Math 481a, Fall 2005

Project 1. The root finding problem

Due October 21, 2005

Problem 1: Compare performance of three algorithms: Newton's method, bisection method, and the fixed-point iteration method.

- Write a code implementing Newton's method, the bisection method, and the fixed-point method. Keep the programing in such a way as to be able to compare performance of the three methods on a selected function.
- Compare performance of each method on the following three root problems:

$$f(x) = 0, \quad \text{on} \quad [-0.9; 1], \quad \text{where} \quad f(x) = x^2 \sin x;$$

$$g(x) = 0, \quad \text{on} \quad [-0.9; 1], \quad \text{where} \quad g(x) = x^2 \sin x - x;$$

$$h(x) = 0, \quad \text{on} \quad [-0.9; 1], \quad \text{where} \quad h(x) = \sqrt[3]{x}.$$

- Write a report. Include results of your calculations with some minor comments, and justify the choice of examples. Attach the code.

Problem 2: Compare performance of Newton's method and Muller's method on the problem of finding roots of a polynomial with real coefficients by the method of deflation.

- Write a code implementing deflation method for finding all roots of a polynomial using a) Newton's method, b) Muller's method.
- On the example of $P(x) = x^2 + 1$, show that Newton's method can not produce complex roots when starts from real initial approximation.
- On the example of $P(x) = x^2 + 1$, show that Muller's method is not sensitive to a real initial approximation.
- Show that Newton's method gives correct roots of $P(x) = x^2+1$, is the initial approximation has a nonzero complex component.
- Write a report. Include results of the calculations done in previous items, add minor comments explaining the results. Attach the code.