev == NULL) {
 newTerm->next = *result;
 *result = newTerm;
 } else {
 newTerm->next = temp;
 prev->next = newTerm;
 }
 }
}
// Function to multiply two polynomials
struct Term* multiplyPolynomials(struct Term* poly1, struct Term* poly2) {
 struct Term* result = NULL;
 struct Term* ptr1 = poly1;
 while (ptr1 != NULL) {
 struct Term* ptr2 = poly2;
 while (ptr2 != NULL) {
 int newCoeff = ptr1->coeff * ptr2->coeff;
 int newExp = ptr1->exp + ptr2->exp;
 addTerm(&result, newCoeff, newExp);
 ptr2 = ptr2->next;
 }
 ptr1 = ptr1->next;
 }
 return result;
}
// Function to print a polynomial with proper formatting
void printPolynomial(struct Term* poly) {
 struct Term* temp = poly;
 int frst = 1;
 while (temp != NULL) {
 if (temp->coeff != 0) {
 if (!frst)
 printf(" + ");
 if (temp->exp == 0)
 printf("%d", temp->coeff);
 else if (temp->exp == 1)
 printf("%dx", temp->coeff);
 else
 printf("%dx^%d", temp->coeff, temp->exp);
 frst = 0;
 }
 temp = temp->next;
 }
 printf("\n");
}
// ---- Main ----

int main() {
 int n, m, coeff, exp;
 struct Term* poly1 = NULL;
 struct Term* poly2 = NULL;
 // Read frst polynomial
 scanf("%d", &n);
 for (int i = 0; i < n; i++) {
 scanf("%d %d", &coeff, &exp);
 insertTerm(&poly1, coeff, exp);
 }
 // Read second polynomial
 scanf("%d", &m);
 for (int i = 0; i < m; i++) {
 scanf("%d %d", &coeff, &exp);
 insertTerm(&poly2, coeff, exp);
 }
 // Multiply polynomials
 struct Term* result = multiplyPolynomials(poly1, poly2);
 // Print polynomials and result
 printPolynomial(poly1);
 printPolynomial(poly2);
 printPolynomial(result);
 return 0;
}
```

Status : Partially correct ***Marks : 5/10***

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>
typedef struct Node
{
 int coeff;
 int exp;
 struct Node*next;
}Node;
Node*createNode(int coeff,int exp)
{
 Node*newNode = (Node*)malloc(sizeof(Node));
 newNode->coeff = coeff;
 newNode -> exp = exp;
 newNode->next = NULL;
 return newNode;
}

void insert(Node**poly,int coeff,int exp)
{
 Node*newNode = createNode(coeff,exp);
 if(*poly == NULL)
 {
 *poly = newNode;
 }
 else{
 Node*temp = *poly;
 while(temp -> next!=NULL)
 temp=temp->next;
 temp->next = newNode;
 }
}
Node*multiplyPolynomials(Node*poly1,Node*poly2)
{
 if(!poly1 || !poly2)return NULL;

 Node*result= NULL;
 Node*temp1= poly1;
 Node*temp2;

 while(temp1)
 {
```

```
temp2 = poly2;
while(temp2)
{
int coeff = temp1 -> coeff*temp2->coeff;
int exp = temp1 -> exp + temp2->exp;
insert(&result,coeff,exp);
temp2 = temp2->next;
}
temp1 = temp1->next;
}
Node *ptr1,*ptr2,*prev;
ptr1 =result;
while(ptr1 && ptr1->next)
{
prev = ptr1;
ptr2 = ptr1 -> next;
while(ptr2)
{

if(ptr1 -> exp == ptr2->exp)
{
ptr1 -> coeff += ptr2->coeff;
prev -> next = ptr2->next;
free(ptr2);
ptr2 = prev ->next;
}
else {
prev = ptr2;
ptr2 = ptr2 ->next;
}
}
ptr1 = ptr1->next;
}
return result; }
void printPolynomial(Node*poly) {
int frst = 1;
while(poly)
{
if(!frst)printf(" + ");
if(poly->exp == 0)
{
printf("%d",poly->coeff);
```

```
 }
 else if(poly -> exp == 1)
 {
 printf("%dx",poly->coeff);
 }
 else
 {
 printf("%dx^%d",poly->coeff,poly -> exp);
 }
 frst =0;
 poly = poly->next;
 }
 printf("\n"); }
Node*readPolynomials() {
 Node*poly = NULL;
 int coeff,exp;
 char choice;

 do{
 scanf("%d",&coeff);
 scanf("%d",&exp);
 insert(&poly,coeff,exp);
 getchar();

 scanf("%c",&choice);
 }while(choice == 'y' || choice =='Y');

 return poly;
}
int main(){
 Node*poly1 = readPolynomials();
 Node*poly2 = readPolynomials();

 Node*result = multiplyPolynomials(poly1,poly2);

 printPolynomial(result);
 return 0;
}
```

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