

- 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. Starting from $x^{(0)} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$, compute 2 iterations of the power method on the matrix

$$A = \begin{bmatrix} 2 & 2 \\ 2 & -1 \end{bmatrix}$$

returning the eigenvector and eigenvalue approximation and showing the intermediate steps.

2. Write the pseudocode of the Newton method. With initial guess $x_0 = 1$ apply one Newton iteration to find an approximate solution of the equation

$$(2x + 2)(x + 3) = 0$$

ADVANCED EXAM

3. Write the pseudo-code of the composite midpoint quadrature rule, then use the composite midpoint quadrature rule to compute an approximation of

$$\int_{-1}^2 (t^2 + 2t) dt$$

by splitting the integration interval $[-1, 2]$ into three subintervals. Report the intermediate computations.

4. Explain the *pagerank* algorithm and write its pseudocode.