

United States International University Africa,

School of Science & Technology, Date: 03/07/2024 Submission Date: 06/07/2024 Department of Data Science & Analytics, Course: MTH3010A Mathematical Finance Semester: US2024

Lecturer: Joseph Owuor

Assignment

Solve all problems while demonstrating each step clearly. The Assignment is worth a total of 10 points.

Consider the initial value problem (IVP) given by the following differential equation: $\frac{dy}{dt} = f(t,y) = t - y$ with the initial condition: y(0) = 1. Solve this IVP using the Euler, Heun (Improved Euler), and Runge-Kutta (4th order) methods over the interval $t \in [0,2]$ with a step size h = 0.1. Compare the numerical solutions obtained from each method with **ten** steps with the exact solution.

- (2 pts) 1. Implement the Euler method to solve the given IVP.
- (2 pts) 2. Implement the Heun method to solve the given IVP.
- (4 pts) 3. Implement the Runge-Kutta method (4th order) to solve the given IVP.
- (2 pts) 4. Write a python code to check your results and plot all the numerical solutions (the three) along with the exact solution in one graph.