

- I want to take the BASIC EXAM  
 I want to take 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. Compute the LU factorization (without pivoting) of the matrix

$$A = \begin{bmatrix} 3 & 3 & 3 \\ 6 & 8 & 8 \\ 9 & 13 & 14 \end{bmatrix}$$

showing the intermediate computations.

2. Write the pseudocode of the composite trapezoidal rule.

**ADVANCED EXAM**

3. Give the definition of the *least square method* for data fitting and write a pseudocode for the computation of the linear regression line. Then, compute the linear regression line that approximates the points:

$$(-2, 0), \quad (-1, 1), \quad (0, 1), \quad (1, -1), \quad (2, 0),$$

4. Give the statement of the convergence theorem for the Newton method for solving nonlinear equations. Prove that the order of convergence of the methods is 2.