#2 Implement MILP solver within Qiskit Optimization - About us

- I just graduated from TU Delft with a MSc Applied Physics.
  - Interest: Quantum network & Quantum algorithm & Error correction (mitigation)
  - Now an intern @ Qunasys (a Tokyo startup focusing on quantum algorithm)
  - I am a heavy fan for Formula 1🏎️

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Accepted Paper

Entanglement distribution with minimal memory requirements using time-bin photonic qudits
PRX Quantum

Yunzhe Zheng, Hemant Sharma, and Johannes Borregaard

Accepted 21 September 2022

Work based on my master thesis

- My mentor Takashi is a Research Scientist @ IBM Research -Tokyo

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Research Scientist at IBM Research - Tokyo
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Motivation

$$\min_x \ c^T x$$
$$\text{such that } b_l \leq Ax \leq b_u,$$
$$l \leq x \leq u,$$
$$x_i \in \mathbb{Z}, i \in X_i$$

- Mixed-Interger Linear Programming (MILP) solver
  - A powerful solver that allows part of variables to take only integer values.
  - *scipy.optimize.milp* come out with Scipy v1.9.0 (July 29 2022)
  - Useful for many problems, but not incorporated with *Qiskit Optimization.*

scipy.optimize.milp

```
scipy.optimize.milp(c, *, integrality=None, bounds=None, constraints=None,
options=None)
```

Why we need MILP for Qiskit?

- In qiskit-optimization, we can use CPLEX and Gurobi to solve quadratic problems
  - but they are commercial APIs and limited by free access! (# of variables & constraints)
  - On the other hand: Scipy doesn't ask for you to pay :p.

- Our goal: integrate the MILP solver with qiskit-optimization library.
  - We expect to build a `*SciPyMILPOptimizer*` class in `*qiskit_optimization.algorithms*`
  - A tutorial introducing how to use our new optimizer!