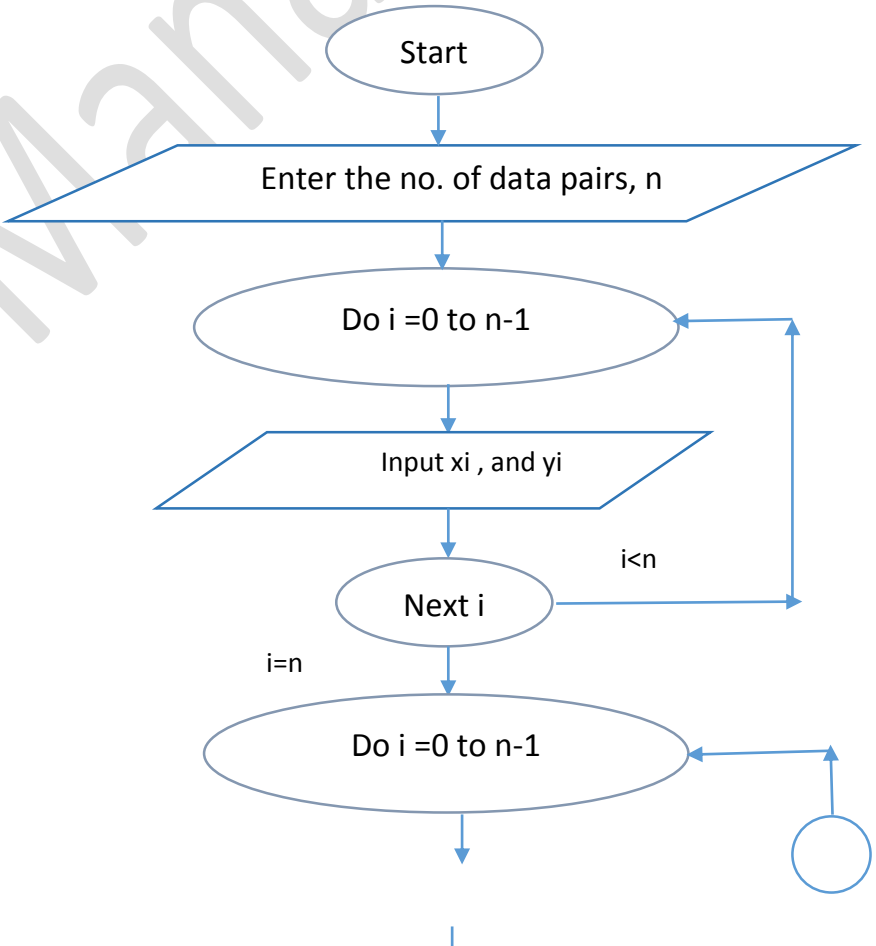
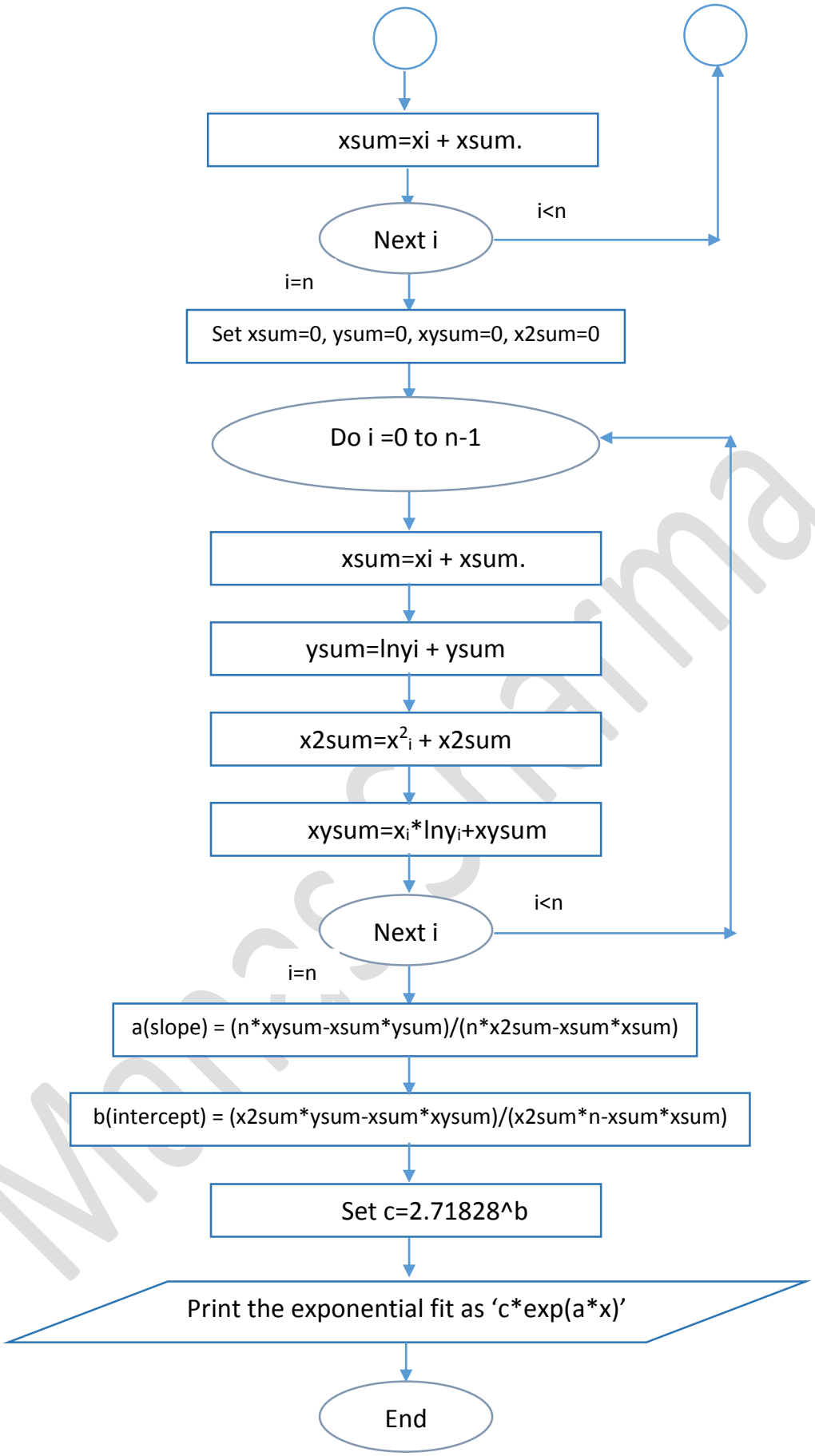
Aim: To find the best exponential fit for a given set of data.

Algorithm:

1. Enter the no. of data pairs, n.
2. Create three arrays, 'x', 'y', and 'lny' of size n.
3. Begin For i=0 to n-1
   Input x_i , and y_i.
   End for.
4. Begin For i=0 to n-1
   $lny_i=log_e y_i$
   End For
5. Set xsum=0, ysum=0, xysum=0, x2sum=0.
6. Begin For i=0 to n-1
   xsum=xi + xsum.
   ysum=lnyi + ysum.
   $x2sum=x^2_i$ + x2sum.
   $xysum=x_i*lny_i$+xysum.
   End for.
7. Set a(slope) = (n*xysum-xsum*ysum)/(n*x2sum-xsum*xsum).
8. Set b(intercept) = (x2sum*ysum-xsum*xysum)/(x2sum*n-xsum*xsum).
9. Set c=2.71828^b.
10. Print the exponential fit as 'c*exp(a*x)'.
11. End.

Flow Chart:




xsum=xi + xsum.
Next i
i<n
i=n
Set xsum=0, ysum=0, xysum=0, x2sum=0
Do i =0 to n-1
xsum=xi + xsum.
ysum=lnyi + ysum
x2sum=x2i + x2sum
xysum=xi*lnyi+xysum
Next i
i<n
i=n
a(slope) = (n*xysum-xsum*ysum)/(n*x2sum-xsum*xsum)
b(intercept) = (x2sum*ysum-xsum*xysum)/(x2sum*n-xsum*xsum)
Set c=2.71828^b
Print the exponential fit as 'c*exp(a*x)'
End

Program:

```
//Exponential Fit
#include<iostream>
#include<iomanip>
#include<cmath>
using namespace std;
int main()
{
   int i,j,k,n;
   cout<<"\nEnter the no. of data pairs to be entered:\n";       //To find the size of arrays
   cin>>n;
   double x[n],y[n],lny[n],a,b,c;
   cout<<"\nEnter the x-axis values:\n";              //Input x-values(observed)
   for (i=0;i<n;i++)
      cin>>x[i];
   cout<<"\nEnter the y-axis values:\n";              //Input y-values(observed)
   for (i=0;i<n;i++)
      cin>>y[i];
   for (i=0;i<n;i++)                    //Calculate the values of ln(yi)
      lny[i]=log(y[i]);
   double xsum=0,x2sum=0,ysum=0,xysum=0;              //variables for sums/sigma of xi,yi,xi^2,xiyi etc
   for (i=0;i<n;i++)
   {
      xsum=xsum+x[i];                    //calculate sigma(xi)
      ysum=ysum+lny[i];                  //calculate sigma(yi)
      x2sum=x2sum+pow(x[i],2);           //calculate sigma(x^2i)
      xysum=xysum+x[i]*lny[i];           //calculate sigma(xi*yi)
   }
   a=(n*xysum-xsum*ysum)/(n*x2sum-xsum*xsum);          //calculate slope(or the the power of exp)
   b=(x2sum*ysum-xsum*xysum)/(x2sum*n-xsum*xsum);          //calculate intercept
   c=pow(2.71828,b);                  //since b=ln(c)
   double y_fit[n];                   //an array to store the new fitted values of y
   for (i=0;i<n;i++)
      y_fit[i]=c*pow(2.71828,a*x[i]);                 //to calculate y(fitted) at given x points
   cout<<"S.no"<<setw(5)<<"x"<<setw(19)<<"y(observed)"<<setw(19)<<"y(fitted)"<<endl;
   cout<<"-----------------------------------------------------------------\n";
   for (i=0;i<n;i++)
      cout<<i+1<<"."<<setw(8)<<x[i]<<setw(15)<<y[i]<<setw(18)<<y_fit[i]<<endl;//print a table of
x,y(obs.) and y(fit.)
   cout<<"\nThe corresponding line is of the form:\n\nlny = "<<a<<"x + ln"<<b<<endl;
   cout<<"\nThe exponential fit is given by:\ny = "<<c<<"e^"<<a<<"x\n";
   return 0;
}
```

Output:

```
Enter the no. of data pairs to be entered:
4

Enter the x-axis values:
0       1       2       3

Enter the y-axis values:
1.05    2.10    3.85    8.30
S.no    x        y(observed)          y(fitted)
---------------------------------------------------------
1.       0           1.05            1.0434
2.       1            2.1            2.0613
3.       2           3.85           4.07223
4.       3            8.3           8.04493

The corresponding line is of the form:

lny = 0.680853x + ln0.0424843

The exponential fit is given by:
y = 1.0434e^0.680853x
```