1. Proof that problem $O3||C_{max}$ is NP-hard

2. Find an optimal schedule for problem $O|p_{ij} = p|C_{max}$ and prove its optimality. ($p_{ij} = p$ means that all operations have processing time $p$)

3. Find an optimal schedule for problem $O|p_{ij} = p_j|C_{max}$ and prove its optimality. ($p_{ij} = p_j$ means that all operations of a job have the same processing time which is equal to $p_j$)

4. Let $S$ be a complete selection for an instance of $J||C_{max}$ and let $P$ be a critical path in $G(S)$. A sequence $o_1, \ldots, o_k$ of successive operations in $P$ to be processed on the same machine is called a block if $k \geq 2$ and the predecessor of $o_1$ and the successor of $o_k$ in $P$ are either on a different machine or equal to 0 or $*$.

   Proof that if another complete selection $S'$ exists with $C_{max}(S') < C_{max}(S)$, then in $S'$ at least one operation of some block $B$ w.r.t. $S$ not equal to the first has to be processed before all other operations of $B$ or at least one operation of some block $B$ w.r.t. $S$ not equal to the last has to be processed after all other operations of $B$.

5. Let $S$ be a complete selection for an instance of $J||C_{max}$ and let $P$ be a critical path in $G(S)$. Show that reversing the direction of a disjunctive arc, which is part of the critical path $P$, leads again to a complete selection.

   Show that this in general is not true for reversing an arbitrary disjunctive arc.