Introduction to AMPL

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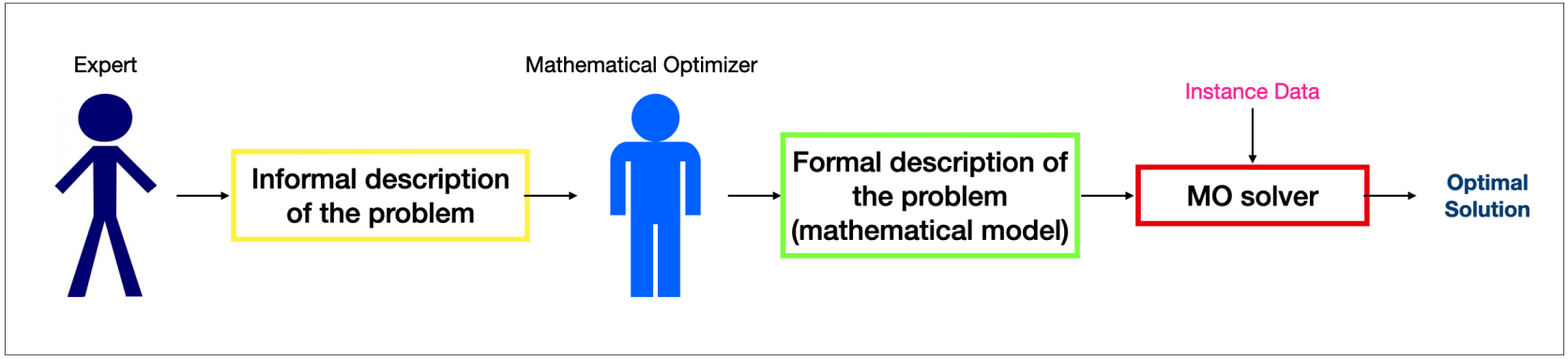
Reminder

Mathematical Optimisation is a knowledge-based approach



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  - `https://amplpy.ampl.com/`

File .mod

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- constraints, lines starting with the keyword `subject to`

File .mod

```
param n > 0;
```

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```

```
param w{1..n} > 0;
```

File .mod

```
param n > 0;
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```
param w{1..n} > 0;
```

```
param n > 0;
param m > 0;
param a{1..n, 1..m};
```

File .mod

```
set N := 1..n;
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File .mod

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set N := 1..n;
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```
param w{N} > 0;
```

```
param w{N} > 0;
param p{j in N} <= 10*w[j];
```

File .mod

Decision variables:

```
var x{j in 1..n} >= 0, <= 1, binary;
```

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var x{j in 1..n} >= 0, <= 1, binary;
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Objective function:

```
maximize total_profit:
  sum{j in N} p[j]*x[j];
```

File .mod

```
subject to capacity_constraint:
  sum{j in N} w[j]*x[j] <= c;
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File .mod

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subject to capacity_constraint:
  sum{j in N} w[j]*x[j] <= c;
```

```
subject to random_constraint{j in 2..n}:
  w[j]*x[j] - w[j-1]*x[j-1]<= 1;
```

The liquid transportation problem: File .mod

```
set L ordered;
param U {j in L} > 0; # max avail per liquid
param p {j in L} > 0; # unit profit per liquid
param w {j in L} > 0; # unit weight per liquid
param W > 0;  # truck max capacity

# decision variables
var x {j in L} >= 0, <= U[j];

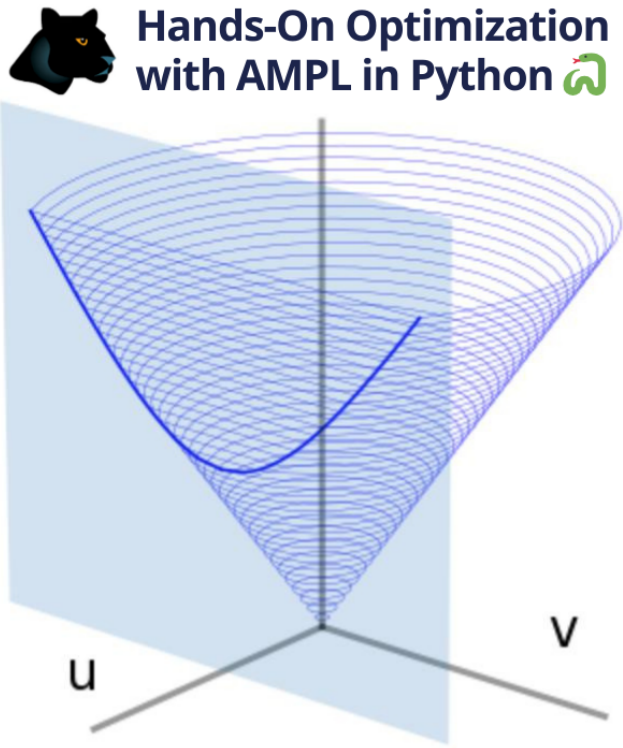
# objective function
maximize Total_Profit:
  sum {j in L} p[j]*x[j];

# constraints
subject to max_weight_constraint:
  sum{j in L} w[j]*x[j] <= W;
```

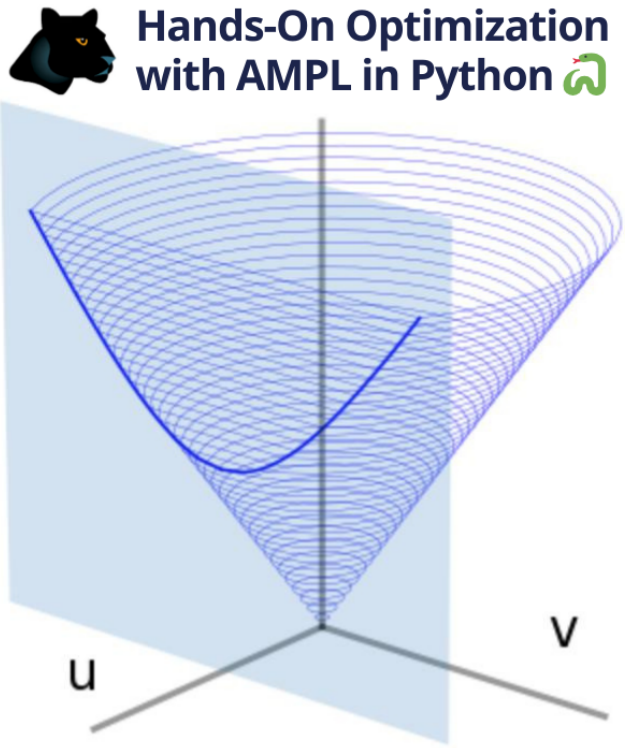
References

- Manual: `www.ampl.com/BOOK/download.html`
- How to install AMPL: jupyter notebook AMPLinstallation.ipynb
- Modeling languages like **ampl**: `ampl.com` or **gams**: `www.gams.com` or **jump** `https://jump.dev/JuMP.jl/` or **pyomo** `https://www.pyomo.org/`
- Open source solvers like **scip**: `scip.zib.de`
- **NEOS Server**, State-of-the-Art Solvers for Numerical Optimization: `www.neos-server.org/neos/`

Amplpy



Amplpy



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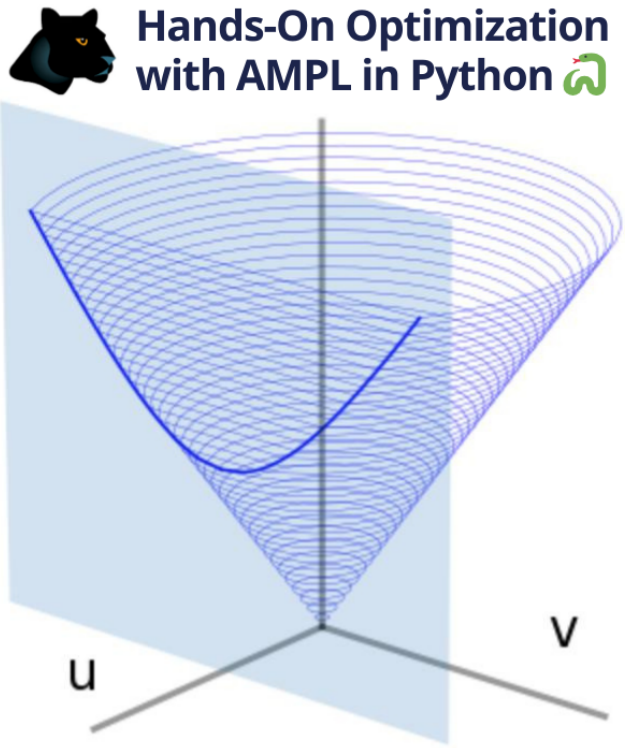

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AMPL modules are installed (see AMPLinstallation.ipynb).

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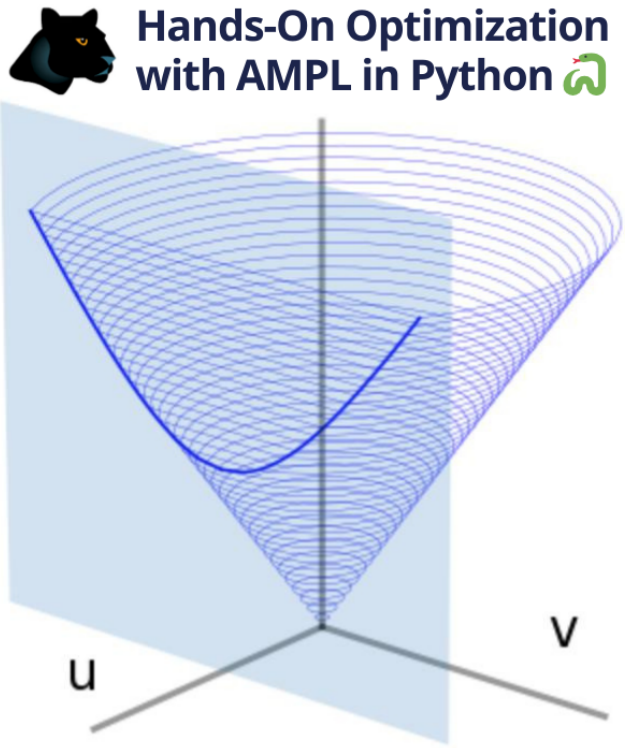

`https://amplpy.ampl.com/en/latest/quick-start.html`

AMPL modules are installed (see AMPLinstallation.ipynb).

Any installation issue?

How to load a model

Load model using **seval**

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ampl.eval(r"""
        set L ordered;
        param U {j in L} > 0; # max avail per liquid
        param p {j in L} > 0; # unit profit per liquid
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        # decision variables
        var x {j in L} >= 0, <= U[j];

        # objective function
        maximize Total_Profit:
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""")
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Load a model **reading the .mod file** .

```
ampl.read("diet.mod")
```

Load the data using Pandas objects

```
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is used to load data into an AMPL parameter

Examples:

- Send the data from "nutr_df" to AMPL and initialize the indexing set "NUTR"

```
ampl.set_data(nutr_df, "NUTR")
```

- Set the values for the parameter "amt" using "amt_df"

```
ampl.get_parameter("amt").set_values(amt_df)
```

Solve a problem

Once the model and the data are loaded:

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ampl.solve()
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Stop if the model was not solved

```
assert ampl.solve_result == "solved"
```

Get an AMPL entity in the programming environment

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totalcost.value() is **equivalent** to totalcost.get().value()

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Example:

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buy = ampl.get_variable("Buy")
df = buy.get_values().to_pandas()
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print(df)
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Read a **.dat file**. Example:

```
ampl.read_data("models/diet.dat")
```

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4. Code the example of **unboundedness** and run a solver to check it is really infeasible.

5. If we modify the objective of the model at point 4, by **minimizing instead of maximizing**, is the problem still unbounded?