

Lab Assignment 6

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QUESTION 1

Initialization

```
numSteps = 50;
stepSize = 2/numSteps;
xValues = -1 + stepSize : stepSize : 1 - stepSize;
matrixG = diag(2.*ones(numSteps-1,1)) + diag(-1.*ones(numSteps-2, 1), 1) + diag(-1.*ones(numSteps-2, 1), -1);
vectorG = computeFunctionG(xValues)';
maxIterations = 1000;
vectorB = - matrixG * vectorG;
residual = ones(numSteps-1, 1);
solutionX = ones(numSteps-1, 1);
relaxationParameter = 1;
```

Iterative calculations

```
for iteration = 2:maxIterations
    for idx = 1:numSteps-1
        residual(idx) = vectorB(idx) - 2 * solutionX(idx);

        % Adjust residual based on idx's position
        if idx == 1
            residual(idx) = residual(idx) + solutionX(idx+1);
        elseif idx == numSteps-1
            residual(idx) = residual(idx) + solutionX(idx-1);
        else
            residual(idx) = residual(idx) + solutionX(idx-1) + solutionX(idx+1);
        end

        previousX = solutionX(idx);
        solutionX(idx) = max(0, previousX + relaxationParameter * residual(idx) / 2);
        correctionY(idx) = -residual(idx) + 2 * (solutionX(idx) - previousX);
    end
end

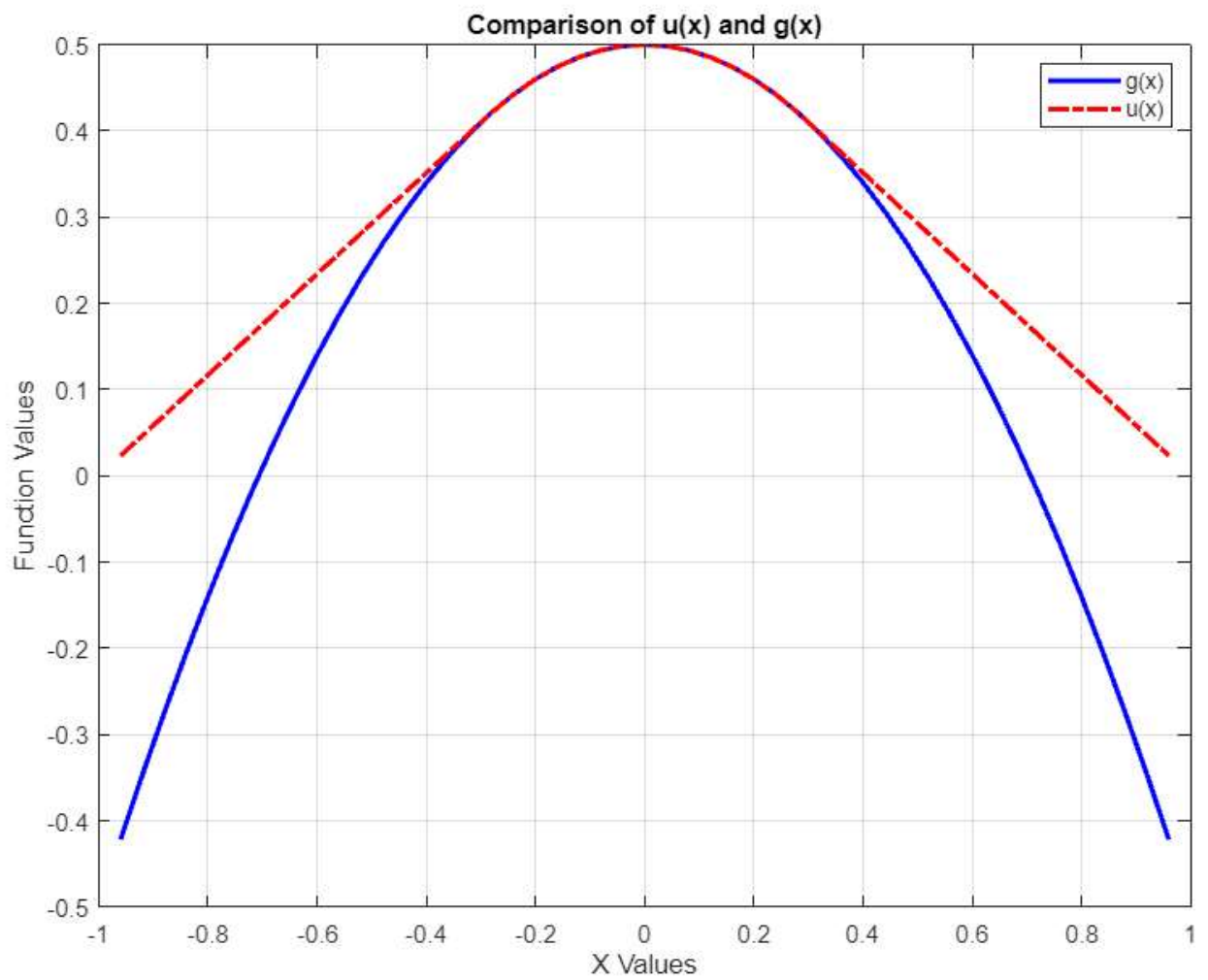
% Calculate resultVector and plot results
resultVector = vectorG + solutionX;
```

Plotting the graphs

```
figure('Position', [100, 100, 800, 600]);
plot(xValues, vectorG, 'b', 'LineWidth', 2); % blue curve for vectorG
hold on;
plot(xValues, resultVector, 'r-.', 'LineWidth', 2); % red dashed-dot curve for resultVector

% plot with labels, title, and legend
xlabel('X Values');
ylabel('Function Values');
title('Comparison of u(x) and g(x)');
legend('g(x)', 'u(x)');
grid on; % Displaying a grid for better readability

hold off;
```



Function definition

```
function output = computeFunctionG(inputX)
    output = 0.5 - inputX .* inputX;
end
```