Modelling and Solving Exercises in MiniZinc - 2

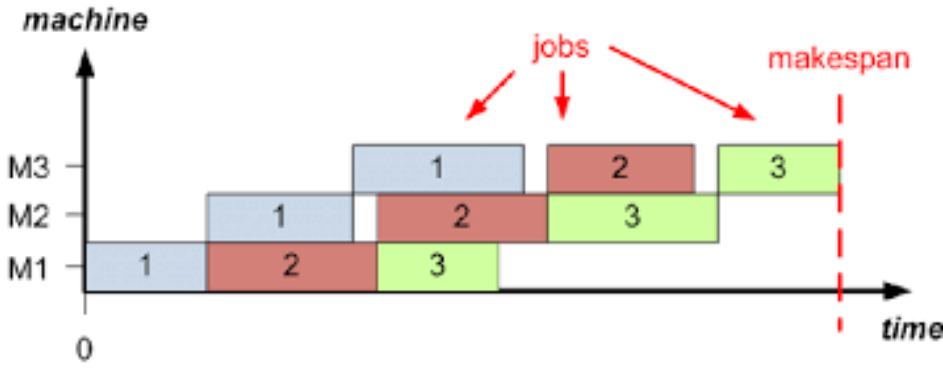
Before Starting

- Use a separate folder for each problem.
- Create a project file (.mzp) for the problem.
  - Add the model files (*.mzn)
  - Add the data files (*.dzn)
- Configure the solver to obtain the solution statistics, to search for one or all solutions, and to set a time limit when needed.

A Disjunctive Scheduling Problem

- Given:
  - a set of machines and a set of jobs, each composed of a sequence of tasks where each task i requires a machine i,
  - durations of the job tasks,

  decide:
  - when to execute each job task so as to minimize the makespan, subject to task precedence and disjunctive resource constraints.



A Disjunctive Scheduling Problem

- # tasks = # machines
- Variables and Domains
  - Start time S_{ji} for each job j and its task i with domain?
- Constraints
  - Precedence constraints on consecutive tasks of each job.
  - Disjunctive constraints for each machine.
- Objective function
  - Makespan as a dummy activity with the lowest precedence in the schedule.
- Objective
  - Minimize makespan.

A Disjunctive Scheduling Problem

- Implement the model using the disjunctive global constraint.
- Implement another by decomposing disjunctive.
- Search for the optimal solution to the provided instances using Gecode and the input order of the variables and the values, with a time limit of 5 mins (300 secs).

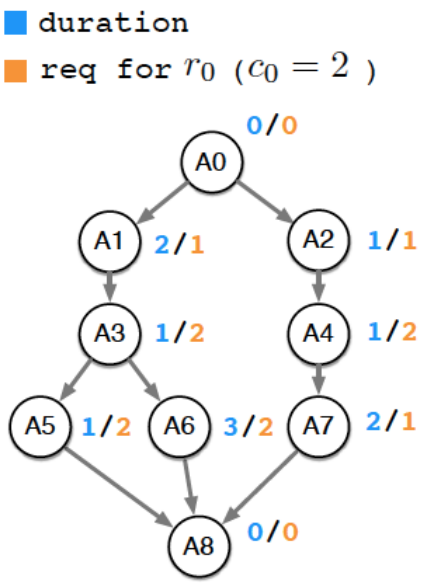
```
solve :: int_search(s, input_order, indomain_min) minimize end;
```

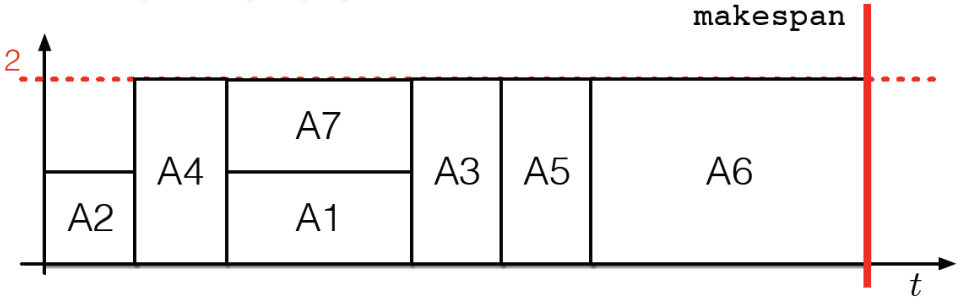
- Compare the objective value and the total time.

A Cumulative Scheduling Problem

- Given:
  - a set of cumulative resources,
  - a set of tasks with durations and resource requirements,
  - precedence constraints between some tasks,

  decide:
  - when to execute each task so as to minimize the makespan, subject to precedence and cumulative resource constraints.





A Cumulative Scheduling Problem

- Variables and Domains
  - Start time S_i for each task with domain?
- Constraints
  - Precedence constraints for each given i → j
  - Cumulative constraints for each resource r.
- Objective function
  - Makespan as the maximum $S_i + d_i$.
- Objective
  - Minimize makespan.

A Cumulative Scheduling Problem

- Implement the model using the cumulative global constraint.
- Can you add any implied constraints to the model?
- Search for the optimal solution to the provided instances using the default search of Gecode, with a time limit of 5 mins (300 secs).

```
solve minimize makespan;
```

- For the difficult instances, experiment with Chuffed using its default search.
- Compare the objective value and the total time.