Assignment

Name of course: Numerical Computation (CS2 120)

Lecturer of the Course: Yusuf Bulale

Semester: Winter Semester, 2023

Deadline date: Wednesday 19th May 2023 @ 9:00am

Instructions: Your software program should somehow be different from others.

Department of Computer Science

Numerical computation   CS 2 120   SS 2023

Question #1   [3 Marks]

You are designing a spherical tank as shown in Figure(Q1) below to hold water for a small village in a country. The volume of liquid it can hold can be computed as

$$V = \pi h^2 \frac{[3R - h]}{3}$$

where V volume (m³), h depth of water in tank (m), and R the tank radius (m).

If $R = 3\,m$, to what depth must the tank be filled so that it holds **30 m³**? Use a computer software program (C++) to determine your answer. You are required to compare bisection method, Newton's method, and Secant method solutions and recommend one of these software programs with justifications. Employ initial guesses of 0 and R
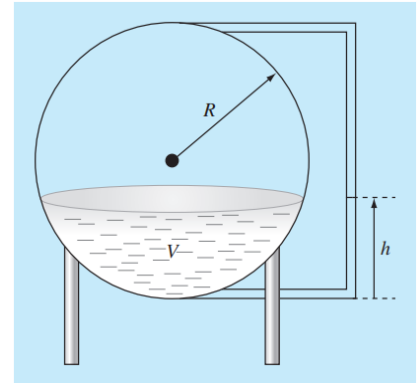
Figure(Q1

Program should show:

- initial guess value input
- second guess value input
- indication of error if the interval inputs are not correct input values.
- Tolerance/error input
- All intermediate values of **h** and its final value

Question #2   [2 Marks]

Given this function,

$$f(x) = x^2 + 5x - \sqrt{|x|}$$

Compute the degree one Lagrange approximation of any given x_0, x_1 and x.
The Lagrange interpolation formula is given by,

$$L(x) = \frac{(x - x_1)}{(x_0 - x_1)} f_0 + \frac{(x - x_0)}{(x_1 - x_0)} f_1$$

Your program should give the user to input:

- x_0, x_1 and x

Your program should then show f_0, f_1 and the answer for $L(x)$.
Note: Your C++ program should notify the user if the inputted x does not fall between x_0 and x_1.

Question #3   [5 Marks]

Develop a user-friendly computer program for the numerical integration technique, **trapezoidal** rule, **Simpson's r**ule and their truncation errors.

Program should show:

- Which options of Simpson's rule or trapezoidal rule should I use
- Interval option input values
- Δ option input values
- All intermediate values of f(**x**) and its final value or graph of f(**x**)
- it's truncation error.
- Your code should solve any given function.

Note: All your programming codes should somehow different from other students.