



1. Summative Assignment 2 Objective

Getting hands-on experience with MIPS assembly programming using MARS IDE ([MARS MIPS simulator - Missouri State University](#)).

2. Abstract

Each student will exercise assembly programming concepts by writing a MIPS assembly program using Mars simulator to solve a unique first order ordinary differential equation numerically using Euler's method.

3. Mathematical background

First order ordinary differential equations are differential equations in the form of $y' = F(x,y)$. solving such an equation means finding $y(x)$ (i.e. value of y at any given x). To solve these equations, the initial value of y (i.e. $y(0)$) is usually given.

One of the methods used to solve those equations numerically is euler method, which finds the value of y at any value of x by the following iterative algorithm:

$$y(x_{n+1}) = y(x_n) + h * F(x_n, y(x_n))$$

$$x_{n+1} = x_n + h$$

Where :

- h is the discrete step size in x -axis.
- x_n and $y(x_n)$ are values of x and y at the step n .
- x_{n+1} , $y(x_{n+1})$ are the values of x and y at the next step.

Algorithm starts by setting $x_n = 0$ and $y(x_n) = y(0)$, then iteratively reaching y at any given x .


4. Requirements

- Write an assembly function with the name "**euler_fn**" that solves the **first order ODE** corresponding to your name in the attached google sheet using **euler method**.
- The function will takes as input
 - $y(0)$
 - h
 - the required number of steps
- The function returns y after this number of steps as output.
- Your program should expect $y(0)$, h , and the required number of steps, to be passed to the program using **pa** option (for more info about **pa** check :[MARS help command line \(missouristate.edu\)](#))
- the returned value should be kept in $\$v0$ and written in memory address (0x10010000) (first data address in mars)

5. Deliverables

- .asm file of your program named with your faculty ID (ex 2001219.asm)
- Upload your .asm here: [Mars assignment submission Form](#)

6. Attachments

- Find your equation here:  Mars Equations

7. Evaluation

- Code will be marked automatically so make sure your code does not have any syntax or logical errors. Failure to assemble your code will stand against assigning points to your code
- **pseudo-instructions or extended instruction formats are not permitted (using them will lead to syntax error while grading, therefore you will get 0 marks)**
- A plagiarism check will be done on your answers and matching answers will get no marks.
- Main evaluation criterion is the correctness of the functionality. i.e., the value stored in memory and returned values.
- Other evaluation criterion involves the correctness of the MIPS calling convention.

8. Deadline

Dec 9th, 2023

9. Notes

- for any further inquiries please refer to Eng.Ibrahem Hassan
 - o [Facebook](#)
 - o Mail: ibrahem.hassan@eng.asu.edu.eg
 - o Teams: Ibrahem Hassan Ibrahem Mohamed

Good Luck!