**Fundamentals of Numerical Thermo-Fluid Dynamics 322.061**

# Exercise 4: Runge-Kutta Method

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4.1) The following equation is given:

$$\begin{cases} y' = y - t^2 + 1 \\ y(0) = 0.5 \end{cases} \tag{1}$$

The exact solution of this problem is $y = t^2 + 2t + 1 - \frac{1}{2}e^t$. Find the value of $y$ for $0 \leq t \leq 2$ using RK2 (step size of $h = 0.5$) and compare the results (at each time-step) with the exact solution.

4.2) Considering equation (1), find the value of $y$ for $0 \leq t \leq 2$ using RK4 (step size of $h = 0.5$) and compare the results with the exact solution.

4.3) Write a computer code for question (4.1) which computes the value of $y$ for $0 \leq t \leq 2$ using RK2. Use the following step sizes and compare the results at $y(t = 2)$ with the exact solution:

$h_1 = 0.5, h_2 = 0.2, h_3 = 0.05$

4.4) Repeat the question (4.3) and apply RK4 with the same time step sizes.

*Note:* Some guides on this exercise: `http://goo.gl/oxFCJz`