

1. a) What is the relative error in the computation $\pi - \frac{22}{7}$ in a minicomputer that has four decimal digits of accuracy.
- b) Criticize and recode the assignment statement $z \leftarrow \sqrt{x^4 + 4} - 2$ assuming that z will sometimes be needed for an x close to zero.
2. (a) If Newton's method is used on $f(x) = 0.5 - x + 0.2 \sin x$, calculate the approximate value (four iterations) of the root.
- b) If the secant method is used on $f(x) = x^5 + x^3 + 3$ and if $x_{n-2} = 0$ and $x_{n-1} = 1$, what is x_n ?
3. Construct a divided-difference diagram for the function $f(x) = e^{-x}$ given in the following table.

x	e^{-x}
0	1.00000000
1	0.36787945
4	0.01831564
10	0.00004540

Write out the Newton form of the interpolating polynomial $p_3(x)$.

4. Determine the lower triangular matrix \mathbf{L} and upper triangular matrix \mathbf{U} such that $\mathbf{A} = \mathbf{LU}$, when

$$\mathbf{A} = \begin{pmatrix} 6 & 7 & 4 \\ 4 & 4 & 3 \\ 2 & 1 & 1 \end{pmatrix}.$$

5. a) Use Taylor series to represent the error of numerical integration in the basic trapezoid rule by an infinite series.
- b) Calculate the error in the composite trapezoid rule.
- c) If the composite trapezoid rule is to be used to compute

$$\int_0^1 e^{-x^2} dx$$

with an error at most $\frac{1}{2} \times 10^{-4}$, how many points should be used?