Okay, so the following is a code for fitting a polynomial to a given set of data using the Least Squares Approximation Method(Wikipedia).

Formula Used:

$$\begin{bmatrix} N & \Sigma x_i & \Sigma x_i^2 & \dots & \Sigma x_i^n \\ \Sigma x_i & \Sigma x_i^2 & \Sigma x_i^3 & \dots & \Sigma x_i^{n+1} \\ \Sigma x_i^2 & \Sigma x_i^3 & \Sigma x_i^4 & \dots & \Sigma x_i^{n+2} \\ & \vdots & & & \vdots \\ \Sigma x_i^n & \Sigma x_i^{n+1} & \Sigma x_i^{n+2} & \dots & \Sigma x_i^{2n} \end{bmatrix} \begin{bmatrix} a \end{bmatrix} = \begin{bmatrix} \Sigma y_i \\ \Sigma x_i y_i \\ \Sigma x_i^2 y_i \\ \vdots \\ \Sigma x_i^n y_i \end{bmatrix}$$

where x_i and y_i are the data-points entered by the user.

I had written a C++ and C code for this a long time ago, and coincidentally it got very popular for some reason. But then I felt the need to make an Android app that does the same.

So I ported my code to JAVA so that it works in my Android App.

Let's say you have *x*-axis values and y-axis values in two double arrays called x[] and y[] of size N(no. of data points). You can either have the user enter them or have them imported from a CSV. It's your call.
Then you need to have the user enter the degree(order) of the polynomial to use to fit the curve.
Note: If you have *n* data-points, then an *n-1* degree polynomial will interpolate your data (fit your data perfectly).

The following information is required:

```
int n;                      //degree of polynomial to fit the data
int N;                      //no. of data points
double[] x=double[];        //array to store x-axis data points
double[] y=double[];        //array to store y-axis data points
```

Once you have all the values for x[], y[], n, and N, the following code will fit a polynomial of nth degree to the given set of data-points and return the coefficients of the polynomial in an array a[], such that a[0] is the coefficient of x^0 , a[1] is the coefficient of x^1,... and so on.

```
            double X[] = new double[2 * n + 1];
            for (int i = 0; i < 2 * n + 1; i++) {
                X[i] = 0;
                for (int j = 0; j < N; j++)
                    X[i] = X[i] + Math.pow(x[j], i);        //consecutive positions of
the array will store N,sigma(xi),sigma(xi^2),sigma(xi^3)....sigma(xi^2n)
            }
            double B[][] = new double[n + 1][n + 2], a[] = new double[n + 1];
//B is the Normal matrix(augmented) that will store the equations, 'a' is for value of
the final coefficients
            for (int i = 0; i <= n; i++)
                for (int j = 0; j <= n; j++)
                    B[i][j] = X[i + j];            //Build the Normal matrix by storing
the corresponding coefficients at the right positions except the last column of the
matrix
            double Y[] = new double[n + 1];                    //Array to store the
values of sigma(yi),sigma(xi*yi),sigma(xi^2*yi)...sigma(xi^n*yi)
```

```
            for (int i = 0; i < n + 1; i++) {
                Y[i] = 0;
                for (int j = 0; j < N; j++)
                    Y[i] = Y[i] + Math.pow(x[j], i) * y[j];        //consecutive
positions will store sigma(yi),sigma(xi*yi),sigma(xi^2*yi)...sigma(xi^n*yi)
            }
            for (int i = 0; i <= n; i++)
                B[i][n + 1] = Y[i];                //load the values of Y as the last
column of B(Normal Matrix but augmented)
            n = n + 1;
            for (int i = 0; i < n; i++)                    //From now Gaussian
Elimination starts(can be ignored) to solve the set of linear equations (Pivotisation)
                for (int k = i + 1; k < n; k++)
                    if (B[i][i] < B[k][i])
                        for (int j = 0; j <= n; j++) {
                            double temp = B[i][j];
                            B[i][j] = B[k][j];
                            B[k][j] = temp;
                        }

            for (int i = 0; i < n - 1; i++)            //loop to perform the gauss
elimination
                for (int k = i + 1; k < n; k++) {
                    double t = B[k][i] / B[i][i];
                    for (int j = 0; j <= n; j++)
                        B[k][j] = B[k][j] - t * B[i][j];    //make the elements below
the pivot elements equal to zero or elimnate the variables
                }
            for (int i = n - 1; i >= 0; i--)                //back-substitution
            {                        //x is an array whose values correspond to the
values of x,y,z..
                a[i] = B[i][n];                //make the variable to be calculated
equal to the rhs of the last equation
                for (int j = 0; j < n; j++)
                    if (j != i)            //then subtract all the lhs values except
the coefficient of the variable whose value                                   is being
calculated
                        a[i] = a[i] - B[i][j] * a[j];
                a[i] = a[i] / B[i][i];            //now finally divide the rhs by the
coefficient of the variable to be calculated
            }
```

Well, that's it. The array a[] contains the coefficients such that a[i]=coefficient of x^i.

To understand the theory behind this, refer to this link.

Hope you guys find it useful!
If you have any questions/doubts, hit me up in the comments section below.

You can refer to the following links for more info:

Polynomial Fitting – C Program
Polynomial Fitting – C++ Program
Linear Fitting – Lab Write-Up
Linear Fitting – C++ Program
Linear Fitting – Scilab Code
Curve Fit Tools – Android App (using the above code)
Curve Fit Tools – Documentation
Curve Fit Tools – Play Store
Curve Fit Tools – GitHub Repository
Curve Fitters – Scilab Toolbox

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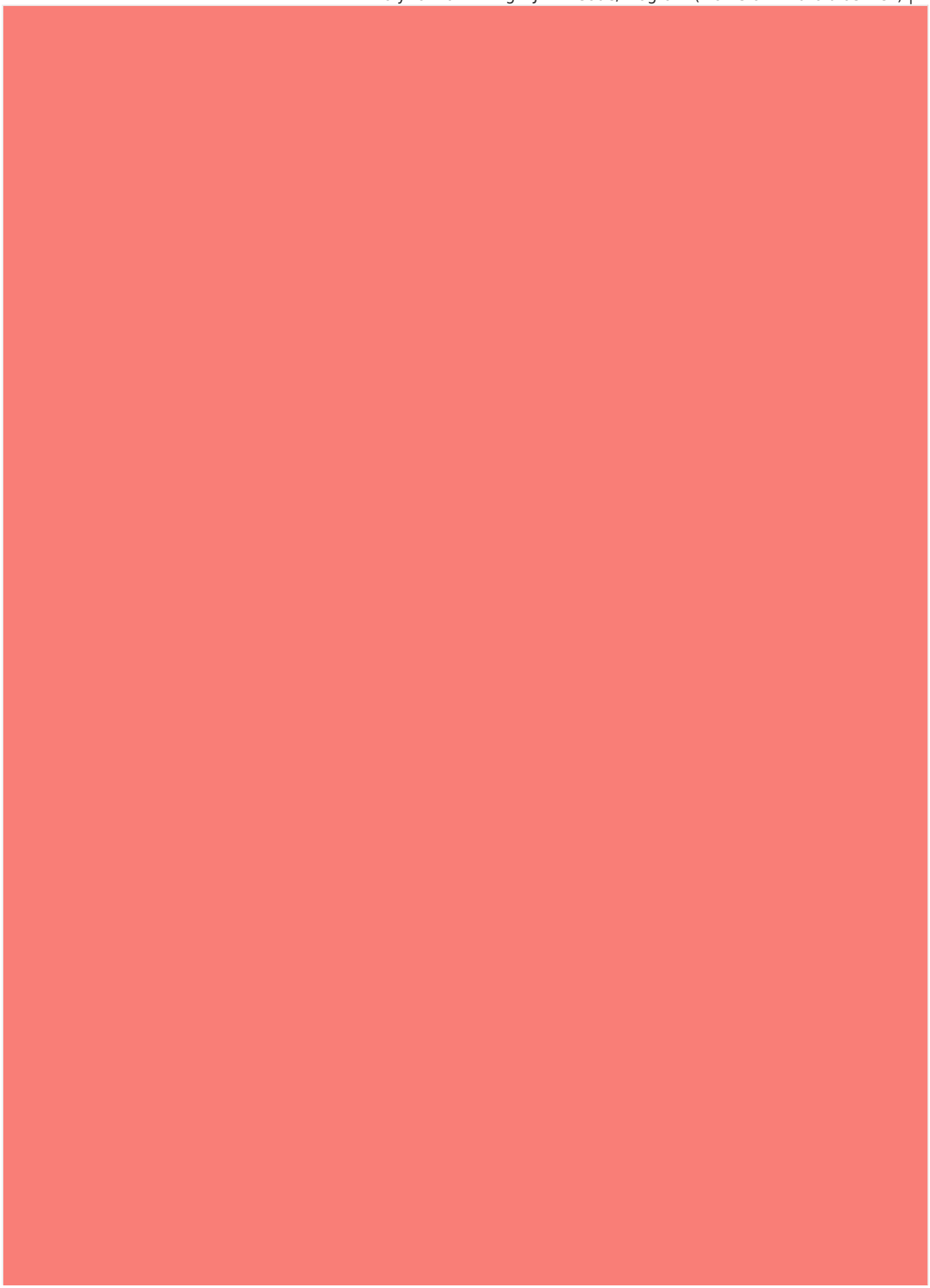

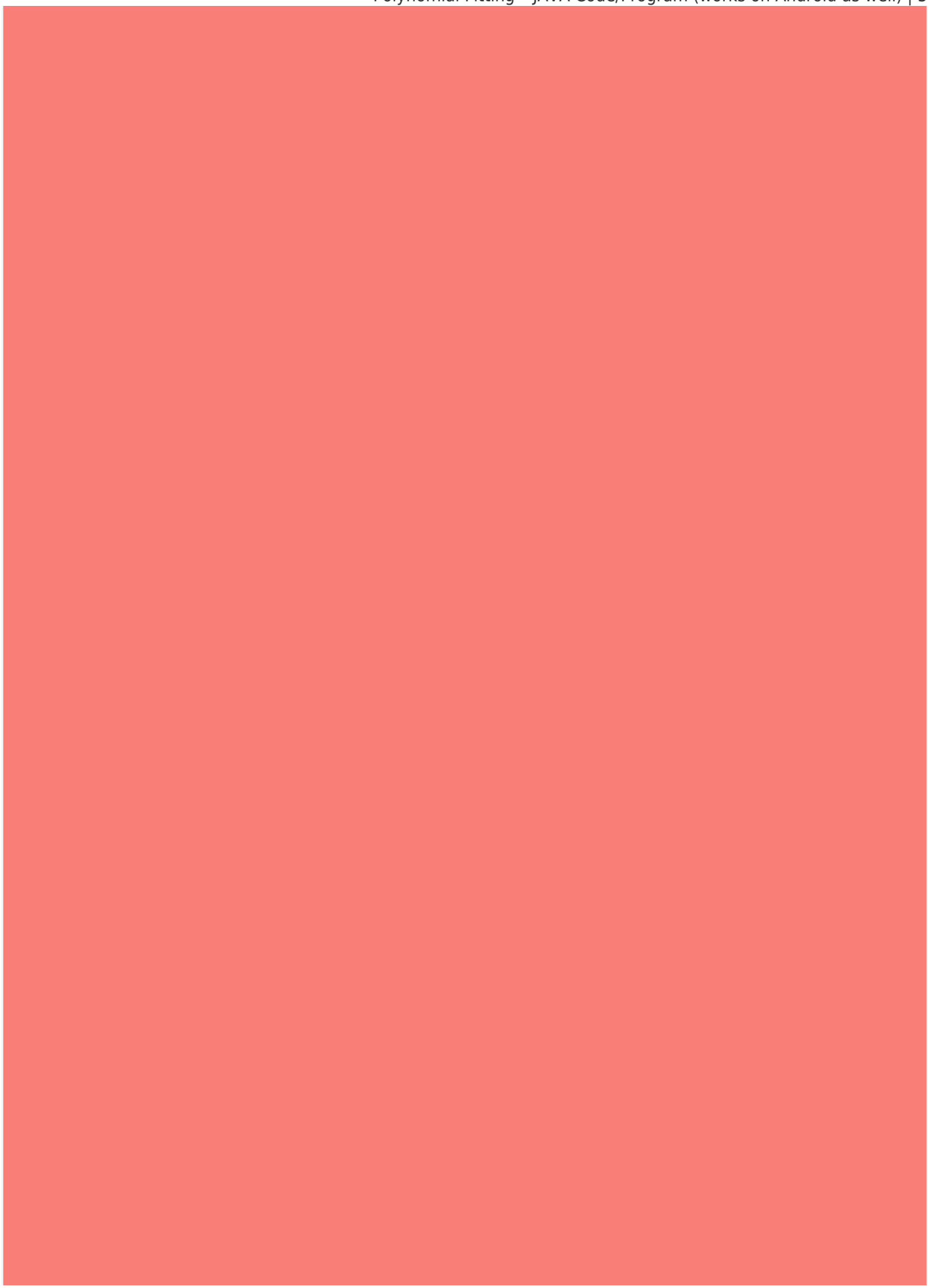

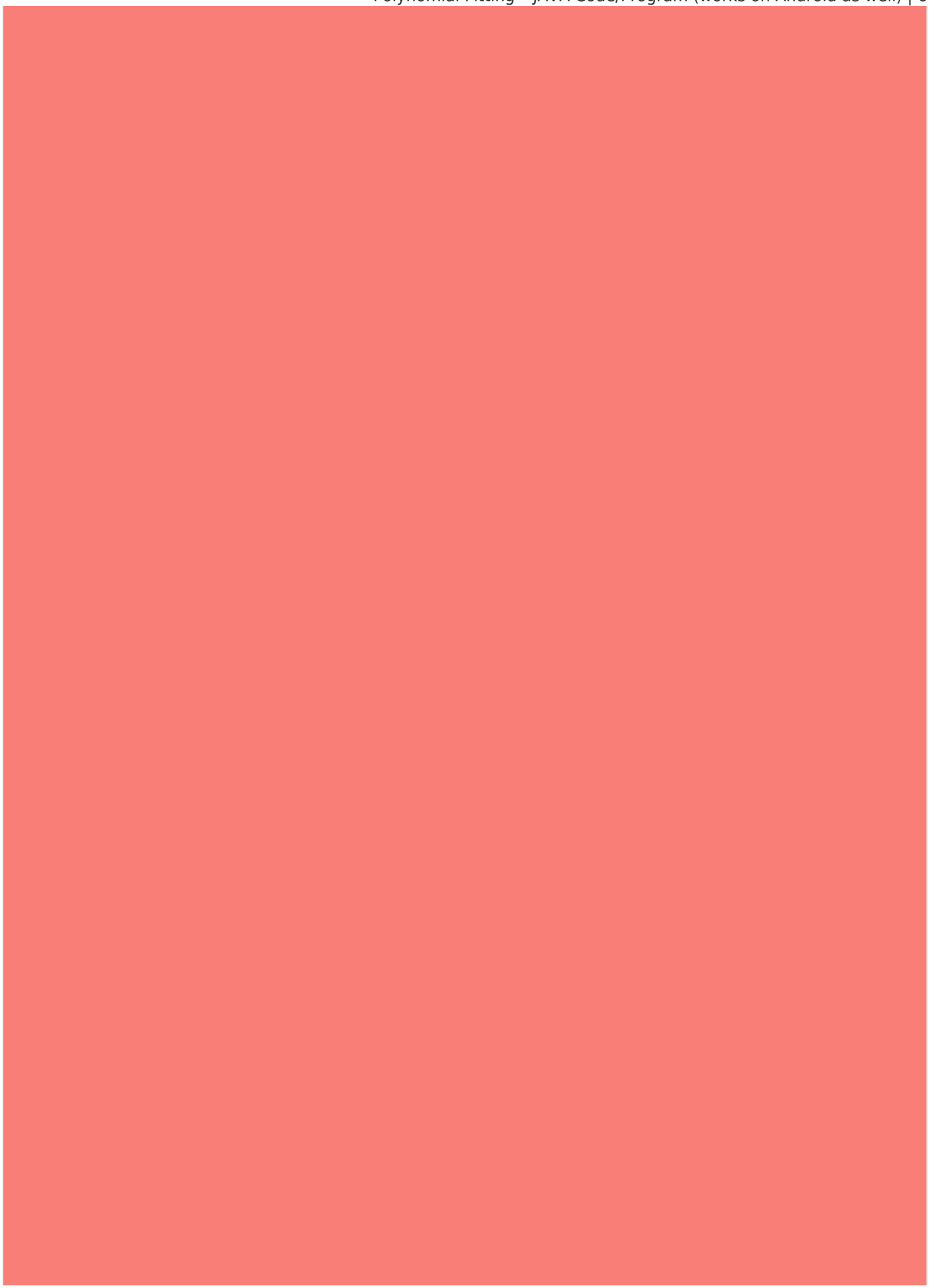

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