DSA ASSIGNMENT 1

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#include <iostream>
#include <cmath>
using namespace std;

class Term {
public:
int coef;
int exp;
Term* next;

Term(int coeff, int exponent) : coef(coeff), exp(exponent), next(nullptr) {}
};

class Polynomial {
private:
Term* head;

public:
Polynomial() {
head = new Term(0, -1);
head->next = head;
}

void readPolynomial() {
int numTerms;
cout << "Enter the number of terms: ";
cin >> numTerms;

for (int i = 0; i < numTerms; i++) {
int coeff, exponent;
cout << "Enter coefficient and exponent for term " << i + 1 << ": ";
cin >> coeff >> exponent;

insertTerm(coeff, exponent);
}
}

void insertTerm(int coeff, int exponent) {
Term* newNode = new Term(coeff, exponent);
Term* current = head;

while (current->next != head && current->next->exp >= exponent) {
current = current->next;
}

newNode->next = current->next;
```

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current->next = newNode;
}

void printPolynomial() {
Term* current = head->next;
bool firstTerm = true;

while (current != head) {
if (current->coef != 0) {
if (!firstTerm && current->coef > 0) {
cout << "+";
}

if (current->exp == 0) {
cout << current->coef;
} else {
cout << current->coef << "x^" << current->exp;
}

firstTerm = false;
}
current = current->next;
}

cout << endl;
}

void addPolynomials(Polynomial& polyA, Polynomial& polyB) {
Term* termA = polyA.head->next;
Term* termB = polyB.head->next;
Polynomial result;

while (termA != polyA.head && termB != polyB.head) {
if (termA->exp > termB->exp) {
result.insertTerm(termA->coef, termA->exp);
termA = termA->next;
} else if (termA->exp < termB->exp) {
result.insertTerm(termB->coef, termB->exp);
termB = termB->next;
} else {
int sum = termA->coef + termB->coef;
if (sum != 0) {
result.insertTerm(sum, termA->exp);
}
termA = termA->next;
termB = termB->next;
}
}

while (termA != polyA.head) {
result.insertTerm(termA->coef, termA->exp);
termA = termA->next;
}
```

```
while (termB != polyB.head) {
result.insertTerm(termB->coef, termB->exp);
termB = termB->next;
}

head = result.head;
}

void subtractPolynomials(Polynomial& polyA, Polynomial& polyB) {
Polynomial negPolyB;
Term* current = polyB.head->next;

while (current != polyB.head) {
negPolyB.insertTerm(-current->coef, current->exp);
current = current->next;
}

addPolynomials(polyA, negPolyB);
}

void multiplyPolynomials(Polynomial& polyA, Polynomial& polyB) {
Polynomial result;

Term* termA = polyA.head->next;
while (termA != polyA.head) {
Term* termB = polyB.head->next;

while (termB != polyB.head) {
int coeff = termA->coef * termB->coef;
int exp = termA->exp + termB->exp;
result.insertTerm(coeff, exp);
termB = termB->next;
}

termA = termA->next;
}

head = result.head;
}

float evaluatePolynomial(float x) {
float result = 0;
Term* current = head->next;

while (current != head) {
result += current->coef * pow(x, current->exp);
current = current->next;
}

return result;
}
```

```
void eraseTerm(int exponent) {
Term* current = head->next;
Term* prev = head;

while (current != head) {
if (current->exp == exponent) {
prev->next = current->next;
delete current;
current = prev->next;
} else {
prev = current;
current = current->next;
}
}
}
};

int main() {
Polynomial polyA, polyB, polyC;
cout << "Write Poly A:" << endl;
polyA.readPolynomial();
cout << "Write Poly B:" << endl;
polyB.readPolynomial();

cout << "Poly A: ";
polyA.printPolynomial();
cout << "Poly B: ";
polyB.printPolynomial();

cout << "Add A & B: ";
polyC.addPolynomials(polyA, polyB);
polyC.printPolynomial();

cout << "Subtr B from A: ";
polyC.subtractPolynomials(polyA, polyB);
polyC.printPolynomial();

cout << "Multiply A & B: ";
polyC.multiplyPolynomials(polyA, polyB);
polyC.printPolynomial();

float evalPoint;
cout << "Give the value of x to evaluate A: ";
cin >> evalPoint;
cout << "A(" << evalPoint << ") = " << polyA.evaluatePolynomial(evalPoint) << endl;

int exp;
cout << "Give the exponent to erase from A: ";
cin >> exp;
polyA.eraseTerm(exp);
cout << "A after erasing term with exponent " << exp << ": ";
polyA.printPolynomial();
```

return 0;
}

```
Write Poly A:
Enter the number of terms: 3
Enter coefficient and exponent for term 1: 5
2
Enter coefficient and exponent for term 2: 6
1
Enter coefficient and exponent for term 3: 4
0
Write Poly B:
Enter the number of terms: 4
Enter coefficient and exponent for term 1: 2
3
Enter coefficient and exponent for term 2: 1
2
Enter coefficient and exponent for term 3: 3
1
Enter coefficient and exponent for term 4: 4
0
Poly A: 5x^2+6x^1+4
Poly B: 2x^3+1x^2+3x^1+4
Add A & B: 2x^3+6x^2+9x^1+8
Subtr B from A: -2x^3+4x^2+3x^1
Multiply A & B: 10x^5+5x^4+12x^4+15x^3+6x^3+8x^3+20x^2+18x^2+4x^2+24x^1+12x^1+16
Give the value of x to evaluate A: 3
A(3) = 67
Give the exponent to erase from A: 2
A after erasing term with exponent 2: 6x^1+4


...Program finished with exit code 0
Press ENTER to exit console.
```