Scientific Programming
(Wissenschaftliches Programmieren)

Exercise 7

1. Gaussian elimination with partial pivoting

- Enhance the Gaussian elimination algorithm by integrating partial pivoting: Evaluate the absolute values in the current column for the rows below the active one. Swap the current row with the one that exhibits the highest absolute value prior to performing the elimination.
- Ensure that the function `test_pivot_3()` also yields the correct output.
- Finalize and commit your modifications.

2. Gaussian elimination with dependency detection

- Enhance the Gaussian elimination algorithm by incorporating a detection mechanism for linear dependency.
- Ensure that all tests within `test_solvers.py` report correct outcomes.
- Finalize and commit your changes.
- Tag the project as v0.2.

3. *LU decomposition

- Separate the elimination and back substitution steps into distinct functions.
- Transform the elimination step into an LU decomposition that incorporates partial pivoting. This function should produce the LU-factorized matrix along with the permutation vector. Design the back substitution function to accept these outputs along with any number of right-hand side column vectors, formatted as a matrix, to resolve the associated linear systems.
- Develop and implement tests for these newly created functions.
- Revise the `gaussian_eliminate()` function so that it simply executes these new functions using appropriate arguments. Make sure, it passes the previously stored unit tests.
- Commit your changes to the repository.