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## Numerical Methods in Informatics - Exercise 1

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Assignment date: 05.10.2023 - Due date: 18.10.2023 (End of day)

Please upload your solutions to the OLAT system.

# Practice

### Code is code

If you spot mistakes or encounter errors, it's absolutely possible the given code has errors in it. If you spot anything that seems odd, you can always ask in OLAT or send me an email.

#### 1.1 Gaussian elimination, checking for consistency and setting up a system

##### a) (60 Min, 6 Points) Solving the system

Please edit the `solveLinearSystem(A, b)` function in `backend.py`. In this function, you're supposed to implement the Gaussian elimination method. The return value should be the vector  $\vec{x}$ , satisfying  $A\vec{x} = \vec{b}$ .

**Hints:** To score all the points, your solver must be numerically stable, which you can achieve by adding partial pivoting to your implementation. Performance is not as important as accuracy. Still, there is a time limit to the evaluation of this task.

##### b) (20 Min, 2 Points) Determining whether the system is consistent

Please edit the `isConsistent(A, b)` function in `backend.py`. In this function, you are supposed to determine whether the linear system is consistent or not.

**c) (10 Min, 2 Points)** Setting up the system

As a long-distance runner training for the upcoming ASVZ SOLA run, I've adjusted my dietary intake to help build up my strength. To this end, I've determined that a daily nutritional intake of 50g of protein, 180g of carbohydrates, 30g of fibers and 60g of fat would be optimal. In my kitchen I have sufficient amounts of chicken breasts, brown rice, black beans and avocados available. The nutrient values (protein, carbohydrate, fiber and fat, respectively) of each of these food items, *measured per 10g each*, are listed below:

- Chicken breast: 2.5g, 0.1g, 0.1g, 0.1g;
- Brown rice: 0.5g, 6.5g, 0.5g, 0.1g;
- Black beans: 1.5g, 3.0g, 1.5g, 0.5g;
- Avocado: 1.0g, 2.0g, 1.5g, 7.0g.

Given the nutrient table and daily target for proteins, carbohydrates, fibers and fats above, please set up a linear system and solve it. Please edit the `solveNutrients()` function in `backend.py` script. In this method, the return value should be the vector  $\vec{x}$ , satisfying  $A\vec{x} = \vec{b}$ . Please make sure your output array is rounded in grams per chicken breast, brown rice, black beans and avocado.

**Handing in:** Please only include your `backend.py` in your hand-in.