Question Number 8

Automated Cryptanalysis (MILP)

Create an example as shown in class to demonstrate your understanding of an optimization problem.

- State the objective function.
- State the constraints and justify them.
- State the restrictions on the variables.
- Generate the `.lp` file using the syntax shown in the sample file used in class.
- Solve it using `Gurobi` solver.

Solution.

```
You are the manager of a small bakery for a day. The bakery produces cakes and muffins, both
    of which consume some amount of ingredients and labor.

    Total ingredients available for the day: 150 units
    Total labor available for the day: 120 hours

Logistics for producing a cake:

    Requires 8 units of ingredients and 5 hours of labor
    Sells for a profit of   500   per cake

Logistics for producing a muffin:

    Requires 4 units of ingredients and 3 hours of labor
    Sells for a profit of   200   per muffin

Your task is to determine how many cakes and muffins to produce to maximize profit.
```

Gurobi Code and solution

```
        Maximize
        500 x + 200 y
        Subject To
        R0: 8 x + 4 y <= 150
        R1: 5 x + 3 y <= 120
        Bounds
        0 <= x
        0 <= y
        Generals
        x y
        End

    # Objective value = 9200
    # x 18
    # y 1

```

```
17
18
```