LINEAR PROGRAMMING

Due date: 02/03/22

Please try to give clear and detailed answers. Remember this is a personal work.

Part I (2 points)
You try to solve a linear problem by using the simplex method and at some point you get the tableau

```
z  a  b  c  d    e  f | Sol
------------------------
0  0  0  1 ½    0  0 | ½
0  2 -4  0 -3   1  0 | 0
0 -1  3  0 -2   0  1 | 0
------------------------
1 -2  1  0  4   0  0 | 4
```

Explain what happens. Could this situation have been avoided?

Part II (3 points)
Solve the following problem:

$$\text{Max } w = -4x - 10y - 5z$$
$$\text{s.t. } 5x + 20y + 15z \geq 4$$
$$-2x + 2y \geq 10$$
$$5x - 15y + 10z \geq -8$$

Part III (5 points)
Solve the following linear programming problem by using the big M method:

$$\text{Max } z = 4x + 5y$$
$$\text{s.t. } x + 2y \geq 10$$
$$2x + 3y \leq 60$$
$$x, y \geq 0$$

Part IV (2 + 2 + 3 points)
In a factory, with a machine M, it is possible to manufacture 2 types of products P and Q but they cannot be produced at the same time. The machine M is only available 100h per week and that 30 units of P or 50 units of Q can be produced in an hour. Also one unit of P gets the company a benefit of 10€ and one unit of Q a benefit of 30€. Finally, we know that the customers will never buy more than 2000 units of P per week or more than 4000 units of Q per week.

a) If the goal is to maximize the profit, can you modelize this problem (without solving it)?
b) You still haven't solved the problem in a) and Monday morning, the engineer in charge of the machine M is telling you there is a bug implying that only one type of product will be manufactured this week but you can still choose which one. Is this still a linear programming problem?
c) If there is no bug (you can produce both products), how how many units of P and Q are required to maximize the benefit per week?

Part V (3 points)

We assume a company makes 2 different types of products A and B with a set of specific linear constraints related to them. The benefit for the company is the same for both products.

Usually we would try to use linear programming to find which quantity of A and B you should produce to maximize the benefit but here we assume that, for some reasons

- you will have to choose one and only one type of product (A or B) to be produced
- the same linear constraints (involving both products) still apply
- you cannot "divide" this problem in 2 smaller problems to make your choice: you have to stick to your set of constraints related to both products A and B

How would you choose between manufacturing only A or only B products?