Polynomial Representation Using Arrays

Array representation assumes that the exponents of the given expression are arranged from 0 to the highest value (degree), which is represented by the subscript of the array beginning with 0. The coefficients of the respective exponent are placed at an appropriate index in the array. Consider The array representation for the below polynomial expression P(x) = $x^2 - 4x + 7$:

Addition of Two Polynomial

For adding two polynomials using arrays is straightforward method, since both the arrays may be added up element wise beginning from 0 to n-1, resulting in addition of two polynomials.

Consider below program to understand addition of two polynomial

```
#include<stdio.h>
#include<math.h>
/*
  This structure is used to store a polynomial term. An array of such terms
represents a   polynomial.
  The "coeff" element stores the coefficient of a term in the polynomial, while
  the "exp"   element stores the exponent.
*/
struct poly
{
    float coeff;
    int exp;
};
//declaration of polynomials
struct poly a[50],b[50],c[50];


int main()
{
   int i;
  int deg1,deg2;        //stores degrees of the polynomial
   int k=0,l=0,m=0;
   printf("Enter the highest degree of polynomial1:");
   scanf("%d",&deg1);        //taking polynomial terms from the user
   for(i=0;i<=deg1;i++)
   {
```

```
    //entering values in coefficient of the polynomial terms
    printf("\nEnter the coeff of x^%d :",i);
    scanf("%f",&a[i].coeff);
    //entering values in exponent of the polynomial terms
    a[k++].exp = i;
}
//taking second polynomial from the user
printf("\nEnter the highest degree of polynomial2:");
scanf("%d",&deg2);
for(i=0;i<=deg2;i++)
{
    printf("\nEnter the coeff of x^%d :",i);
    scanf("%f",&b[i].coeff);
    b[l++].exp = i;
}
//printing first polynomial
printf("\n Expression 1 = %.1f",a[0].coeff);
for(i=1;i<=deg1;i++)
{
    printf("+ %.1fx^%d",a[i].coeff,a[i].exp);
}
//printing second polynomial
printf("\nExpression 2 = %.1f",b[0].coeff);
for(i=1;i<=deg2;i++)
{
     printf("+ %.1fx^%d",b[i].coeff,b[i].exp);
}
//Adding the polynomials
if(deg1>deg2)
{
    for(i=0;i<=deg2;i++)
    {
        c[m].coeff = a[i].coeff + b[i].coeff;                c[m].exp = a[i].exp;
        m++;
    }
```

```
    for(i=deg2+1;i<=deg1;i++)
    {
        c[m].coeff = a[i].coeff;
        c[m].exp = a[i].exp;
        m++;
    }
  }
  else
  {
    for(i=0;i<=deg1;i++)
    {
        c[m].coeff = a[i].coeff + b[i].coeff;
        c[m].exp = a[i].exp;
        m++;
    }
    for(i=deg1+1;i<=deg2;i++)
    {
        c[m].coeff = b[i].coeff;
        c[m].exp = b[i].exp;
         m++;
    }
  }
  //printing the sum of the two polynomials
  printf("\nExpression after addition  = %.1f",c[0].coeff);
  for(i=1;i<m;i++)
  {
    printf("+ %.1fx^%d",c[i].coeff,c[i].exp);
  }
return 0;
}
```

On compiling and executing above program, following is the output produced :

```
Enter the highest degree of polynomial1:3
Enter the coeff of x^0 :2
Enter the coeff of x^1 :3
```

```
Enter the coeff of x^2 :5
Enter the coeff of x^3 :1
Enter the highest degree of polynomial2:2
Enter the coeff of x^0 :7
Enter the coeff of x^1 :8
Enter the coeff of x^2 :5
Expression 1 = 2.0+ 3.0x^1+ 5.0x^2+ 1.0x^3
Expression 2 = 7.0+ 8.0x^1+ 5.0x^2
Expression after addition  = 9.0+ 11.0x^1+ 10.0x^2+ 1.0x^3
```