**Problem Description:** According to the description of the thesis I have received, the problem can be defined as follows:

Machine environments: Hybrid Flexible Flow Shop

The processing restrictions and constraints:

* Unrelated machines
* Sequence-dependent setup times
* Intermediate storage availability
* Two stages with skipping
* Machine eligibility restrictions
* Due date
* Blocked pair of jobs

The objective function is to **minimize total tardiness**, as the due dates exist.

**The problem in thesis:** After the implementation of the model in the thesis, some points should be considered as well as their solutions.

The objective function is not linear. To make it linear, I introduced two variables: . The objective function is reformulated into:

with and .

Constraints (6) and (7) are reformulated as linear. Constraints (7) extend for HFSP-UPM-SDST.

BigM = (number of jobs)\*(number of stages)\*(max processing time at a machine + max setup-time)

Constraints (9) is incorrect and be reformulated into:

Additional constraints (15) ensure jobs must be assigned to the machine positions in sequential order:

(1.1)

(1.2)

(2)

(3)

(4)

(5)

(6)

(7)

(8)

(9)

(10)

(11)

(12)

(13)

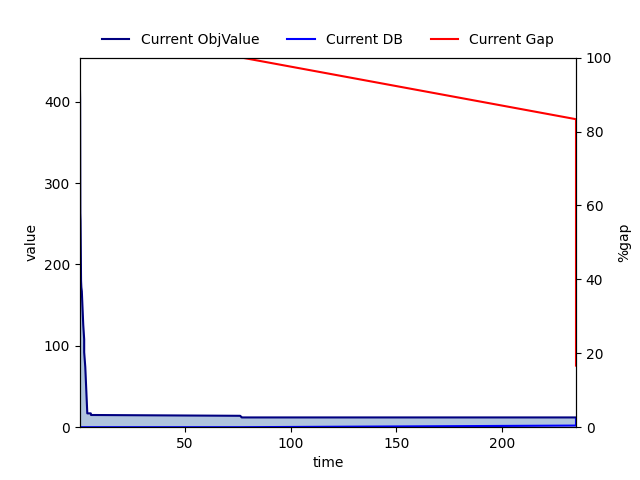
(14)

(15)

* Ensuring the relation between the two decision variables for machine selection and operation sequencing. (3)
* Ensuring each job at each stage is assigned exactly to one machine. (2)
* Preventing a job from being processed on the same machine multiple times. (3)
* Preventing two jobs from being processed simultaneously on the same machine. (4)
* Preventing incompatible pair of jobs be processed successively in a machine. (5)
* Ensuring jobs must be assigned to the machine positions in sequential order. (15)
* The job’s completion time at a stage is the sum of its start time and processing time. (8)
* Ensuring each operation of a job can only begin after its preceding operation at the previous stage has been completed. (6)
* Ensuring the precedence constraints on each machine. (7)
* The job’s completion time at a stage is the sum of its start time and processing time. (8)
* Calculates the completion time of a job. (9)
* Only positive tardiness values are considered. (1.1 + 1.2)

**Questions:**

* Can the blocked pair of jobs options be integrated into sequence-dependent setup times by setting the very big values of setup times between two blocked pairs?
* Do we have skipping in model? There is a difference between the description in the thesis and the model in the thesis.
* **A group of doors with different colors

  Description automatically generated**The picture above shows instances with 7 jobs (optimal solution with 0 total tardiness). The due date of jobs 3 and 5 is 200. Therefore, the machines did not complete these jobs as soon as possible but waited until close to the due date to process them. Is there any way to fix this?
* Lower bound development seems very slow for the instances that I can solve on my laptop (max 15 jobs). I want to ask if it is special that the objective function is to minimize total tardiness.
* I have received a contract from the chair, is there any way I can use the computer at university remotely?