Problem Set 3

Due date: Feb 05, 2021

Instructions: Hand-in is in electronic form via email. Please create a single PDF-file containing all your answers and results. Show the names and student numbers of the group members on top. Maximum 4 students can work in a group. Make use of figures and tables. The code should be well documented and readable. Have a look at Latex-Example_with_Matlab (on Olat) for how to include Matlab code in a Latex file. Pay attention to the use of mcode package.

Exercise 1: Univariate Problems

1. Code the Bisection algorithm for any function $f(x)$
2. Use bisection to compute the zeros of the functions
   - $f(x) = x^3 + 4 - \frac{1}{x}$
   - $f(x) = -\exp(-x) + \exp(-x^2)$
3. Code the Secant algorithm for any function $f(x)$
4. Use secant to compute the zeros of the functions
   - $f(x) = x^2 + 10 - \frac{1}{x}$
   - $f(x) = \exp(-x^2)$
5. Revisit the demand-supply example of problem set 1:

$$\mathbf{D}: \qquad p = a - b \cdot q \tag{1a}$$

$$\mathbf{S}: \qquad p = c + d \cdot q^{\psi} \tag{1b}$$

   where p is the price, q is the quantity, a, b, c, d, ψ are some parameters.

   - Write it as a univariate problem:

$$b \cdot q + d \cdot q^{\psi} - (a - c) = 0.$$

   - Parameterize the model with $a = 3$, $b = 0.5$, $c = d = 1$, $\psi = 0.5$. Compute the solution analytically.
   - Compute the solution with your bisection algorithm.
   - Compute the solution with the Matlab internal function `fzero`.

Exercise 2: A Contribution to the Empirics of Economic Growth

Consider the empirical analysis conducted in Mankiw, Romer, and Weil (1992): A Contribution to the Empirics of Economic Growth, in: *The Quarterly Journal of Economics*, Vol. 107(2), pp. 407-437.

> "This paper examines whether the Solow growth model is consistent with the international variation in the standard of living. It shows that an augmented Solow model that includes accumulation of human as well as physical capital provides an excellent description of the cross-country data. [...]"

1. Load the data set of Mankiw, Romer and Weil 1992 (file: `MRW92QJE-data.xls`). The data set contains the country number, a non-oil country dummy, an intermediate country dummy, an OECD country dummy, GDP per adult in 1960, GDP per adult in 1985, the annualized GDP growth rate, the annualized population growth rate, the average investment to GDP ratio, average secondary school enrollment rate. Delete countries with missing values (hint: after having loaded the data, check with `isnan`).

2. Generate sub-samples for non-oil countries, intermediate countries, and OECD countries (hint: test for equality ==).

3. For each sub-sample, compute the regression coefficients and respective standard errors for the following regression model

$$\log(gdp1985_j) - \log(gdp1960_j) = \beta_0 + \beta_1 \cdot log(gdp1960_j) + \beta_2 \cdot log(investment/gdp_j) + \\ \beta_3 \cdot log(popgrowth_j + g + \delta) + \beta_4 \cdot log(schoolenrol_j) + \epsilon_j$$

   where $g + \delta = 0.05$.

4. Provide a table with your results that is similar to Table V (p. 426) in the article. No need to replicate it exactly.