

- I want to take the BASIC EXAM
 I want to take the the ADVANCED EXAM

Exam rules:

- Basic exam: the maximum grade is 24/30.
- Advanced exam: the maximum grade is 30/30 cum laude.

Total time is 1 hour. Students who get a positive grade in the written part (i.e., at least 18/30) *might* choose to take an oral exam. For students who choose the basic written exam, the maximum grade obtainable can never exceed 24/30.

BASIC EXAM

1. Given the function $f(x) = \sin(x)$ compute its Lagrange interpolant of degree 2 through the points $x_1 = -\pi$, $x_2 = 0$, $x_3 = \frac{\pi}{2}$.
2. Write the pseudocode of the Jacobi method to solve a linear system.

ADVANCED EXAM

3. Write the pseudocode of the forward substitution method used to solve linear systems where the matrix is upper triangular. Describe its computational cost. Show how it works when solving the system $Ax = b$, where

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 2 & 0 \\ 1 & 2 & 3 \end{bmatrix}, \quad b = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}.$$

4. Describe the composite midpoint quadrature rule, write its pseudocode, state and prove an error bound.