HW3 Solution Highlights

Algorithm

As the central parts of your algorithm, there should be one function for the Newton's method and another function for the bisection or golden section method.

The bisection method and golden section method are slower than Newton's method, but more stable and robust. The Newton's method is faster, but does not always work well. In our assignment two problems related to the convergence of the approach and the speed of the convergence are required to be handled inside your function, which are:

1) Divergence
2) Slow convergence

The conditions to check for the detection of the two problems are listed in the problem statement. As you might notice, there are two ways mentioned for the detection of slow convergence, i.e., "a simple way" and "a better way". Either way is all right for our grading purpose.

To rectify the situations, you have to switch to the bisection/golden section method as the first step. After that, for divergence problem, you need to switch back to the Newton's method after several bisection/golden section steps. For slow convergence problem, no switching back is required.

Use your code

The function $f(x)=x^5/5+5x^4/2+35x^3/3+25x^2+24x$ has four extremes, while two of them are minima and the other two are maxima. In order to find all the max and min, you have two choices:

1) Split the original interval manually to make each resulted interval only contain one min/max. For our current f(x), you can solve the problem analytically first and then invoke your code with the 4 intervals obtained from the analytical result.
2) Build some intelligence in your code to adjust search interval automatically, which will handle multiple min/max points with a given larger interval containing all possible min/max points. This is more challenging and is not required for our assignment.

If your code is designed to find minima only, you need to use $-f(x)$ in order to find maxima.

Common error

- Didn't check for divergence condition or slow-convergence condition in the Newton's method.
- Didn't switch back to the Newton's method after switching to bisection method in case of divergence situation in the Newton's method.
- Didn't break down the initial bracketing interval for Part III.