LOADING BALANCE PROBLEM

Greedy loading balance strategy

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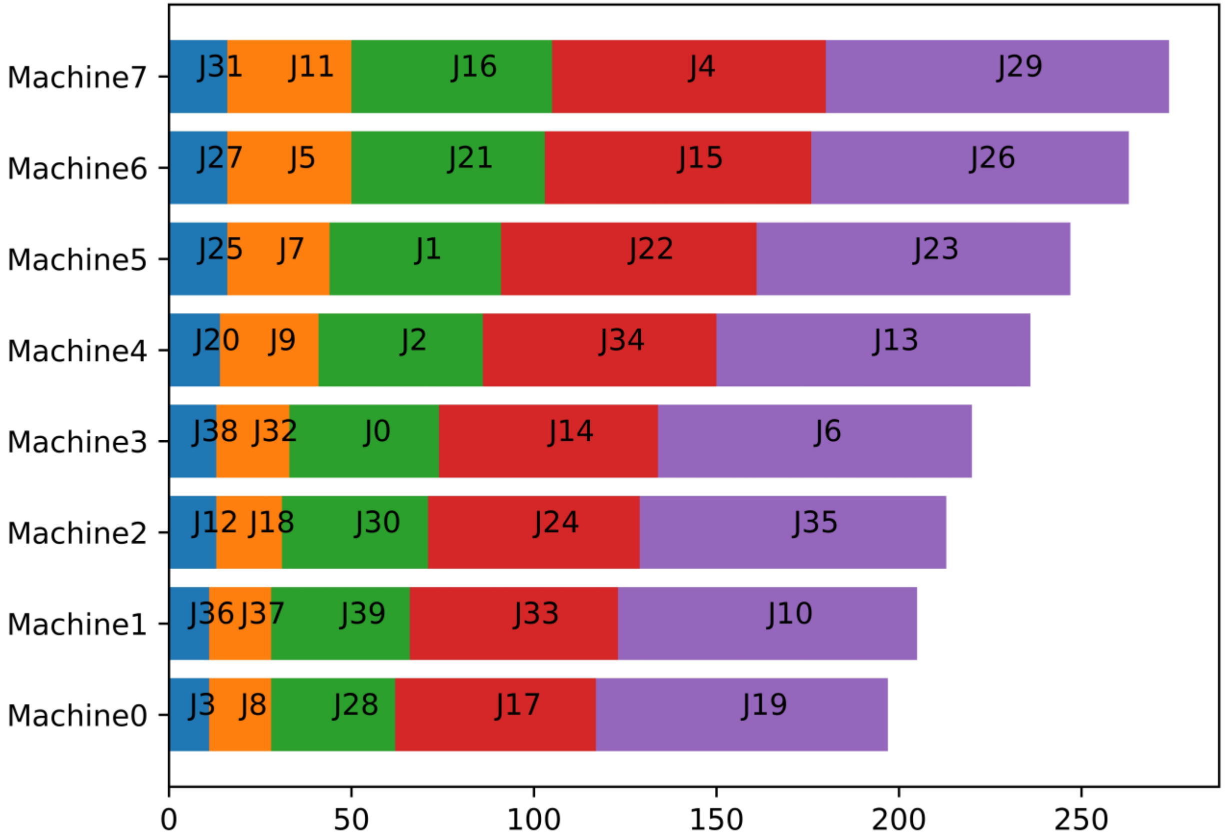
This problem's target is assign jobs to computing machines to minimizes the total time consumption.



GREEDY LOADING BALANCE STRATEGY

This strategy will assign a job to the machine with the smallest load in an arbitrary order of jobs.

Algorithm 2 Loading Balance Problem

Require: m : number of machines, job_times : The time of each jobs
Ensure:

function $greedy\_workload\_balance(m, job\_time)$
    $M \leftarrow []$
    for i=1 to m **do**
        $L_i \leftarrow 0$
        $M(i) \leftarrow []$
    end for
    for j=1 to n **do**
        $i \leftarrow argmin_k L_k$
        $M(i) \leftarrow M(i).append(j)$
        $L_i \leftarrow \mathrm{L}_i + t_j$
    end for
    returnM
end function

EFFECT OF ALGORITHM

If the theoretical optimal makespan of the job queue is T^*, then the greedy algorithm's makespan T will not worse than $2T^*$.

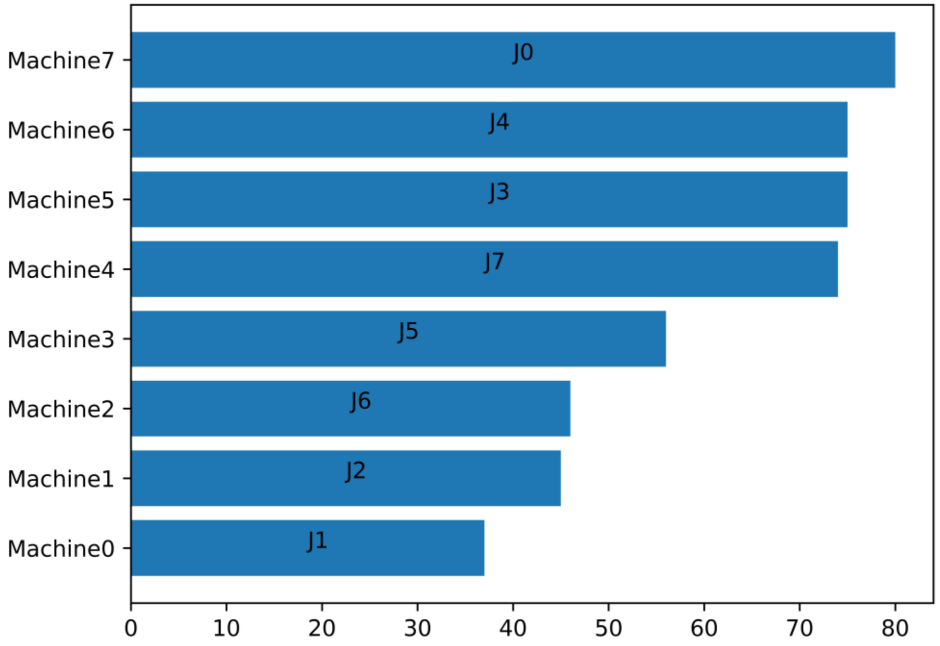
$$\boldsymbol{T^* \leq T \leq 2T^*}$$

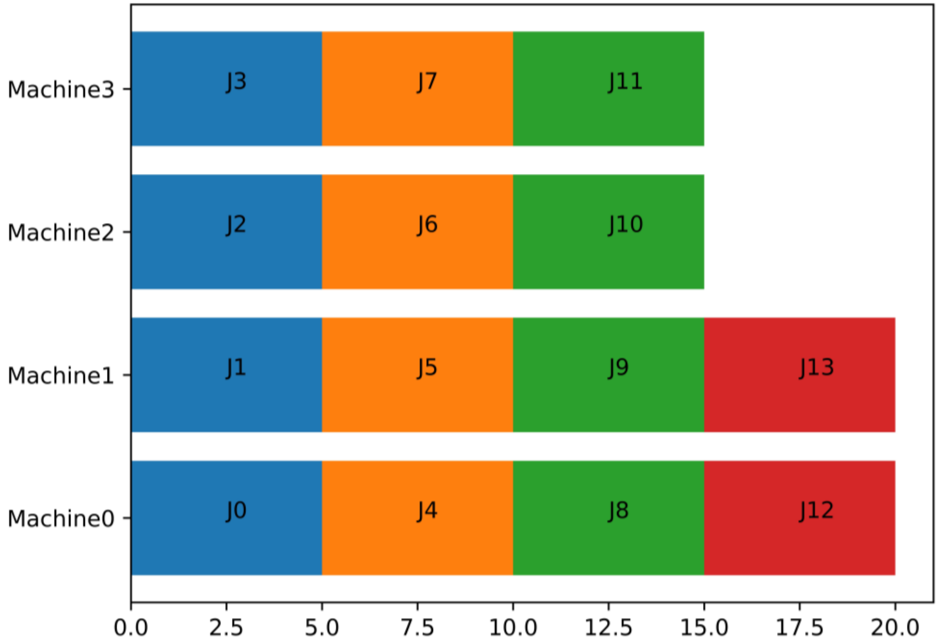
THE FIRST EXAMPLE

You want a example that the makespan T equal to the T^*? It's so easy!

What if the number of the jobs equal to the jobs of machine?

What if that each jobs need the time?





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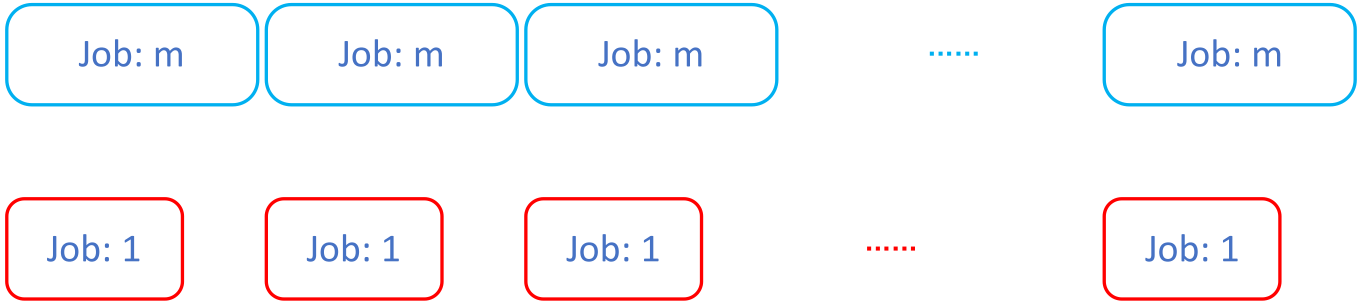
THE SECOND AND THIRD EXAMPLE

These two question can be answered by one case.

Let’s suppose that there are m machines, and the minimum unit of time is 1.

What if we have m jobs with time m, and m jobs with time 1?



Let's consider two scenarios

1. Let the jobs queue be: [m, m, m, ……, m, 1, 1, ……, 1, 1]
2. Let the jobs queue be: [m, 1, m, 1, m, 1, ……, m, 1, m, 1]

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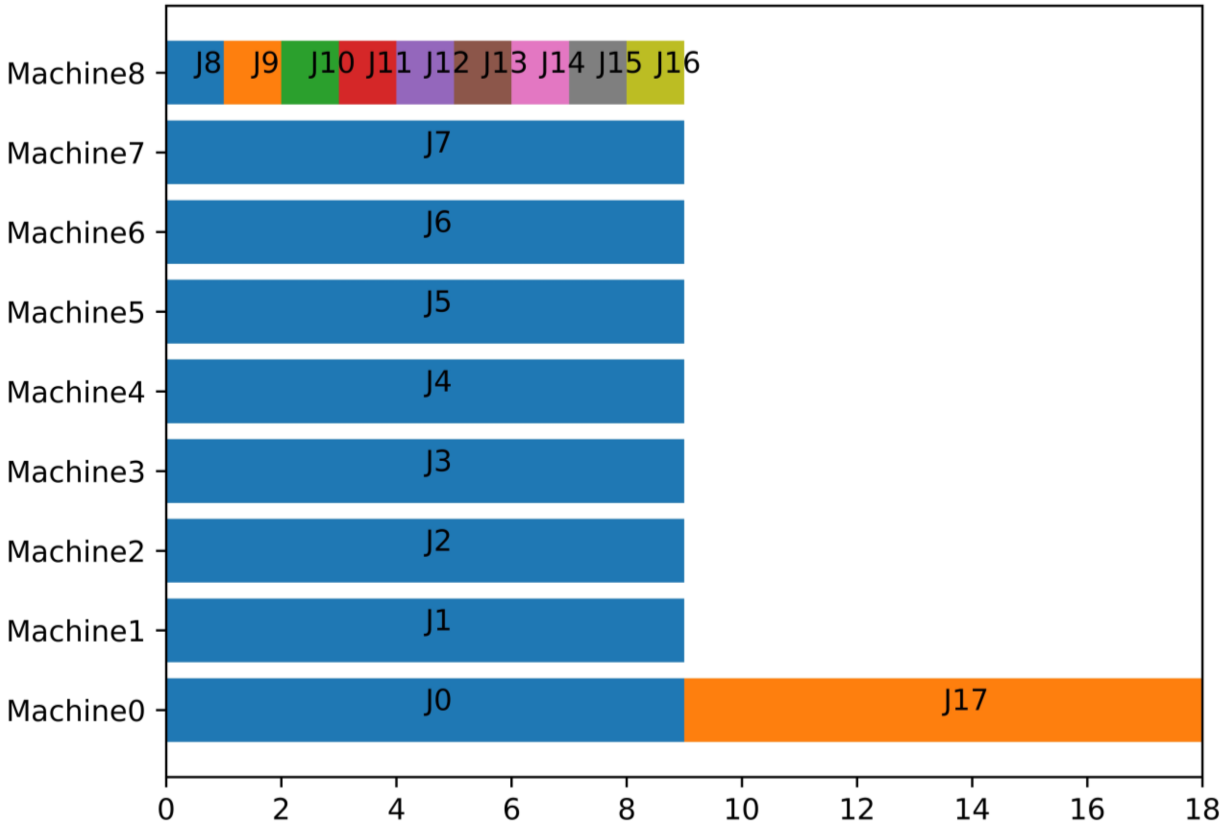

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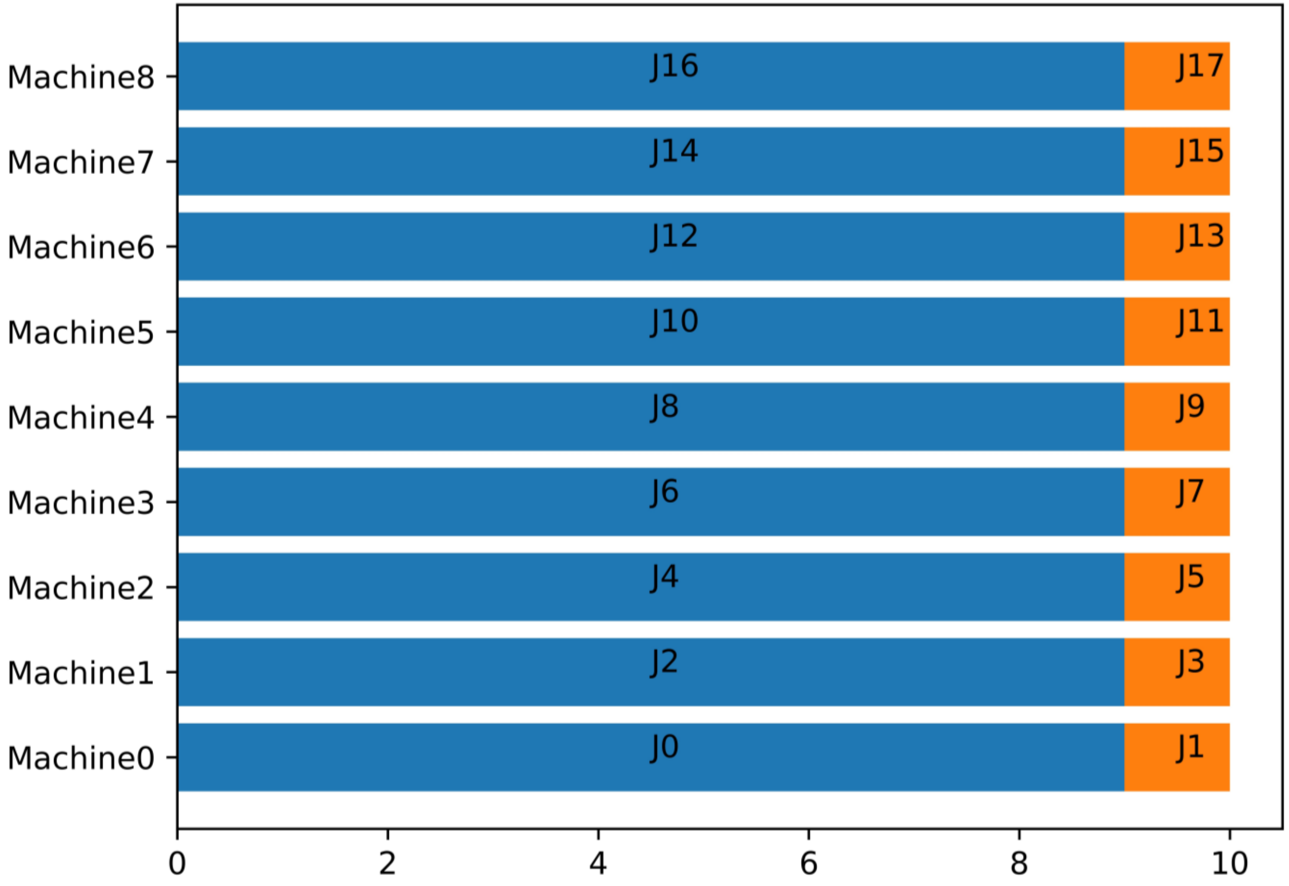

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For the two examples above:

1. When the job queue is [m, 1, m, 1, m, 1, ……, m, 1, m, 1], the result of the greedy algorithm is optimal, $T=T^{*}=m+1$
2. When the job queue is [m, m, m, ……, m, 1, 1, ……, 1, 1, m], it will get the worst solution of the greedy algorithm, $T=2m$

So, for these jobs, the result can equal to T^{*}, and also can equal to $2T^{*}-2$, which is depend on the order of the jobs.

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THANK YOU !

Q&A

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