LAB NR. 6
C PROGRAMMING

November 15, 2023

Problem 1:

Create the function that performs the numerical integration. You want to calculate the integral

$$I = \int_a^b f(x)dx.$$

You can approximate it as the sum

$$I = \sum_{i=1}^{N} f(m_i)\Delta x,$$

where $m_i = a + (i - 0.5)\Delta x$, and $\Delta x = \frac{b-a}{N}$, N is the number of intervals used to calculate the integral. To pass any $f(x)$ as an argument to your function that performs the integration, you may declare it as

`float integrate(float (*function_to_integrate)(float))`, where the `function_to_integrate` returns the float value. You can get the value of your function_to_integrate as

`f=(*function_to_integrate)(x);`

You can integrate for example an arbitrary polynomial, or any trigonometric function, defining it inside function_to_integrate. You can start with $N = 1000$ and check how result changes wih increasing/decreasing N.

Problem 2:

Find the zero of the function $f(x)$, i.e., such an x_0, for which $f(x_0) = 0$. You can assume that your function is monotonous over the interval $[a, b]$, where you look for the solution $f(x) = 0$, The simplest root-finding algorithm is the bisection method. Let f be a continuous function, for which one knows an interval $[a, b]$ such that $f(a)$ and $f(b)$ have opposite signs (a bracket). Let $c = (a + b)/2$ be the middle of the interval (the midpoint or the point that bisects the interval). Then either $f(a)$ and $f(c)$, or $f(c)$ and $f(b)$ have opposite signs, and one has divided by two the size of the interval. By repeating the steps, you decrease the interval, and you get closer to the solution. You perform it in N steps, where initially you can use $N = 20$. Check, how what is the value of $f(x)$ for the x_0 you have found. Check, how it depends on N. For $f(x)$ use any function, which is known to have a zero in the chosen interval.