Constraint Solving - Global Constraints (2)

Job Shop

A job shop problem consists of scheduling J jobs, each consisting of T tasks, which have precedence constraints. For any job i (in 0..J-1), the beginning of task [i,j+1] should should occur earlier than the end of task [i,j] (for j in (0..T-2).

The jobs are independent, except for the fact that the tasks are executed in machines of certain types and there are only a limited number of machines of each type. The number M of machines is equal to the number T of tasks, and the number of tasks executing in each machine is exactly the number of jobs.

The goal is to finish all tasks within a certain makespan (Satisfaction) or to minimize the makespan.

Solve the job shop problem modelling the non-overlaping between tasks executing in the same machine,

a) With disjunctive constraints
b) With cumulative constraints (either with or without using Task classes).

You have two instances in file **job_shop_aula.java**, that you can download from the web page of the course.

More generally, you should solve the job-shop problem for (small) instances obtained from the OR-library[1], and available in the **jobshop_benchmarks** folder, also available from the web page.

For example, benchmark " la03.txt" with the following data:

```
instance la03
Lawrence 10x5 instance (Table 3, instance 3); also called (setf3) or (F3)
10 5
1 23 2 45 0 82 4 84 3 38
2 21 1 29 0 18 4 41 3 50
2 38 3 54 4 16 0 52 1 52
4 37 0 54 2 74 1 62 3 57
4 57 0 81 1 61 3 68 2 30
4 81 0 79 1 89 2 89 3 11
3 33 2 20 0 91 4 20 1 66
4 24 1 84 0 32 2 55 3  8
4 56 0  7 3 54 2 64 1 39
4 40 1 83 0 19 2  8 3  7
```

specifies a problem with 10 jobs (rows) and 5 tasks each, where each row indicates, for that job, the types of the machines in which the tasks are executed and their duration.

For example, job 0 is composed of 5 tasks, to be executed, respectively, in machines of type 1,2,0,4 and 3, with durations 23, 45, 82, 84 and 38.

[1] ORlibrary URL: http://people.brunel.ac.uk/~mastjjb/jeb/info.html. Job shop benchmarks from library (available in the course page) obtained from http://people.brunel.ac.uk/~mastjjb/jeb/orlib/files/jobshop1.txt