

Non-Programming Homework

1. Develop flowchart for the programming homework problem 1

Programming Homework

1. Euler's method is a numerical method for generating a table of values (x_i, y_i) that approximate the solution of the differential equation $y' = f(x, y)$ with boundary condition $y(x_0) = y_0$. The first entry in the table is the starting point (x_0, y_0) . Given the entry (x_i, y_i) , then entry (x_{i+1}, y_{i+1}) is obtained using the formula $x_{i+1} = x_i + \Delta x$ and $y_{i+1} = y_i + \Delta x \times f(x_i, y_i)$. Where h is the small value called step size.

Use Euler's method to estimate the value of y when $x = 2.5$ for the solution of the differential equation $y' = x + 3y/x$ with the boundary condition $y(1) = 1$. Take $\Delta x = 0.1$, the exact solution of this differential equation is $y = 2x^3 - x^2$. Compare your approximation values with the exact value.

2. Write a program that estimates the integral of the following function $f(x)$ using the trapezoidal rule.

$$\int_a^b f(x) dx$$

where $f(x) = e^{-x^2}$, limits $a = 1$ and $b = 2$. Part of your program, use at least two functions named **fun** and **trapez** that define the integral function $f(x)$ and compute the integral.

3. The cosine of an angle can be computed from the following infinite series:

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots$$

Write a program that reads an angle x (in radians) from the keyboard. Then, in a function compute the cosine of the angle using first five terms of the series. Print the value computed along with the value of the cosine computed using the C++ library function.

4. (Optional: extra credit-10%) Write a program that prints at least 10 characters of your name (last, first) in uppercase at the terminal. Use a **n by m array** (i.e., a two dimensional array, with **n** (=7) as size of the first dimension and **m** (=10) as the second dimension) to represent each oversized letter.



To Turn In via Blackboard:

1. Word file with Cover page, Answer non-programming homework / questions, Screen Capture of outputs, and Results and Discussion
2. Source code e-file (upload to the blackboard, the source code should be saved as phw31_XXX.cpp, phw32_XXX.cpp, ...etc., where XXX is your initial)