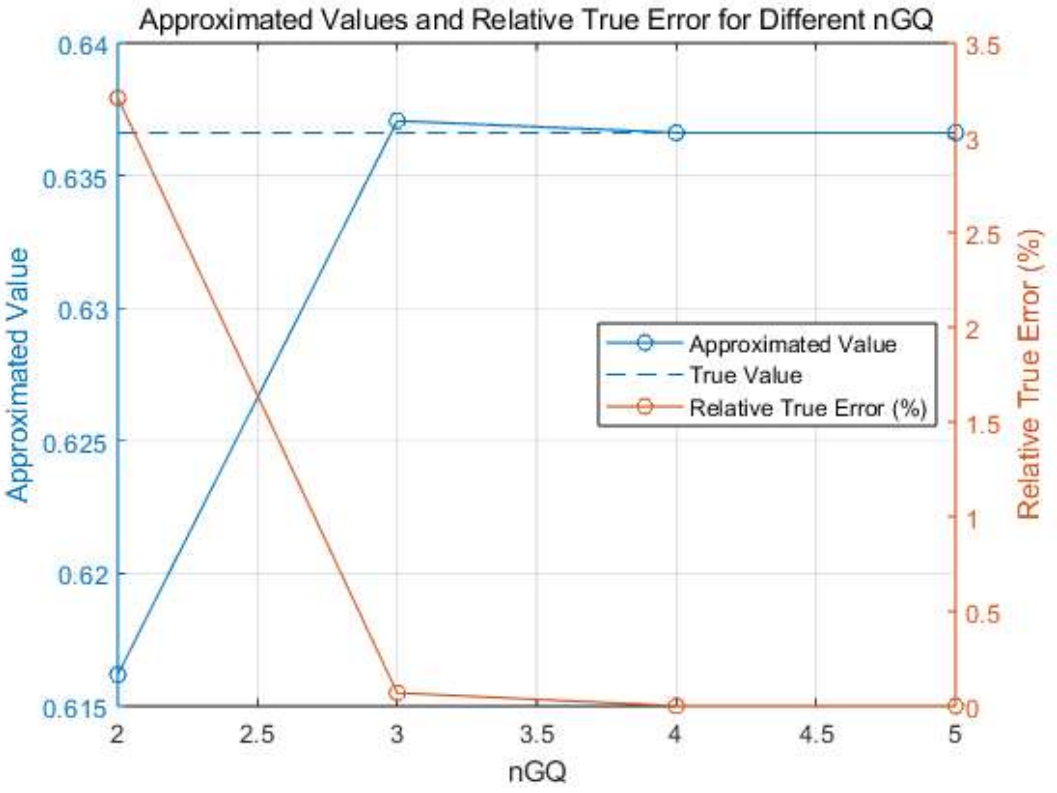
```
clc;
clear;
close all;
format long;

% 조건
a = 0;
b = 1;
f = @(x) sin(pi * x);


% nGQ에 따른 error를 비교하기 위한 코드 (line 12 : line 46, 삭제해도 무방)

nGQ_values = 2:5;
true_value = 2 / pi;


approx_values = zeros(size(nGQ_values));
relative_errors = zeros(size(nGQ_values)); %relative error로 시각화

for idx = 1:length(nGQ_values)
    nGQ = nGQ_values(idx);
    [points, weights] = GQref1D(nGQ);

    approx_values(idx) = GQintegral1D(f,a,b,nGQ);

    relative_errors(idx) = abs(true_value - approx_values(idx)) / (true_value) * 100;
end

% 그래프 플로팅
figure;

yyaxis left;
plot(nGQ_values, approx_values, '-o', 'DisplayName', 'Approximated Value');
ylabel('Approximated Value');
hold on;
plot(nGQ_values, repmat(true_value, 1, numel(nGQ_values)), '--', 'DisplayName', 'True Value');

yyaxis right;
plot(nGQ_values, relative_errors, '-o', 'DisplayName', 'Relative True Error (%)');
ylabel('Relative True Error (%)');

title('Approximated Values and Relative True Error for Different nGQ');
xlabel('nGQ');
legend('show', 'Location', 'east');
grid on;



% Assignment

function [points, weights] = GQref1D(nGQ) %점과 가중치를 반환
switch nGQ
    case 1
        weights = 0;
        points = 2;
    case 2
        weights = [1,1];
        points = [-0.5773502691896257,  0.5773502691896257];
    case 3
        weights = [0.8888888888888888, 0.5555555555555556, 0.5555555555555556];
        points = [0, -0.7745966692414834, 0.7745966692414834];
```

```
    case 4
        weights = [0.6521451548625461, 0.6521451548625461, 0.3478548451374538, 0.3478548451374538];
        points = [-0.3399810435848563, 0.3399810435848563, -0.8611363115940526, 0.8611363115940526];
    case 5
        weights = [0.5688888888888889, 0.4786286704993665, 0.4786286704993665, 0.2369268850561891, 0.2369268850561891];
        points = [0, -0.5384693101056831, 0.5384693101056831, -0.9061798459386640, 0.9061798459386640];

end
end



function approx_values = GQintegral1D(f,a,b,nGQ) % f is function; a,b is bound; nGQ determine points, weights
[points, weights] = GQref1D(nGQ);

%GQ를 계산하는 부분
approx_values = ( (b-a)/2 ) * sum(weights .* f( ( (b - a) / 2 * points ) + ( (a + b) / 2) ) );

end
```



Published with MATLAB® R2023b