Assignment 7

- Use either C/C++ or Python for your program.
- Include the solvers of differential equations in your library. Don't re-write them in your main program.
- Append your final results, *i.e.* just the answer, at the end of the codes as usual.
- Take four step sizes "dx" or "dt", as the case may be, of your choice ranging from coarse (say, 0.5) to fine (say, 0.02). Plot the solutions together with the analytical solutions, if exist.
- Take $e = 2.71828$.
- No appended results $= -1$; no plots $= -1$

1. Use explicit Euler's mathod to solve equations (1) and (2) **[3]**

$$\frac{dy}{dx} = \frac{y \ln y}{x}, \quad \text{where} \quad y(2) = e \tag{1}$$

$$\frac{dy}{dx} = 6 - \frac{2y}{x}, \quad \text{where} \quad y(3) = 1 \tag{2}$$

2. Use RK4 to solve the equation (3),

$$\frac{d^2y}{dx^2} + \frac{dy}{dx} = 1 - x, \quad \text{where} \quad y(0) = 2, \; y'(0) = 1 \tag{3}$$

   Crosscheck your answer, by plotting, with the analytical solution $y(x) = c_1 + c_2 e^{-x} - x^2/2 + 2x$ over the range $x \in [-5, 5]$ and $y \in [-5, 5]$. **[3]**

3. Solve the boundary value problem given in equation (4) **[4]**

$$y'' = y' + 1, \quad \text{where} \quad y(0) = 1, \; y(1) = 2(e - 1) \tag{4}$$