Name: _____

Date: _____

Collaborators: _____

(Collaborators submit their individually written assignments together)

New: if the submitted code is not runnable (e.g. because the project is not shared with the instructor, or because not all needed files have been uploaded, or because the code has not been tested in the first place, or for any other reason that has been under complete student's control, the homework grade is decreased by 10%.

Question:	1	2	3	4	Total
Points:	15	25	5	5	50
Score:					

Instructor/grader comments:

Boundary value problem for ODEs

1. (15 points) Let u represent the electrostatic potential between two concentric conducting spheres of radii r_1 and r_2, $(r_1 < r_2)$. The potential of the inner sphere is kept constant at $u(r_1) = V_1$, and the outer sphere is grounded, $u(r_2) = 0$. The potential in the region between the two spheres is governed by the following equation:

$$\frac{\mathrm{d}^2 u}{\mathrm{d}r^2} + \frac{2}{r}\frac{\mathrm{d}u}{\mathrm{d}r} = 0,$$

   Write a matlab script to find the numerical solution of the boundary value problem above using the Linear Shooting Algorithm. Assume the following numerical values of the parameters:

$$r_1 = 2 \text{ a.u.}, \quad r_2 = 4 \text{ a.u.}, \quad V_1 = 100 \text{ a.u.}.$$

   Use one of the matlab's own IVP solvers as a part of your method. Explain your choice in your README file.

   On the same figure plot your numerical solution as well as the analytical solution of the BVP,

$$u(r) = \frac{r_1}{r}\left(\frac{r_2 - r}{r_2 - r_1}\right)V_1.$$

2. (25 points) Use the Nonlinear Shooting Algorithm to approximate the solution to the boundary-value problem

$$y'' = -(y')^2 - y + \ln x, \quad 1 \le x \le 2, \quad y(1) = 0, \quad y(2) = \ln 2.$$

   Use one of the matlab's own IVP solvers as a part of your method Explain your choice in your README file.

   On the same figure plot your numerical solution as well as the analytical solution of the BVP,

$$y(x) = \ln x.$$

Gitlab

3. (5 points) Create a gitlab project called **hw09** (name it exactly as shown). Upload **all** required matlab code and create your readme file. Share the project with the instructor.

4. (5 points) Clearly describe your code design and your observations in the project's readme file.