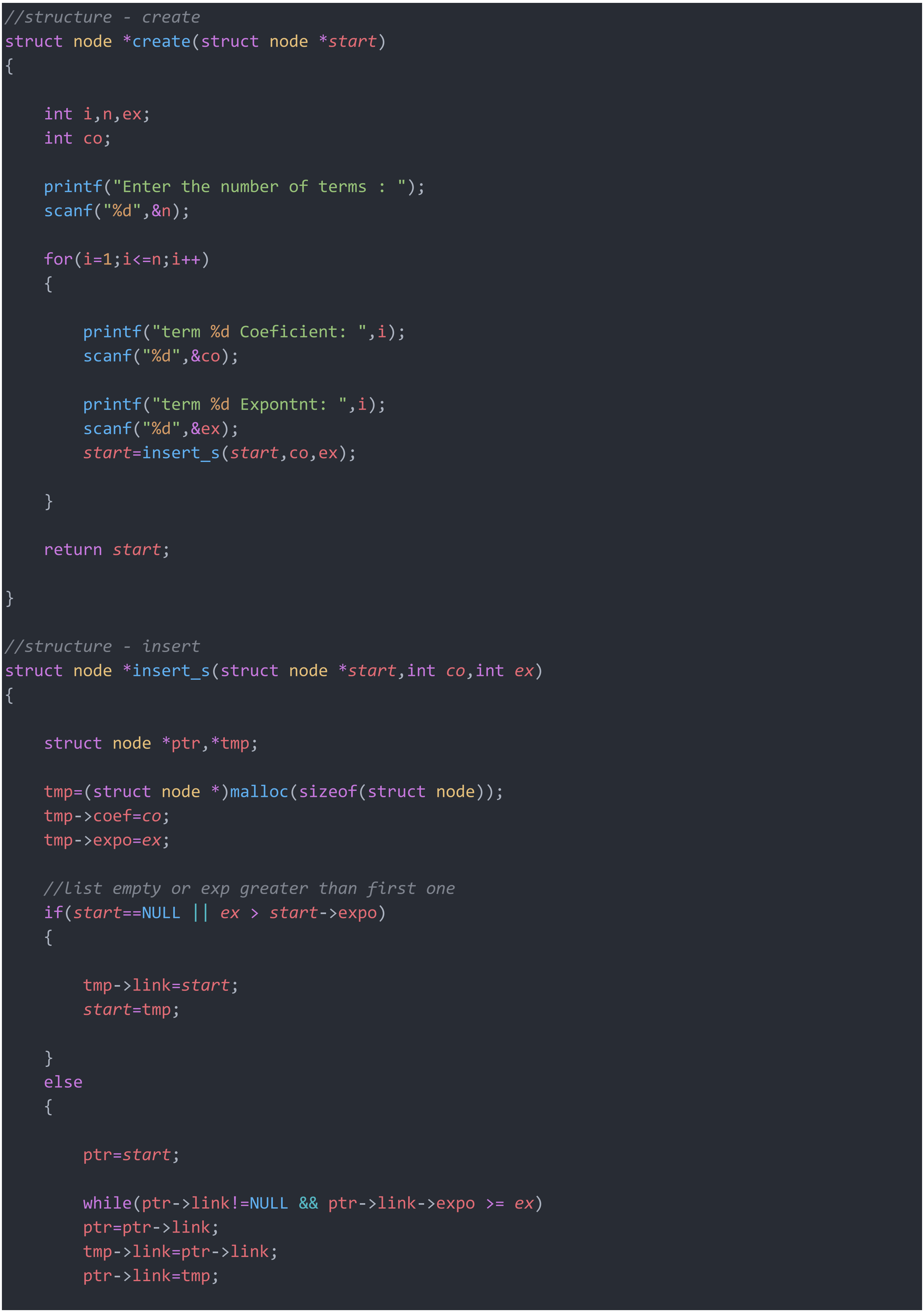
DAY 7 – POLYNOMIAL

9. Write a menu driven C program. to representation polynomials using linked list and perform (i) polynomial addition and (ii) polynomial multiplication.

PROGRAM

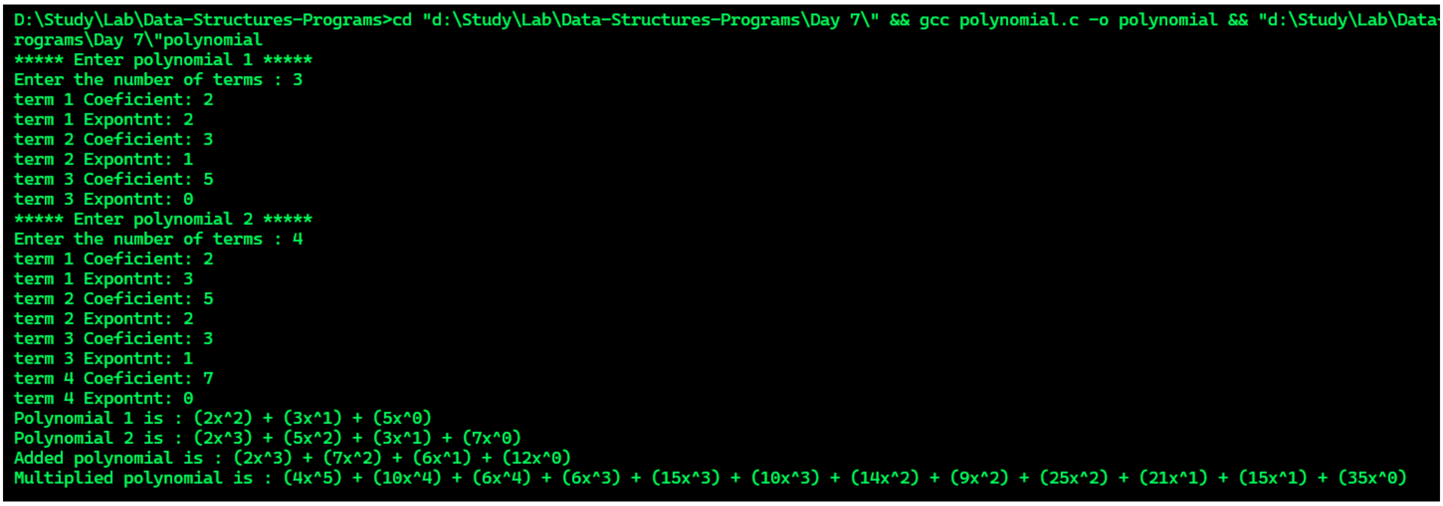
```
#include<stdio.h>
#include<stdlib.h>

struct node
{
    int coef;
    int expo;
    struct node *link;
};

struct node *create(struct node *);
struct node *insert_s(struct node *,int,int);
struct node *insert(struct node *,int,int);
void display(struct node *ptr);
void poly_add(struct node *,struct node *);
void poly_mult(struct node *,struct node *);

void main( )
{

    struct node *start1=NULL,*start2=NULL;

    printf("***** Enter polynomial 1 *****\n");
    start1=create(start1);

    printf("***** Enter polynomial 2 *****\n");
    start2=create(start2);

    printf("Polynomial 1 is : ");
    display(start1);

    printf("Polynomial 2 is : ");
    display(start2);

    poly_add(start1, start2);

    poly_mult(start1, start2);

}
```



```c
//structure - create
struct node *create(struct node *start)
{

    int i,n,ex;
    int co;

    printf("Enter the number of terms : ");
    scanf("%d",&n);

    for(i=1;i<=n;i++)
    {

        printf("term %d Coeficient: ",i);
        scanf("%d",&co);

        printf("term %d Expontnt: ",i);
        scanf("%d",&ex);
        start=insert_s(start,co,ex);

    }

    return start;

}

//structure - insert
struct node *insert_s(struct node *start,int co,int ex)
{

    struct node *ptr,*tmp;

    tmp=(struct node *)malloc(sizeof(struct node));
    tmp->coef=co;
    tmp->expo=ex;

    //list empty or exp greater than first one
    if(start==NULL || ex > start->expo)
    {

        tmp->link=start;
        start=tmp;

    }
    else
    {

        ptr=start;

        while(ptr->link!=NULL && ptr->link->expo >= ex)
        ptr=ptr->link;
        tmp->link=ptr->link;
        ptr->link=tmp;
    }

    return start;

}

//structure - insert
struct node *insert(struct node *start,int co,int ex)
{
    struct node *ptr,*tmp;

    tmp=(struct node *)malloc(sizeof(struct node));
    tmp->coef=co;
    tmp->expo=ex;

    //If list is empty
    if(start==NULL)
    {

        tmp->link=start;
        start=tmp;

    }
    else /*Insert at the end of the list*/
    {

        ptr=start;

        while(ptr->link!=NULL)
        ptr=ptr->link;
        tmp->link=ptr->link;
        ptr->link=tmp;
    }
    return start;
}

//display
void display(struct node *ptr)
{

    if(ptr==NULL)
    {

        printf("Zero polynomial\n");
        return;

    }

    while(ptr!=NULL)
    {

        printf("(%dx^%d)", ptr->coef,ptr->expo);
        ptr=ptr->link;
        if(ptr!=NULL)
        printf(" + ");

        else
        printf("\n");
    }

}


void poly_add(struct node *p1,struct node *p2)
{

    struct node *start3;
    start3=NULL;

    while(p1!=NULL && p2!=NULL)
    {

    if(p1->expo > p2->expo)
    {
    start3=insert(start3,p1->coef,p1->expo);
    p1=p1->link;
    }

    else if(p2->expo > p1->expo)
    {
    start3=insert(start3,p2->coef,p2->expo);
    p2=p2->link;
    }

    else if(p1->expo==p2->expo)
    {
    start3=insert(start3,p1->coef+p2->coef,p1->expo);
    p1=p1->link;
    p2=p2->link;
    }
    }

    /*if poly2 has finished and elements left in poly1*/
    while(p1!=NULL)
    {
    start3=insert(start3,p1->coef,p1->expo);
    p1=p1->link;
    }

    /*if poly1 has finished and elements left in poly2*/
    while(p2!=NULL)
    {
    start3=insert(start3,p2->coef,p2->expo);
    p2=p2->link;
    }

    printf("Added polynomial is : ");
```

```c
    display(start3);
}

void poly_mult(struct node *p1, struct node *p2)
{
 struct node *start3;
 struct node *p2_beg = p2;
 start3=NULL;

 if(p1==NULL || p2==NULL)
 {
 printf("Multiplied polynomial is zero polynomial\n");
 return;
 }

 while(p1!=NULL)
 {
 p2=p2_beg;

 while(p2!=NULL)
 {
 start3=insert_s(start3,p1->coef*p2->coef,p1->expo+p2->expo);
 p2=p2->link;
 }

 p1=p1->link;

 }

 printf("Multiplied polynomial is : ");
 display(start3);
}
```

OUTPUT



```
D:\Study\Lab\Data-Structures-Programs>cd "d:\Study\Lab\Data-Structures-Programs\Day 7\" && gcc polynomial.c -o polynomial && "d:\Study\Lab\Data-
rograms\Day 7\"polynomial
***** Enter polynomial 1 *****
Enter the number of terms : 3
term 1 Coeficient: 2
term 1 Expontnt: 2
term 2 Coeficient: 3
term 2 Expontnt: 1
term 3 Coeficient: 5
term 3 Expontnt: 0
***** Enter polynomial 2 *****
Enter the number of terms : 4
term 1 Coeficient: 2
term 1 Expontnt: 3
term 2 Coeficient: 5
term 2 Expontnt: 2
term 3 Coeficient: 3
term 3 Expontnt: 1
term 4 Coeficient: 7
term 4 Expontnt: 0
Polynomial 1 is : (2x^2) + (3x^1) + (5x^0)
Polynomial 2 is : (2x^3) + (5x^2) + (3x^1) + (7x^0)
Added polynomial is : (2x^3) + (7x^2) + (6x^1) + (12x^0)
Multiplied polynomial is : (4x^5) + (10x^4) + (6x^4) + (6x^3) + (15x^3) + (10x^3) + (14x^2) + (9x^2) + (25x^2) + (21x^1) + (15x^1) + (35x^0)
```