QMDA (combin. optimization): workgroup

QMDA (Combinatorial Optimization) // Course topics

- Prerequisites (videos I,II,III,IV):
  - Linear programming modeling;
  - Properties of continuous linear programming and the simplex algorithm.
- Computational complexity (videos 1,2,3).
- Exact approaches for CO (videos 4,5,6,7,8).
- Heuristics (videos 9,10,11,12,13).
- Exercise classes (videos 14,15,16).
- Workgroup

The two-machine total completion flow shop problem

The two-machine total completion flow shop problem ($F2||\sum C_i$ in the three-fields notation) is considered.

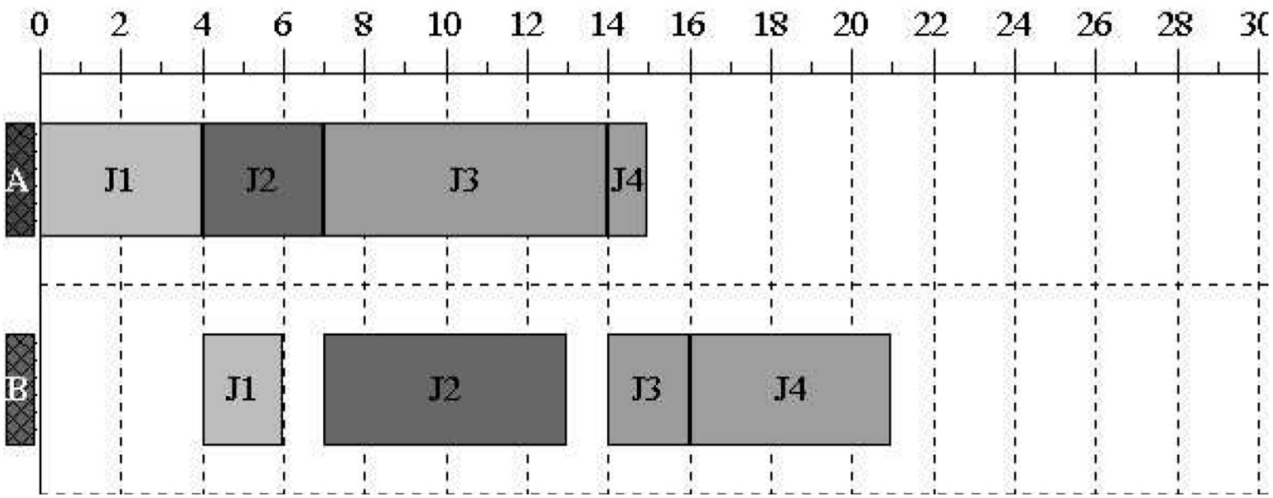
- The problem requires to arrange a set of jobs $N = \{1, 2, \ldots, n\}$ in a sequence S, defining a permutation schedule on two machines $M = \{1, 2\}$, in order to minimize the sum of completion times.
- Every job j consists of two operations, with each i-th operation to be processed on machine M_i for a specified amount of time p_{ij}.
- The schedule is a permutation schedule in the sense that each machine processes the (operations of the) jobs in the same order according to sequence S.
- Machine preemption is not allowed.

The two-machine total completion flow shop problem

Consider the following example with 4 jobs, two machines A, B and the sequence J_1, J_2, J_3, J_4 with tot. compl. time $= 6 + 13 + 16 + 21 = 56$.

J_i	1	2	3	4
p_{1i}	4	3	7	1
p_{2_i}	2	6	2	5

Two-machine flow shop problem



The two-machine total completion flow shop problem

- The optimal solution is actually J_4, J_1, J_2, J_3 with total completion time $= 6 + 8 + 14 + 17 = 45$.
- To get a solution it is sufficient to determine a permutation of the jobs.
- But with n jobs we have $n!$ permutations...

Workgroup

- You are supposed to be split into distinct workgroups (2-3 people).
- Each group is expected to apply a different heuristic procedure for the mentioned flow shop problem.
- Proposed heuristics are:
  Iterated Local Search, Variable Neighborhood search, Tabu Search, Greedy Randomized Adaptive Search, Genetic algorithms, ...
- You will be given a set of known instances with 100 jobs.
- The instances will be provided in distinct files each with 100 rows with row format $[i \; p_{1i} \; p_{2i} \; 0]$.

Workgroup

- The evaluation of the workgroup will take into account the quality of your slides and the performance of your algorithm on the set of known instances plus a final subset of hidden instances that will be delivered to you at the end of the course.
- The evaluation of the workgroup will provide the relevant mark for the exam of the CO part of QMDA (unless a student asks for a standard exam on the course topics)