Exam Mastermath course 'Scheduling' 2020 6-7-2020

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.

Important: Please write down the following **statement** on your first sheet of paper: "This exam will be solely undertaken by myself, without any assistance from others, and without use of sources other than my personal notes and the sources available on the Scheduling website of elo.mastermath.nl."

Note that you are only allowed to use your **personal notes** and the **material** that we provided on the Scheduling website of elo.masthermath.nl.

Do not forget to include your **student ID** in the scans of your work. Good luck!

Question 1 *(10 points)***:**

Consider an instance of $P||C_{max}$ with the following 3 jobs.

Job 1: deterministic processing time of 2, so $p_1 = 2$.
Job 2: processing time of 1 with probability ½ and a processing time of 3 with probability ½, so $P(P_2 = 1) = P(P_2 = 3) = \frac{1}{2}$.
Job 3: uniformly distributed processing time on the interval [0,2], so $P_3 \sim U(0,2)$ and $P_3 \in \mathbb{R}_{\geq 0}$.

Give the expected makespan for the optimal schedule in the cases that there are one, two or three machines. Explain your results in detail.

Question 2 *(10 points)***:**

Consider the problem $1|r_j, prmp|\sum C_j$.

Give an optimal scheduling rule for this problem and proof that it leads to an optimal solution.

Question 3 *(10 points)***:**

Prove that problem $F_2|r_j|C_{max}$ is NP-hard by reducing PARTITION to it.

Question 4 *(10 points)***:**

Consider the problem $1|r_j|\sum C_j$ for which the nonpreemptive SPT* rule is defined as selecting, whenever the machine is freed, the shortest job among those available for processing.

Perform a worst case analysis of the SPT* rule by determining the maximum possible value of the ratio $\sum C_j(SPT^*)/\sum C_j(OPT)$.

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

Give a general description of the battery planning problem, including objectives and constraints. Furthermore, give a sketch of a solution approach and how it can be used within the TRIANA.

IMPORTANT: please submit **<u>one</u> pdf file** using for example the app Tiny Scanner.

END OF THE EXAM