```
% Compute the weighted least squares solution using the diagonal Gaussian
% weight with t = 1/23
clear all
close all

tex = 1/23;
delta = 1;

%exact approximation
fex = cos(4*tex);

%Guassian function
w = @(t,tj,delta) exp(-(abs(t - tj)/delta).^2);

%m equally spaced points over [0,1]
m = 50; n=12;

% Vandermonde matrix t
t = zeros(m,n);
for i = 1:n
    for j = 1:m
        t(j,i) = ((j-1)/(m-1))^(n-i);
    end
end

%fliping the vandermonde matrix t to form A
A = fliplr(t);

%fuction f
tj = zeros(m,1);
for j = 1:m
    tj(j) = (j-1)/(m-1);

end

f = cos(4*tj);

%Compute the weighted least square Using the Diagonal Gaussian  weight, W
W = diag(w(tex,tj,delta));

format long
%Report the polynomial coefficients of the weighted least squares solution.
fprintf('Polynomial coefficients of the weighted least squares solution \n');
[qw,rw] = qr(W*A); xw = rw\(qw'*(W*f))

%Non Weighted least squares solution xh
fprintf('Polynomial coefficeients non weighted least squares solution \n');
[q,r] = qr(A); xh = r\(q'*f)

%Report the value of the polynomial with these coefficients at t =1/23
% Vandermonde matrix t
tc = zeros(m,n);
for i = 1:n
    for j = 1:m
        tc(j,i) = (1/23)^(n-i);
    end
end

%fliping the vandermonde matrix t to form A
Ac = fliplr(tc);

%value of the polynomial at t =1/23
pw = Ac*xw; pw(11);
fprintf('Polynomial value computed using weighted coeffieients:')
disp(pw(11));

%Compare these coefficients
%for non weighted coefficients
pnonw = Ac*xh; pnonw(11);
fprintf('Polynomial value computed using non-weighted coeffieients:');
disp(pnonw(11));
fprintf('Exact Polynomial value computed directly:')
disp(fex)
%Which method provides better approximation?
fprintf('Comparing the three polynomial values, its clear that the onw computed with the weighted \n coefficients best approximates the polynomial com
```

```
Polynomial coefficients of the weighted least squares solution

xw =

   1.000000000624414
  -0.000000284232230
  -7.999986974996736
  -0.000227372752382
  10.668683630048903
  -0.010250539427060
  -5.657718013285455
```

```
  -0.054936278918560
   1.668544782170136
   0.025157808795187
  -0.382483093694967
   0.089572717334469

Polynomial coefficeients non weighted least squares solution

xh =

   1.000000000996605
  -0.000000422742916
  -7.999981235689359
  -0.000318763182124
  10.669430795534385
  -0.013820286397571
  -5.647075631757315
  -0.075316016420060
   1.693606954334381
   0.006032115361104
  -0.374241706147935
   0.088040576549043

Polynomial value computed using weighted coeffieients:   0.984915205139420

Polynomial value computed using non-weighted coeffieients:   0.984915205008979

Exact Polynomial value computed directly:   0.984915205128733

Comparing the three polynomial values, its clear that the onw computed with the weighted
 coefficients best approximates the polynomial compared to the one computed with non-weighted coefficients.
```

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