

## Exam Mastermath course 'Scheduling' 2019

17-6-2019

The exam consists of 5 questions worth 10 points each. Your grade is given by  $1 + \frac{9p}{50}$ , where  $p$  is the total number of points obtained.

Note: You are only allowed to use the handout written by the lecturers. **Good luck!**

### Question 1 (10 points):

Consider the following instance of problem  $F2||C_{max}$ :

$$n = 6, p = \begin{pmatrix} 2 & 9 & 5 & 1 & 3 & 3 \\ 4 & 4 & 2 & 6 & 4 & 3 \end{pmatrix}.$$

Apply the presented optimal algorithm for problem  $F2||C_{max}$  (Johnson's Algorithm) to this instance. Explain the different steps, give the results of these steps and present the optimal solution.

### Question 2 (10 points):

Consider problem  $1||\sum 2^{C_j}$  (objective is the sum of  $2^{C_j}$  over all jobs  $j$ ).

Give an optimal scheduling rule (algorithm) for this problem and ~~proof~~ *prove* that it leads to an optimal solution.

Hint: you may use an interchange argument.

### Question 3 (10 points):

*Prove* ~~Proof~~ that problem  $1||\sum w_j U_j$  is ~~strongly~~ NP hard.

### Question 4 (10 points):

Consider problem  $P2||C_{max}$ .

Prove that  $(5 - \sqrt{5})/2$  is a lower bound for the performance guarantee of any deterministic on-line algorithm for this problem.

### Question 5 (10 points, indication 300 words):

Give a general description of the OR rescheduling problem. Describe the problem including objectives and constraints, the characteristics of the problem, and the used solution approaches.

END OF THE EXAM