# Scheduling

Johan Montelius

KTH

2016

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- What metrics are important?
- Does it matter in what order we schedule processes?
- Are there optimal solutions?

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*This is unrealistic - we will relax these requirements.*

# ...every now and then I get a little bit lonely

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# Performance metrics

$$T_{\text{turnaround}} = T_{\text{completion}} - T_{\text{arrival}}$$

*How long time does it take to complete the job?*

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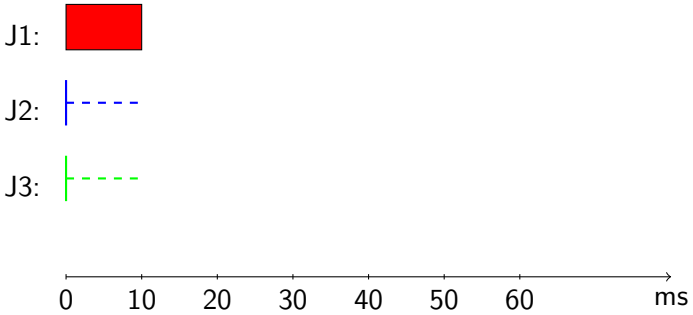

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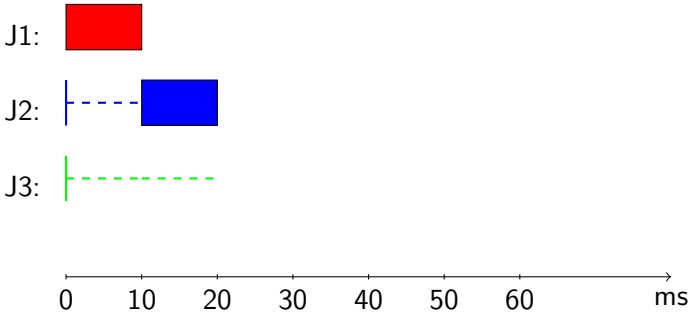

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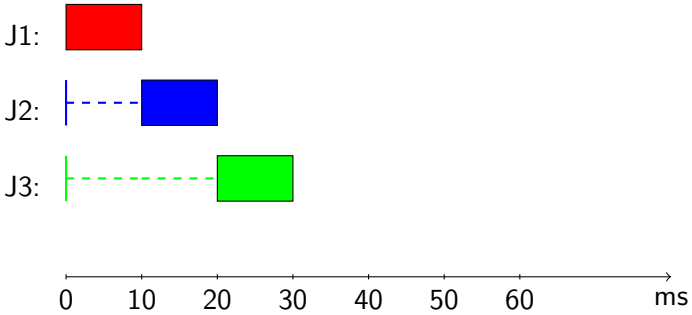

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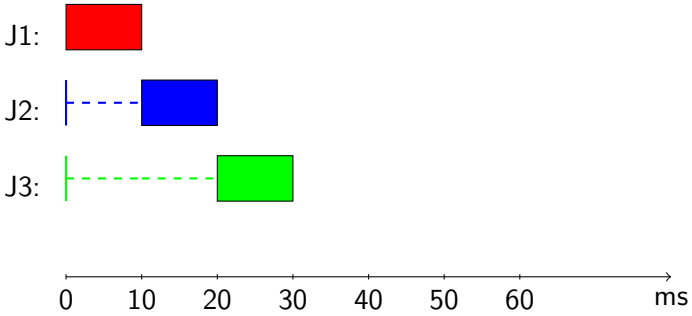


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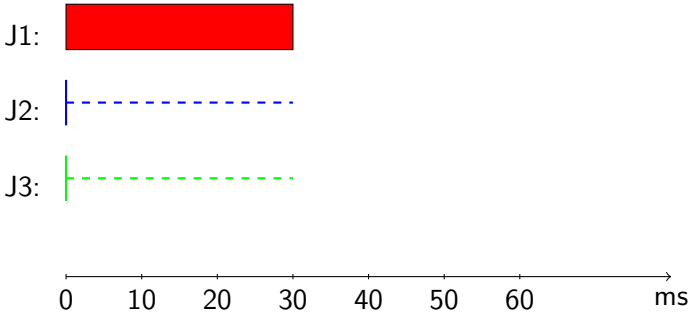

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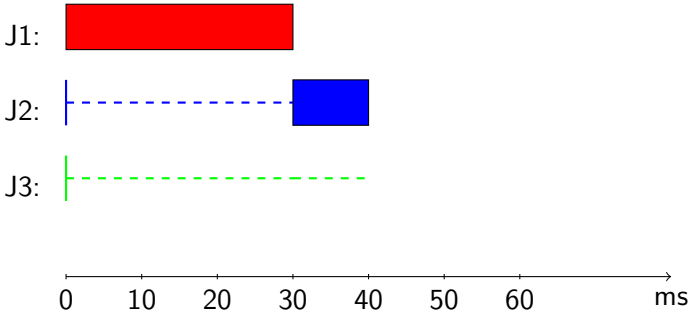

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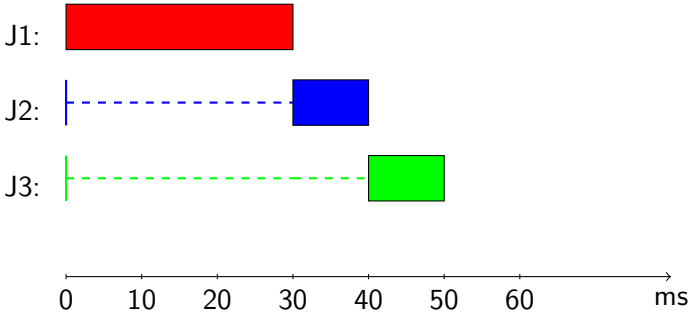

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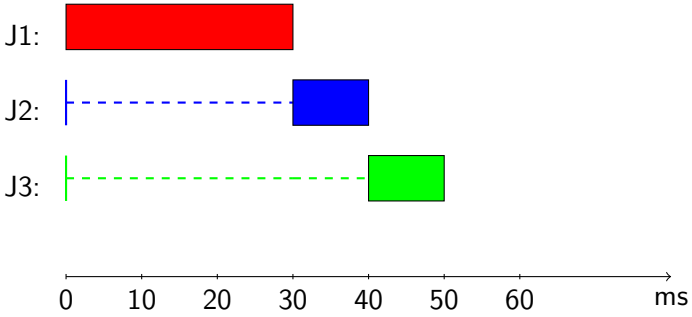


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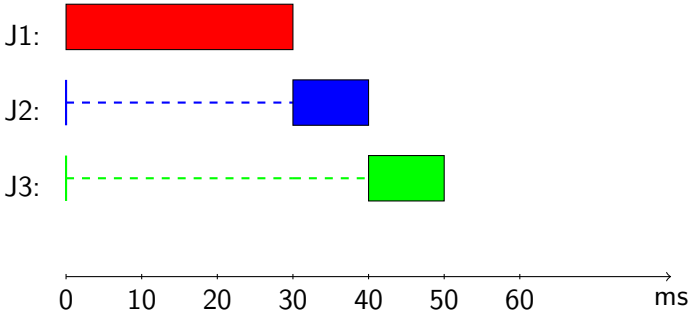


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Can we do better?

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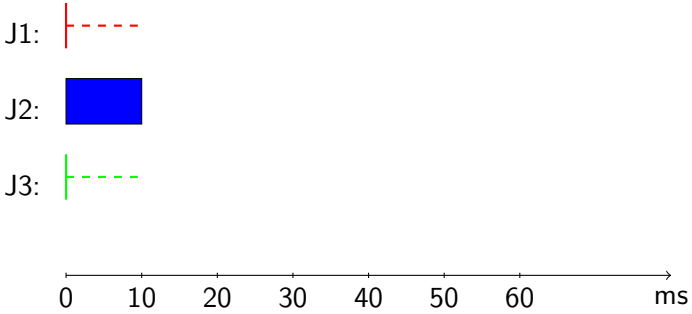

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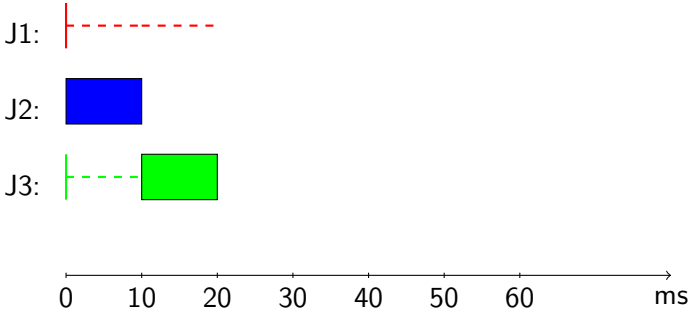

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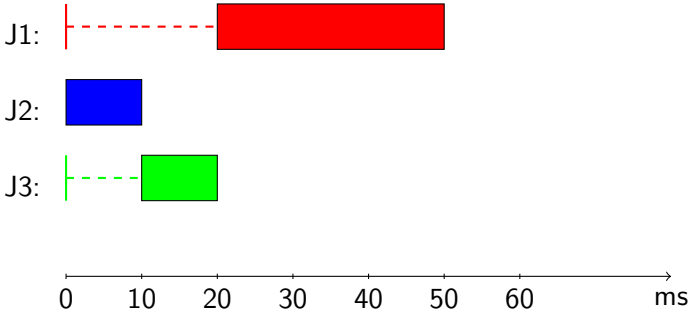

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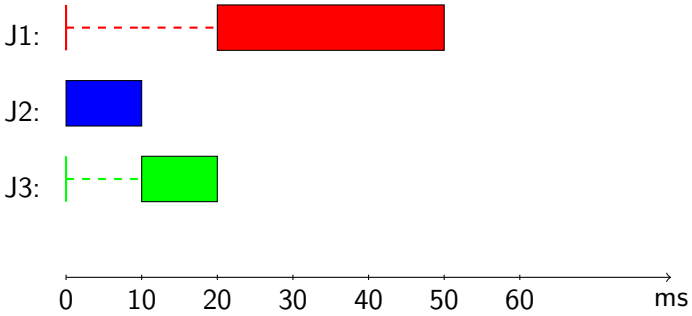


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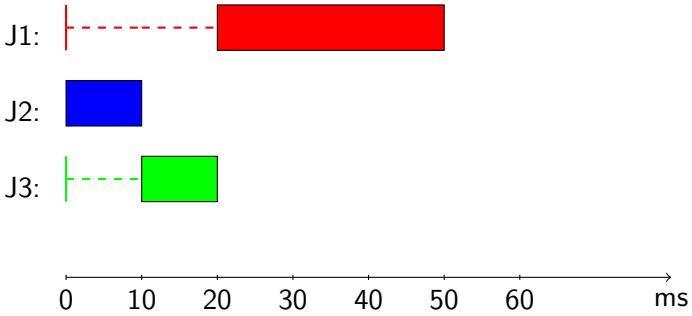


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Problem solved!

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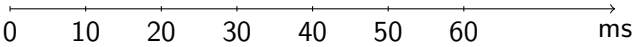

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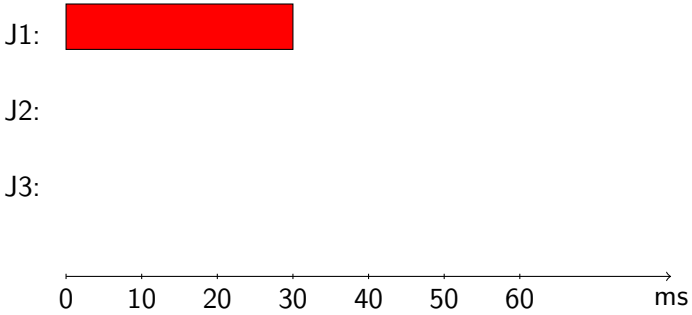

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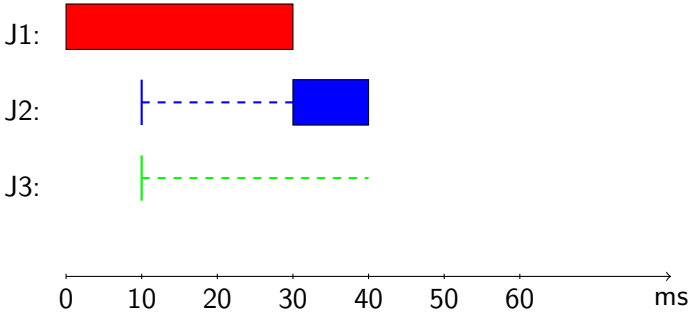

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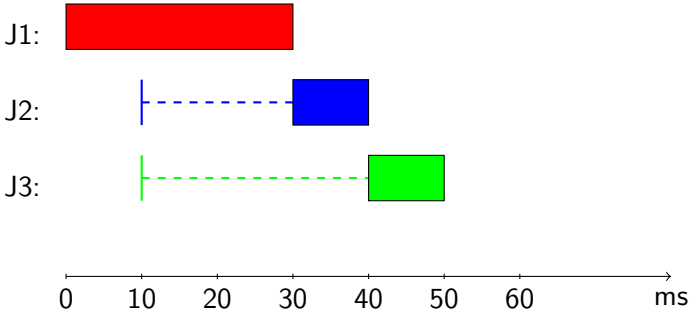

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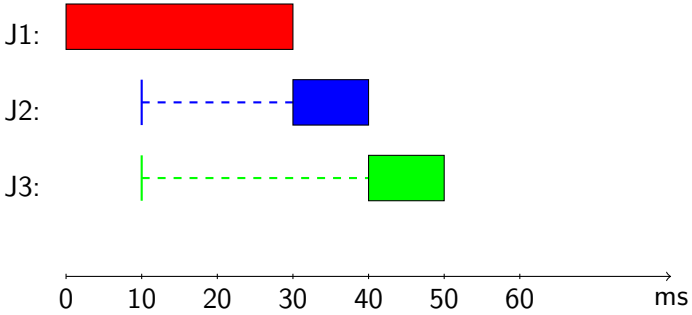


*We need to preempt the execution of a job.*

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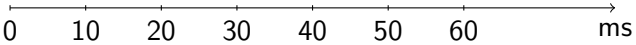

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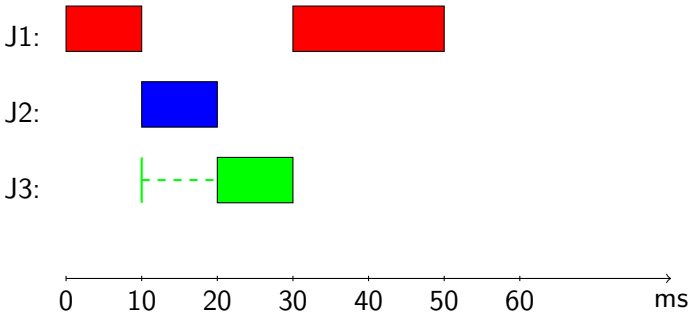

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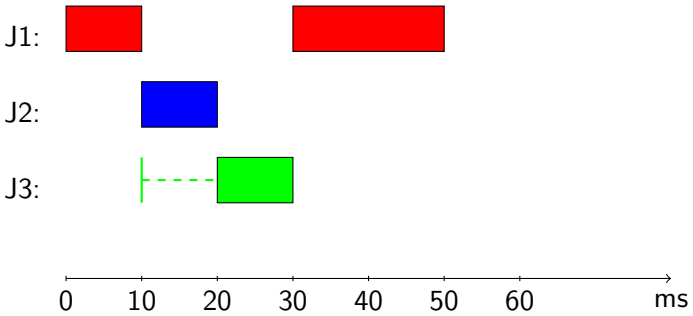


*The policy is also known as Preemptive Shortest Job First (PSJF)*

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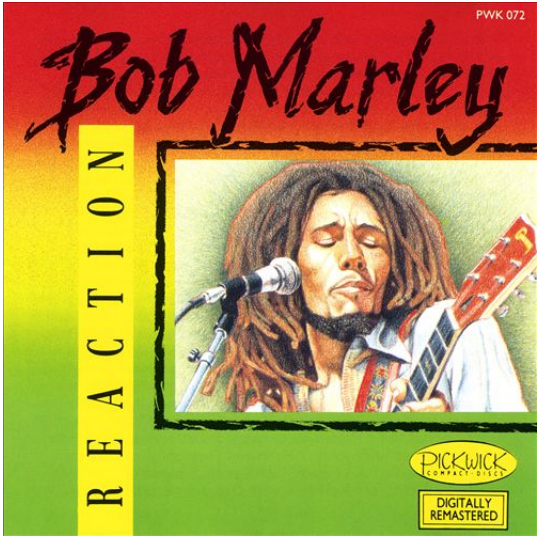
*There might be more important metrics than turnaround time.*

# Talk about ...


PWK 072
Bob Marley
REACTION
PICKWICK
COMPACT DISCS
DIGITALLY
REMASTERED

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*The response might not be completed unless the job completes but it's an ok metrics.*

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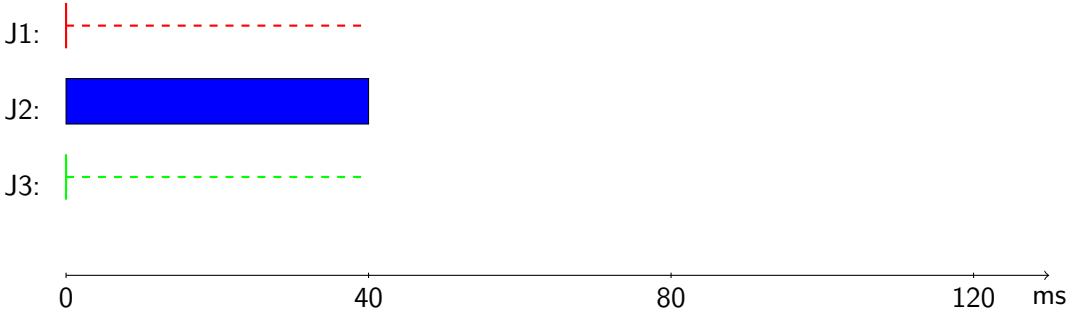

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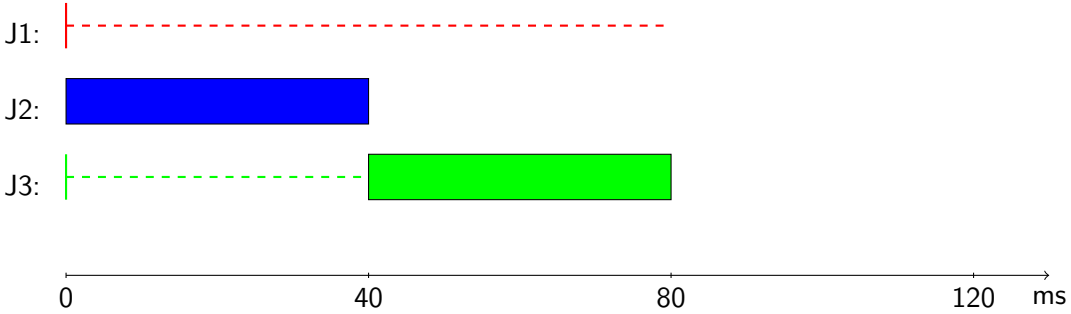

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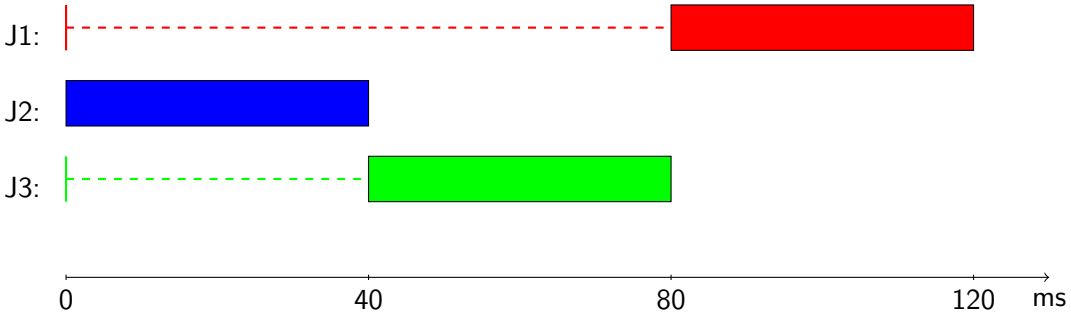

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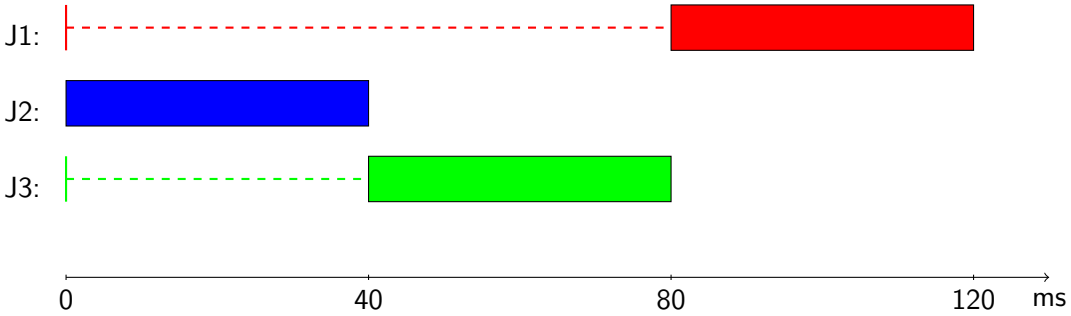


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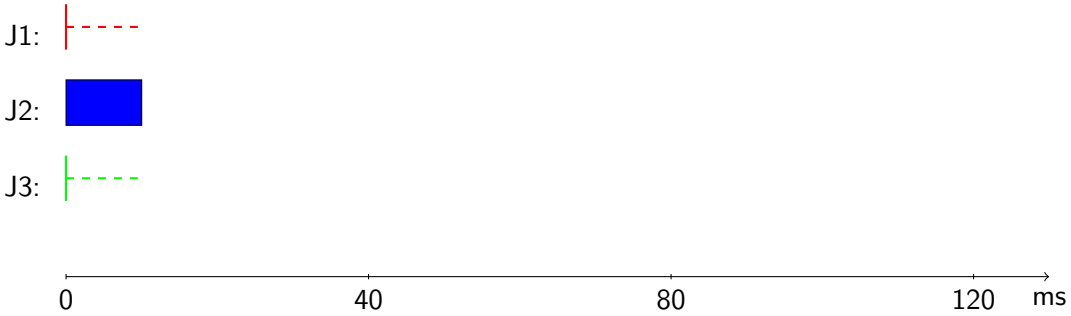

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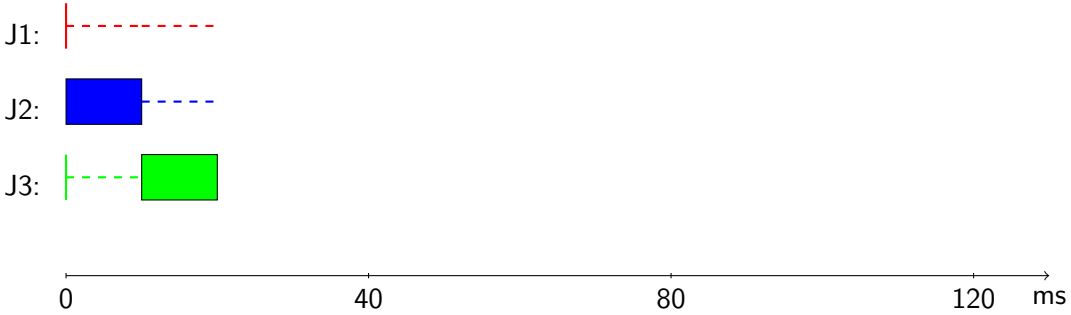

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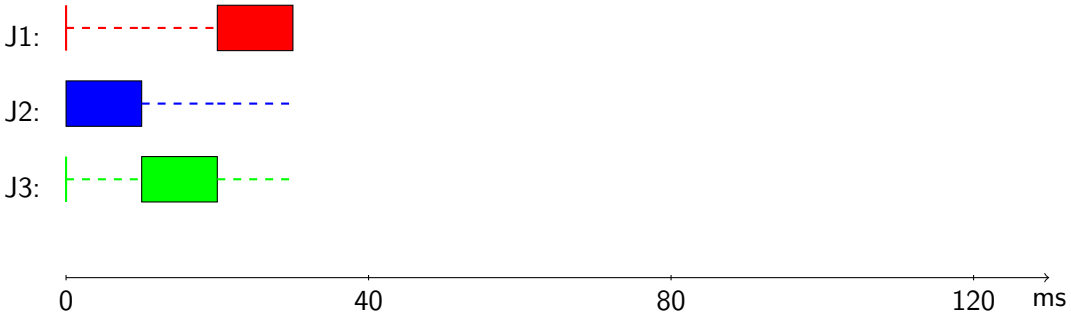

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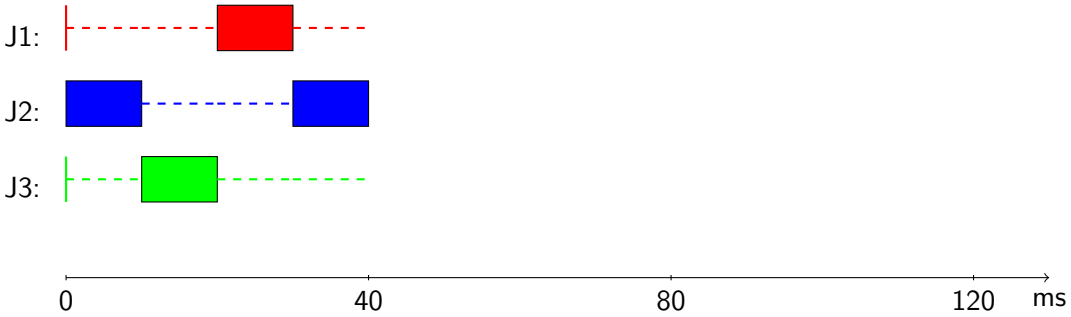

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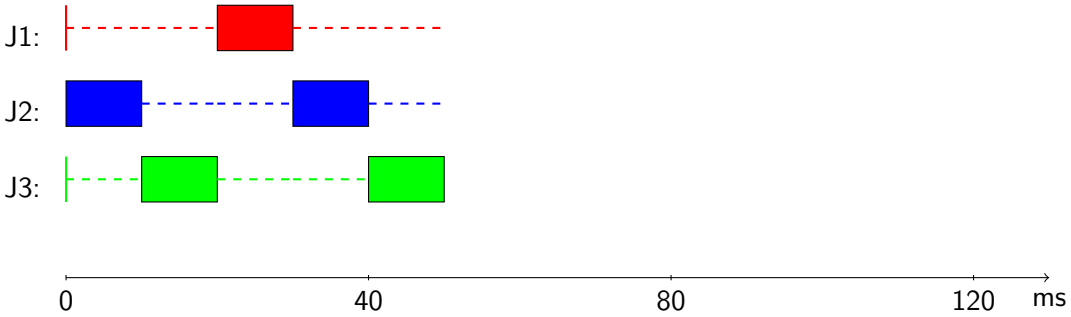

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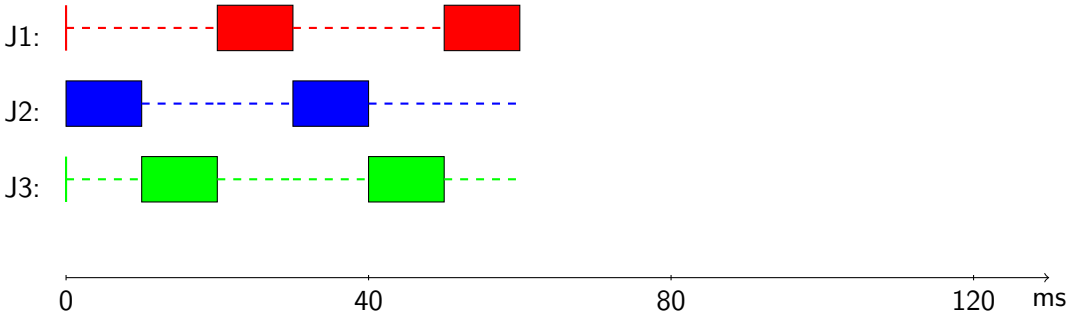

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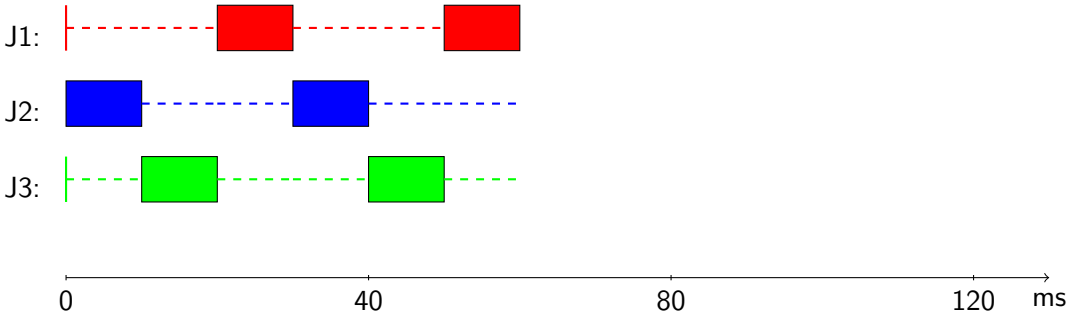


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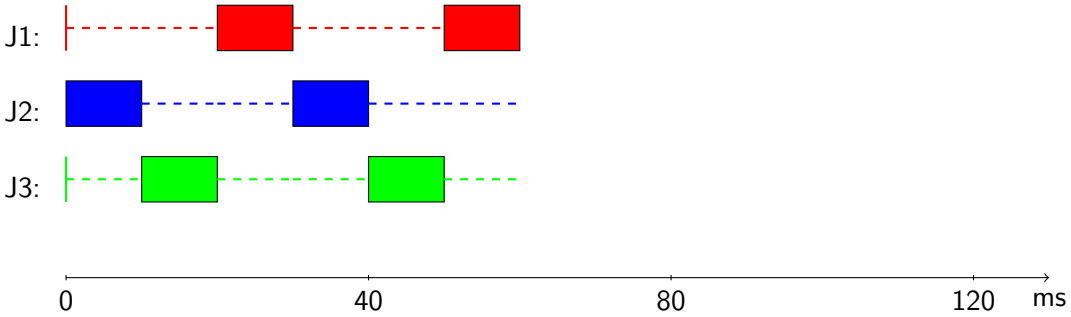


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What is the average turnaround time?

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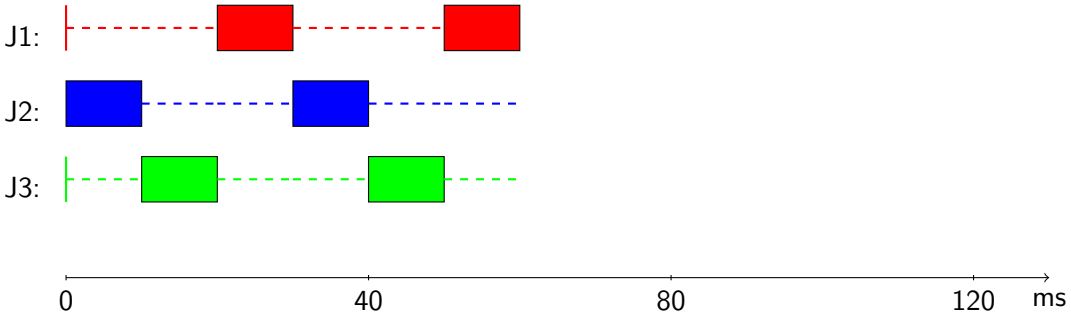


What is the average response time?

What is the average turnaround time?

How to choose the time-slice?

# You can't ....


6103 062
sad day
DECCA
the rolling stones
you can't always get
what you want

# processes do I/O

Assume we have two processes, each take 40 ms of CPU time but one will do I/O-operations every 10 ms.

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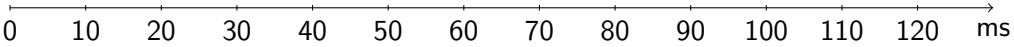
J2:



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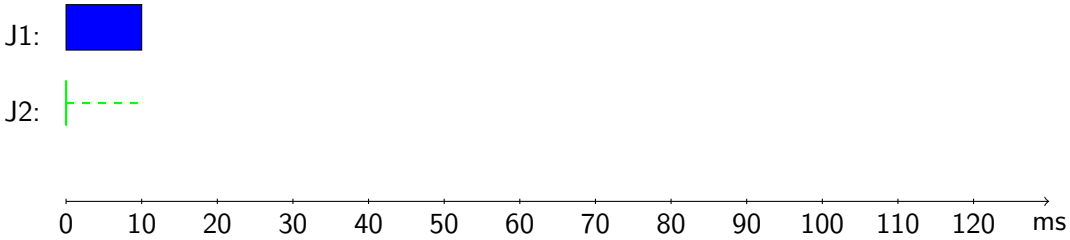

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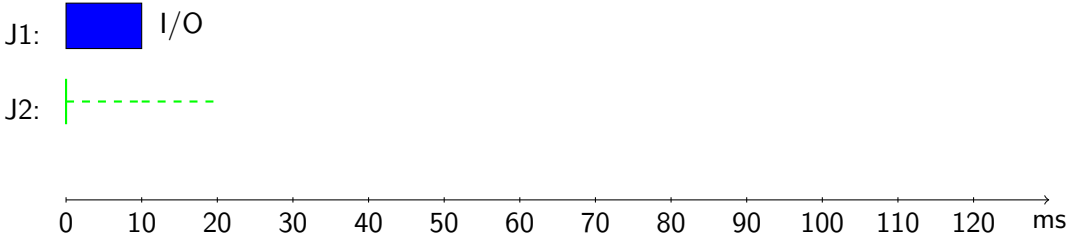

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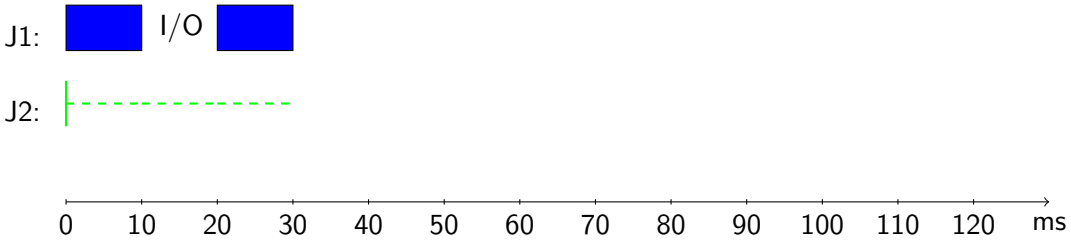

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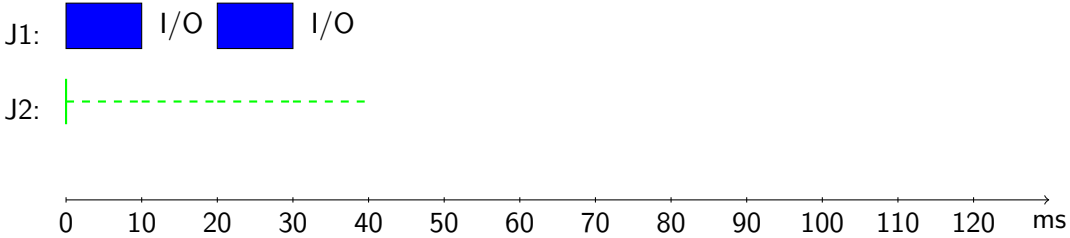

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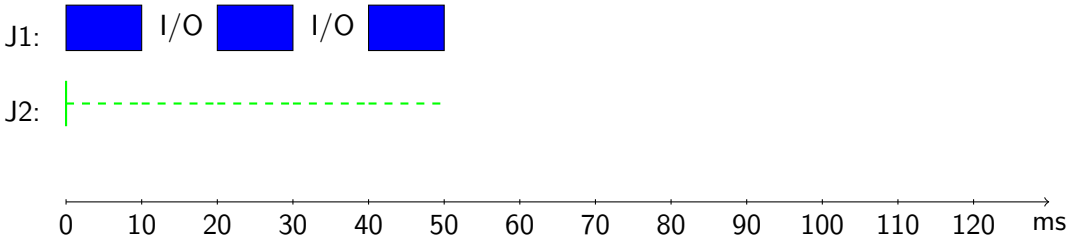

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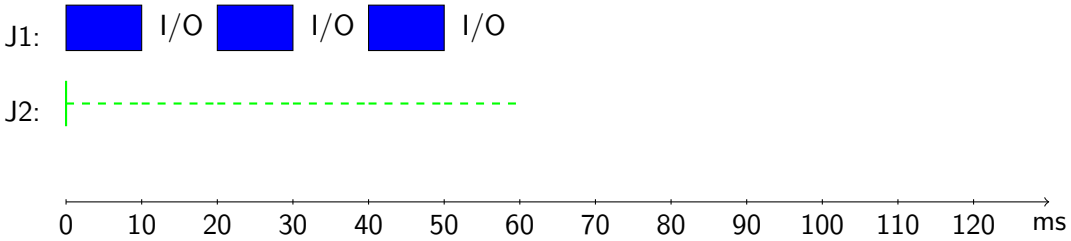

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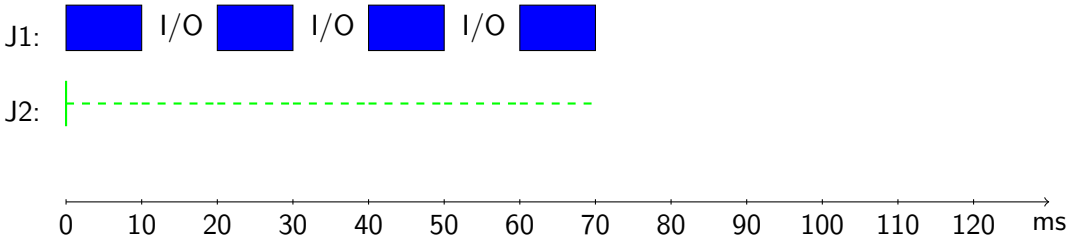

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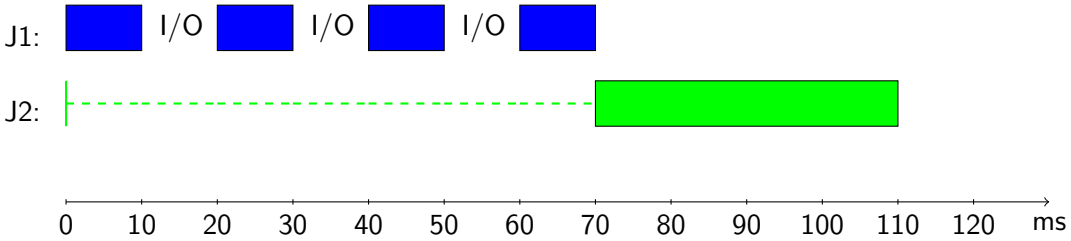

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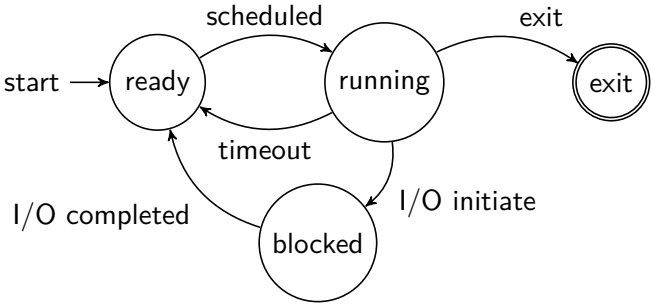

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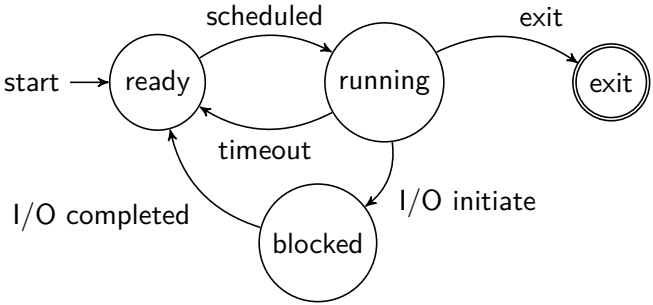


*A process is descheduled if it is preempted or if it initiates a I/O-operation.*

# much better

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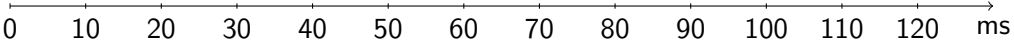

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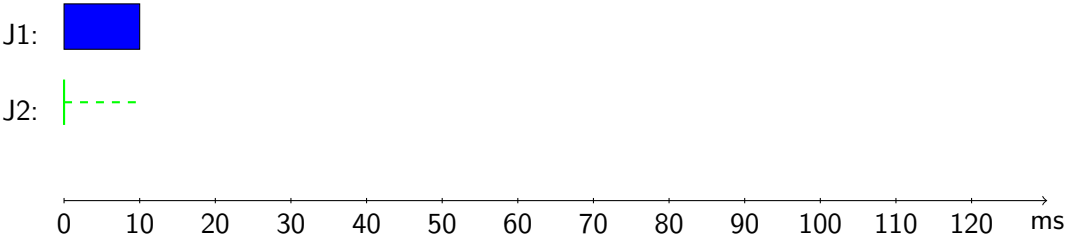

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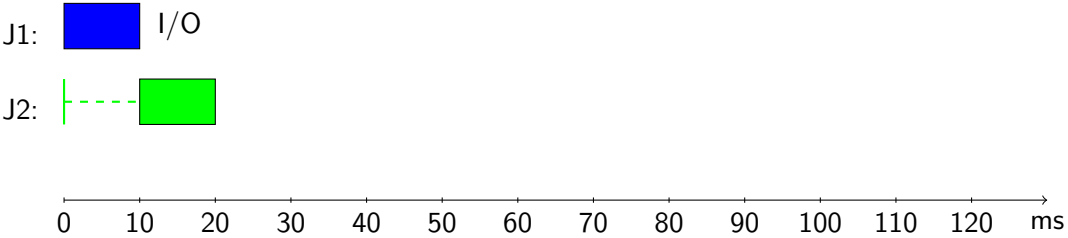

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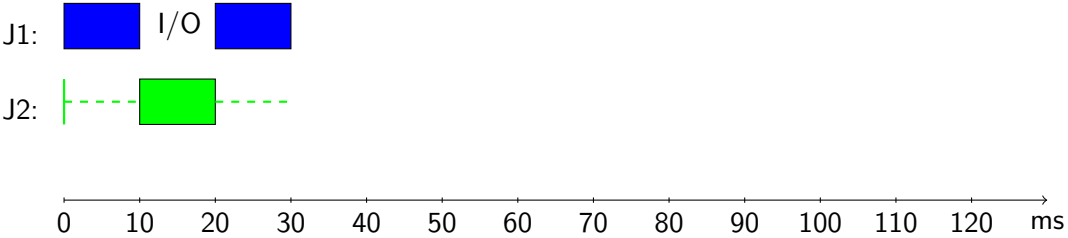

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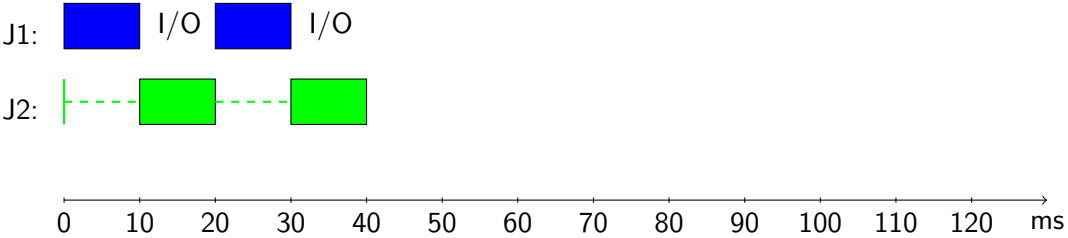

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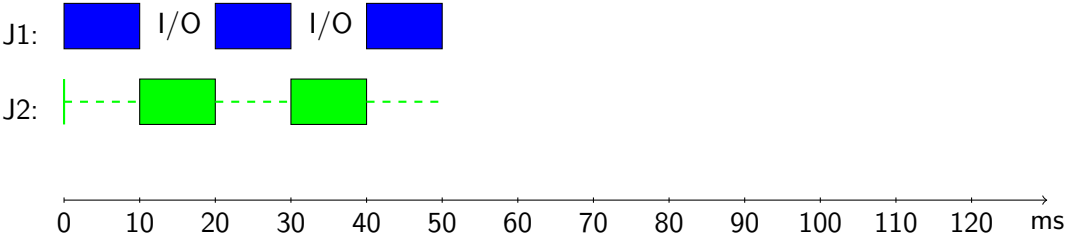

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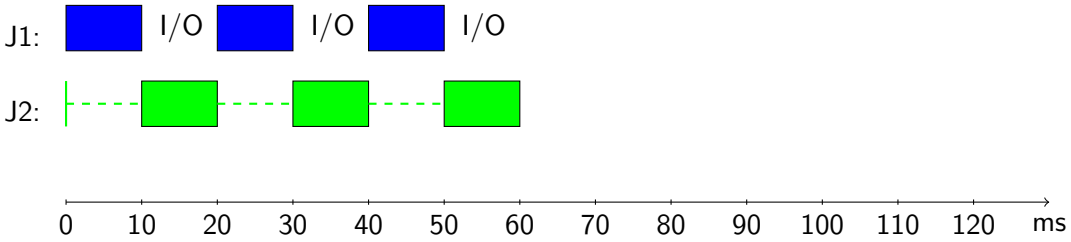

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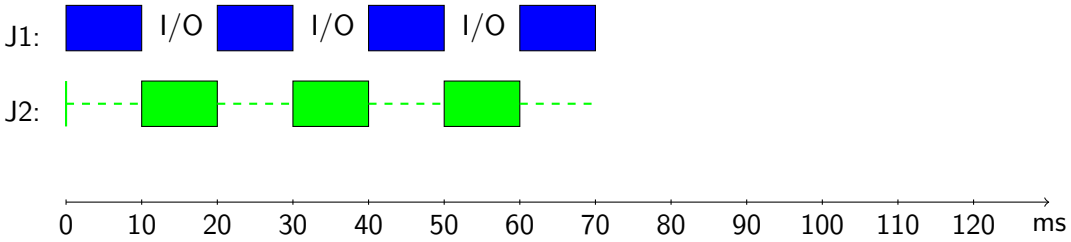

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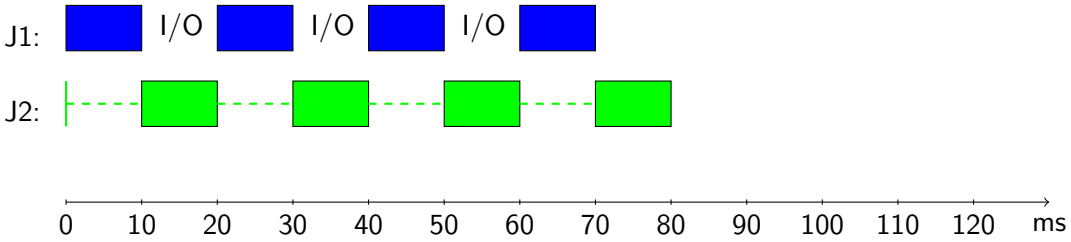

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*Can we design scheduling policies that give us good turn-around time and short response time?*

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*How do we identify interactive processes and how do we make sure that they have high priority?*

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- Rule 4b: a job that initiates a I/O-operation (or yields) remains on the same level.

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Q1:

Q0:

0 10 20 30 40 50 60 70 80 90 100 110 120 ms

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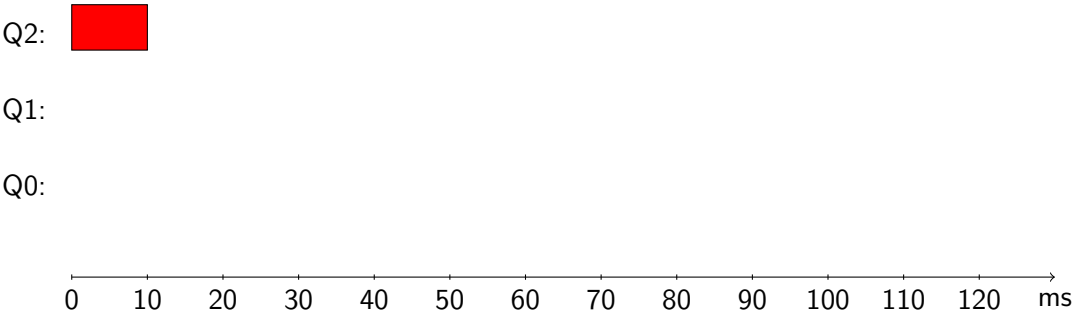

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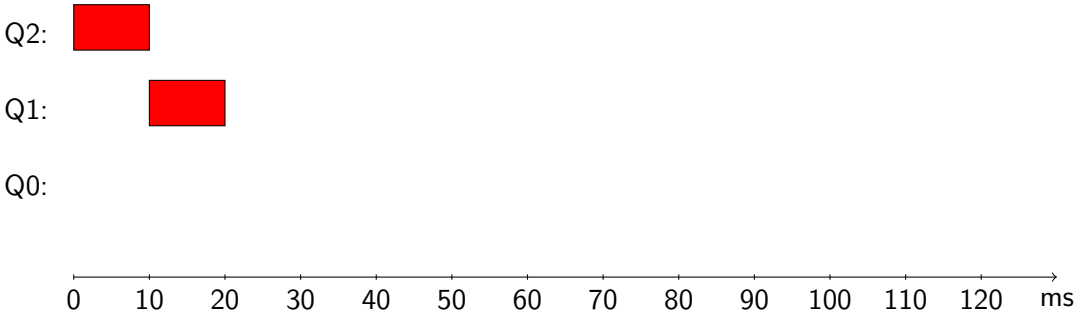

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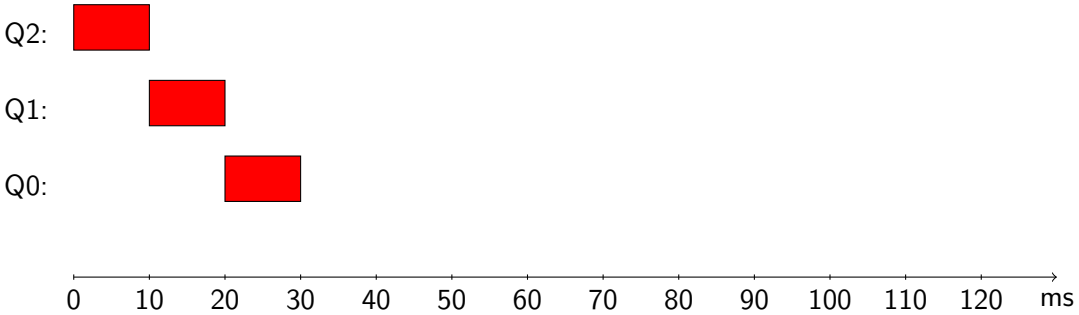

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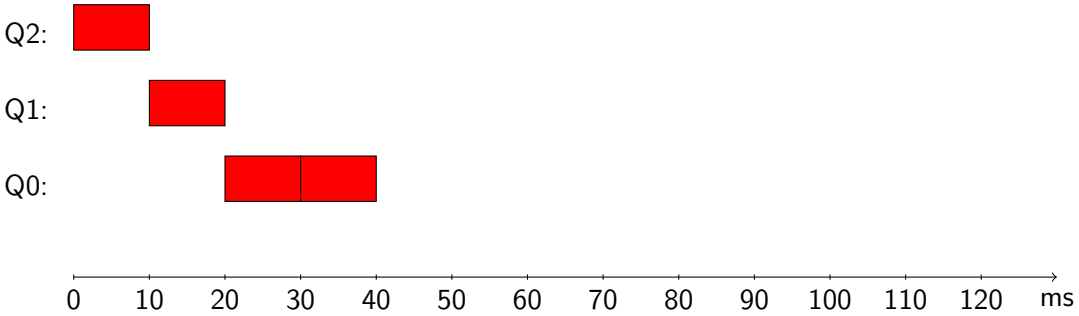

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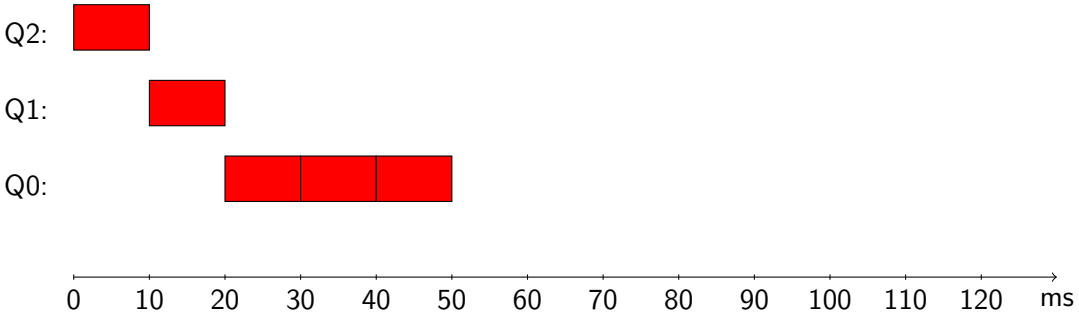

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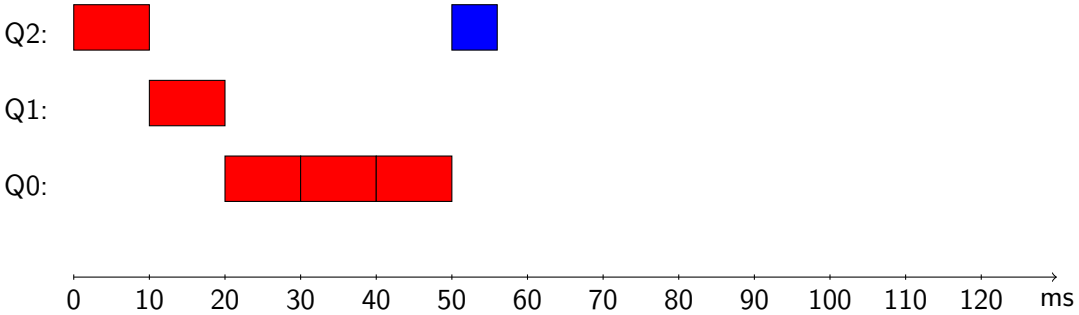

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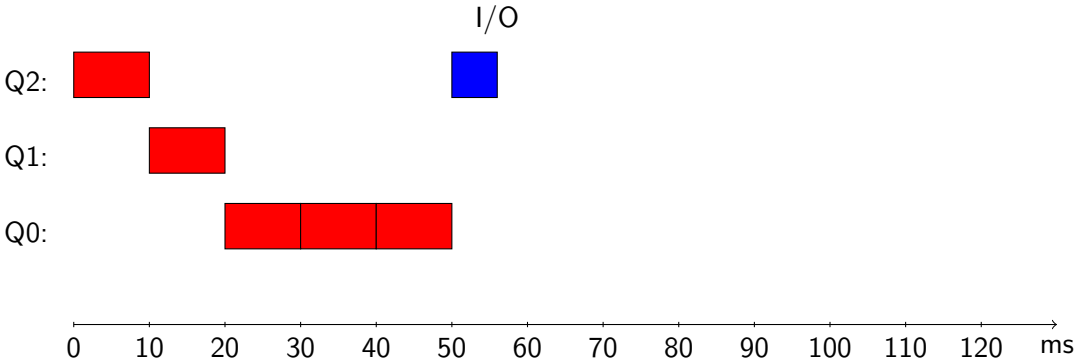

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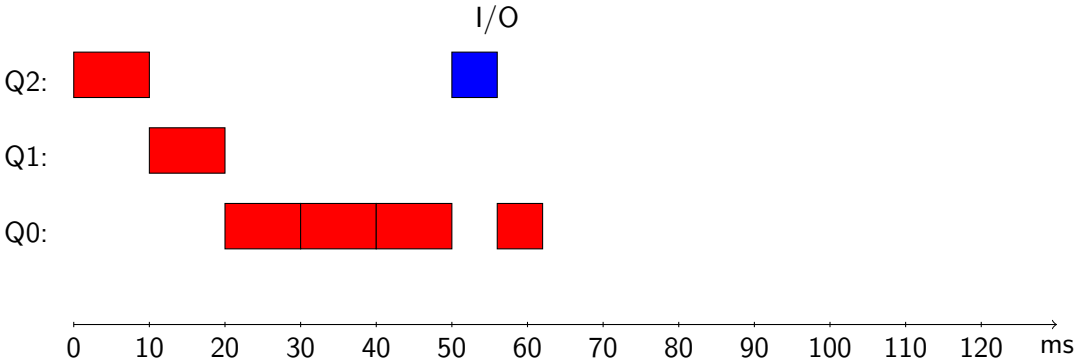

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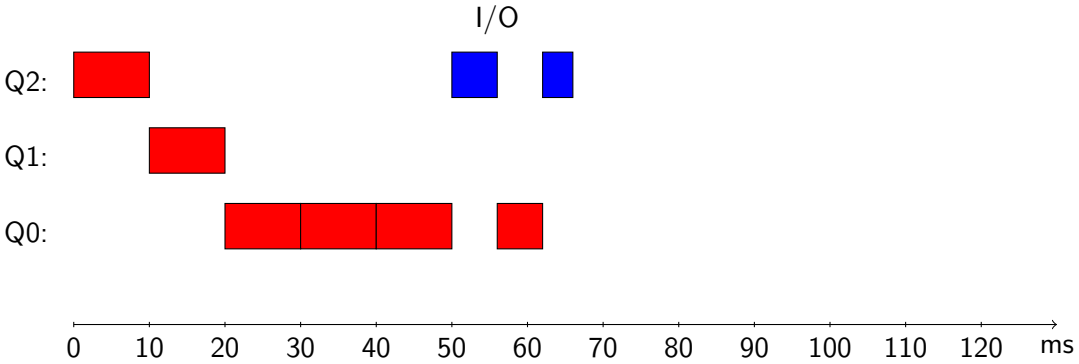

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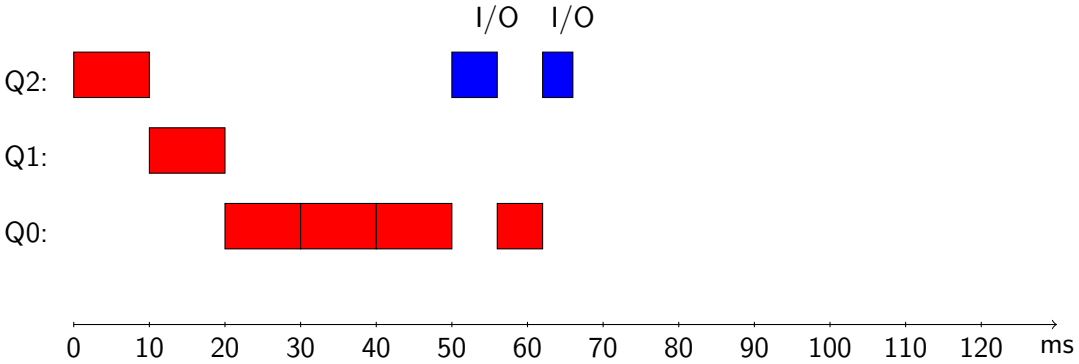

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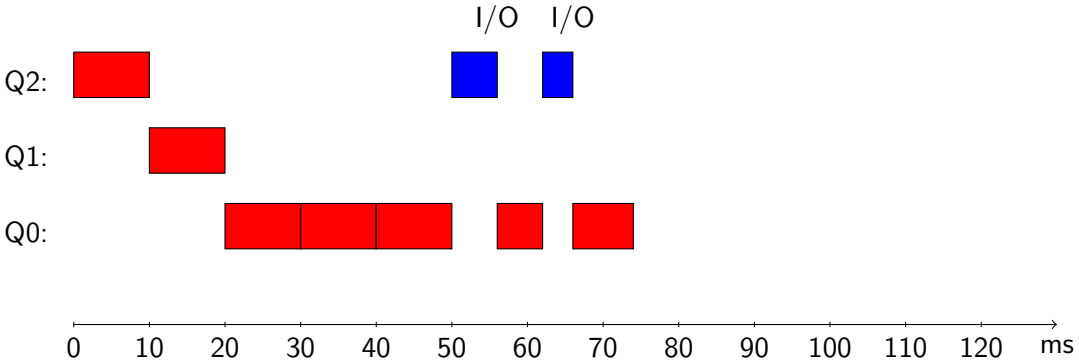

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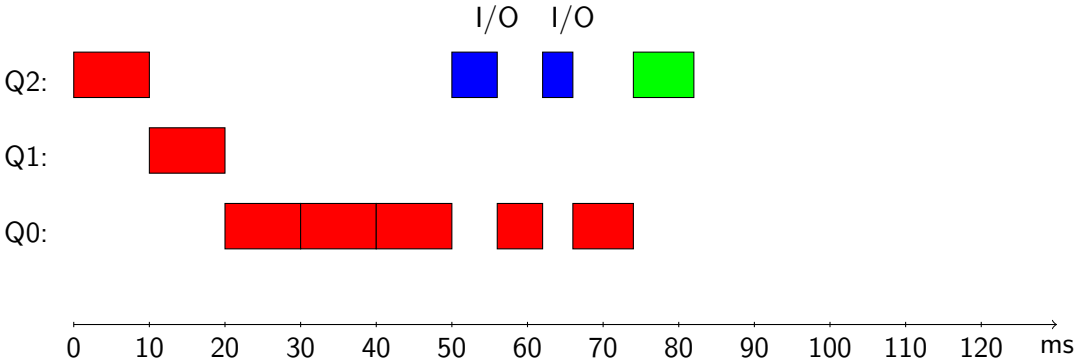

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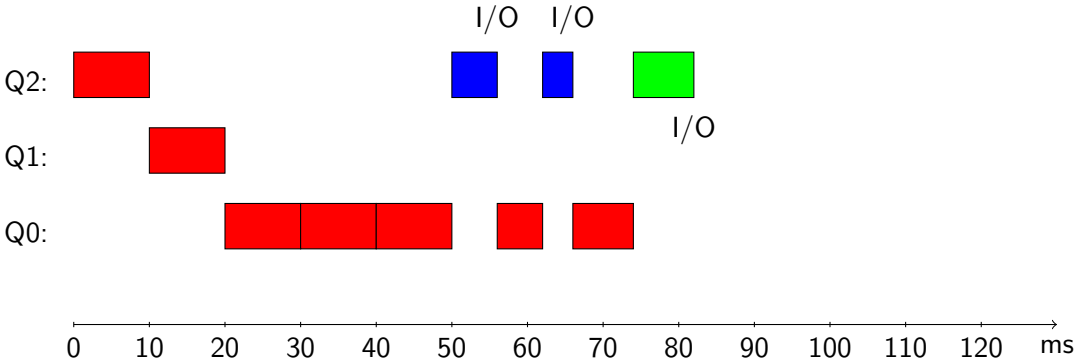

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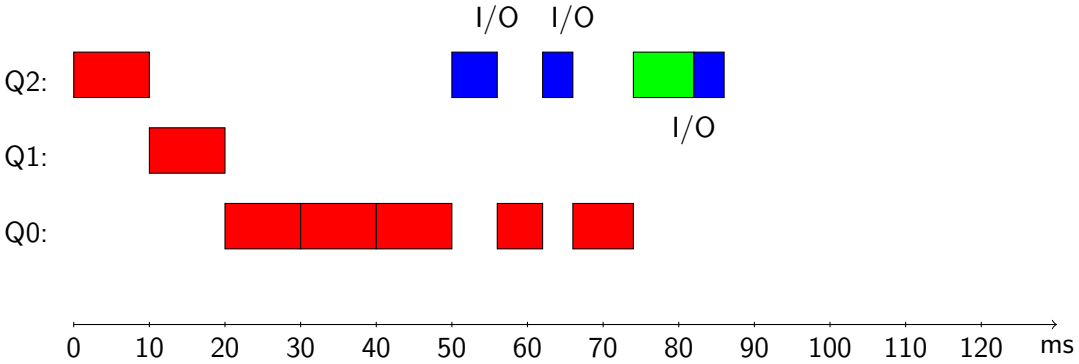

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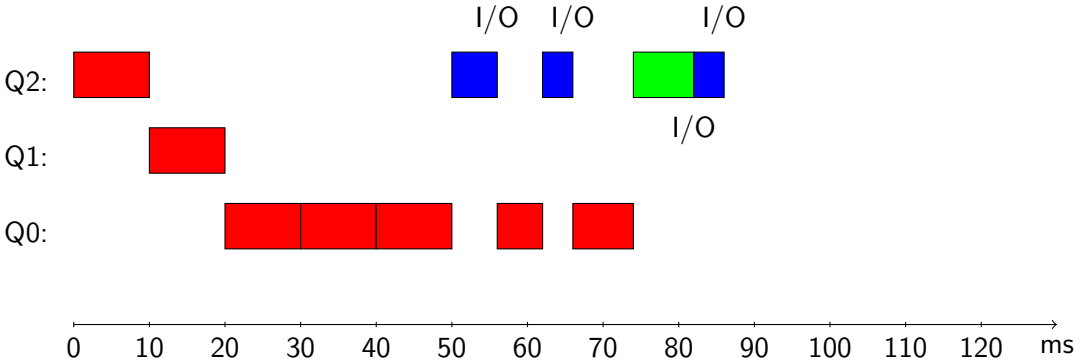

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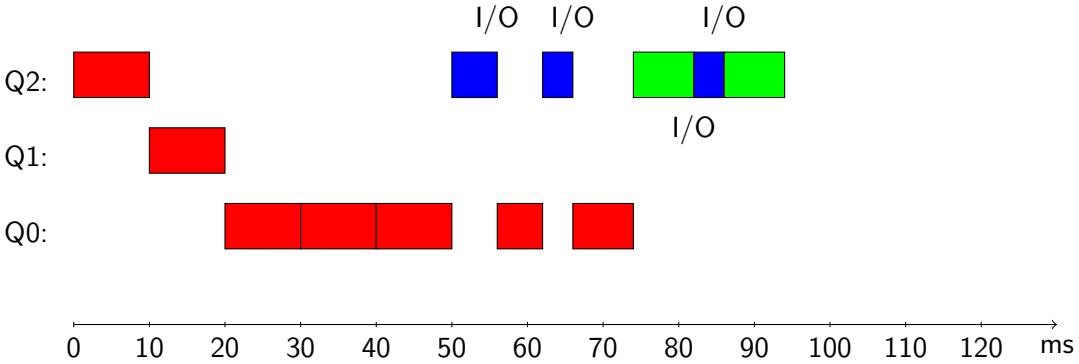

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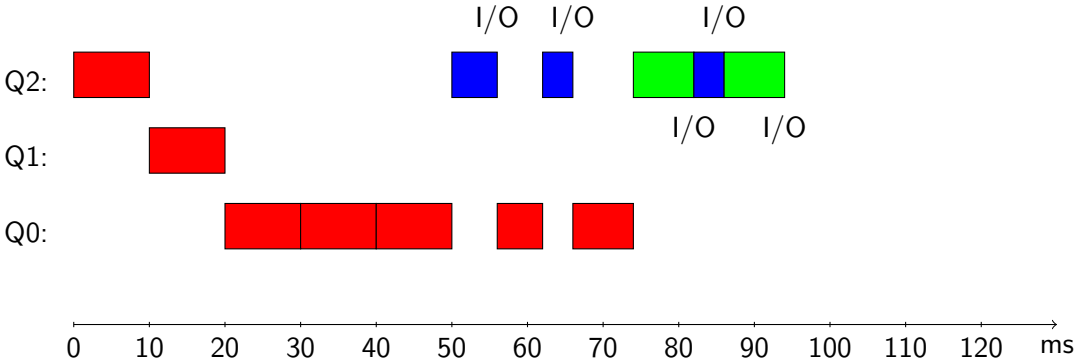

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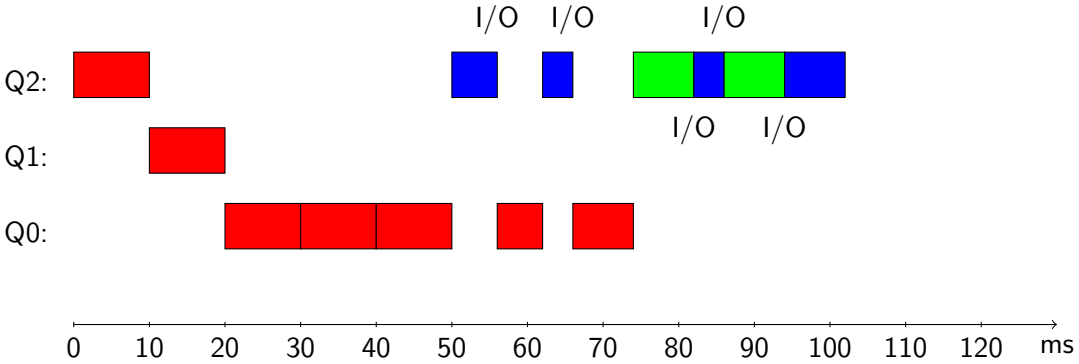

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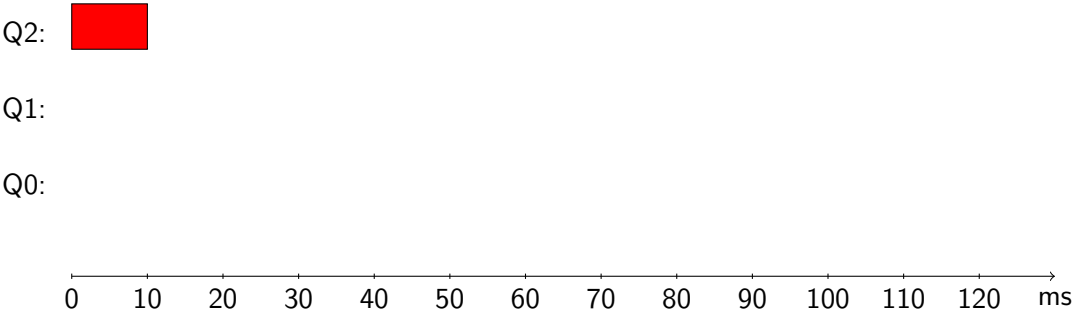

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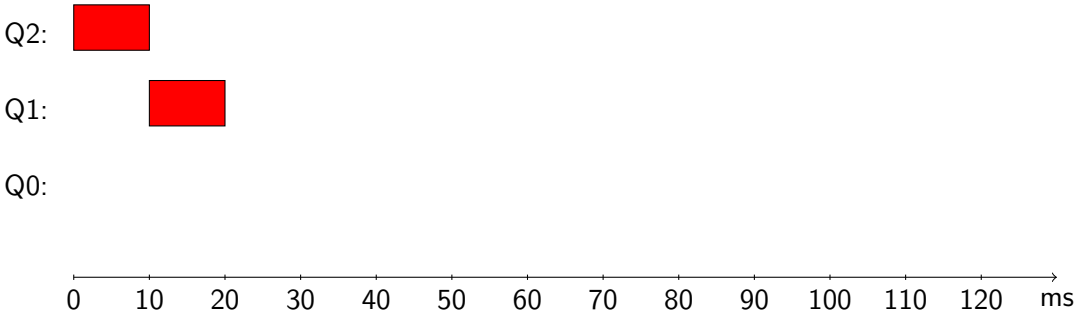

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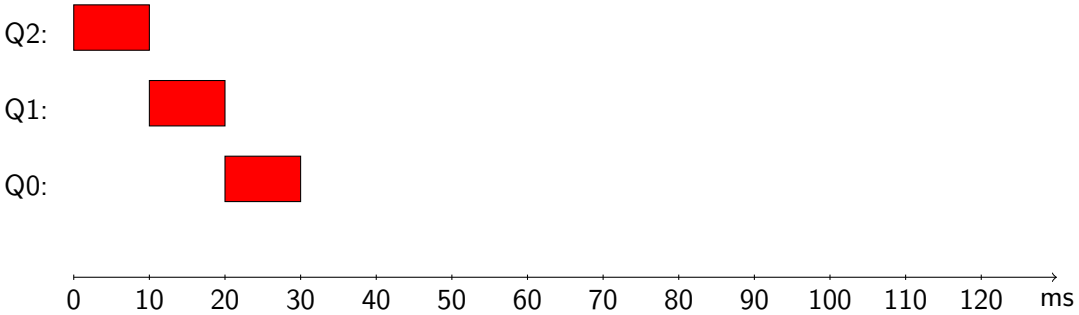

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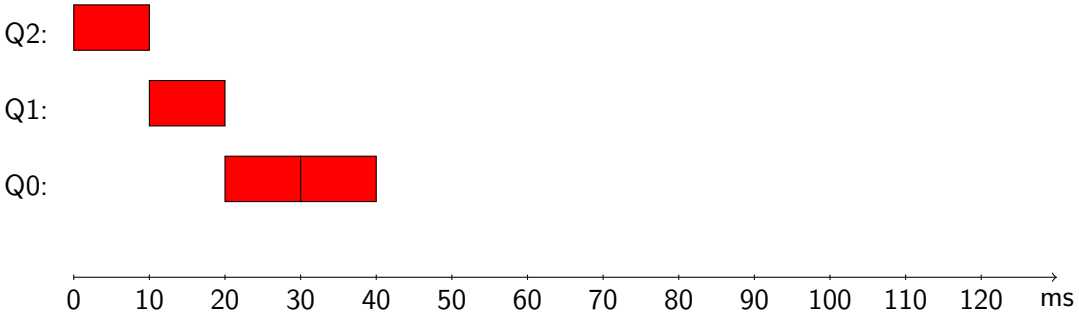

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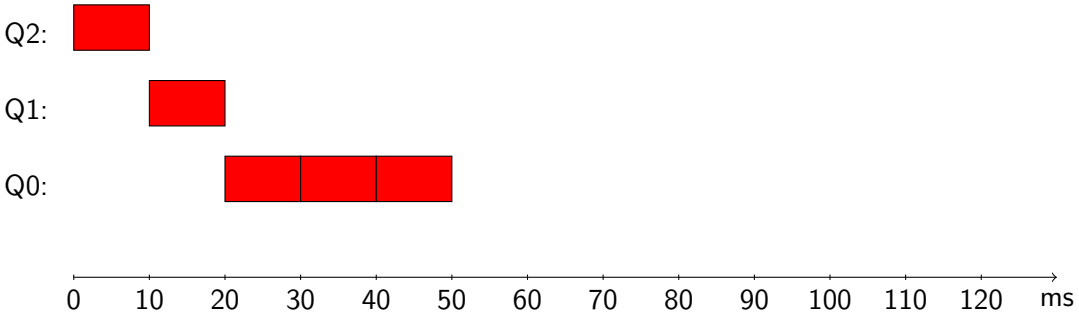

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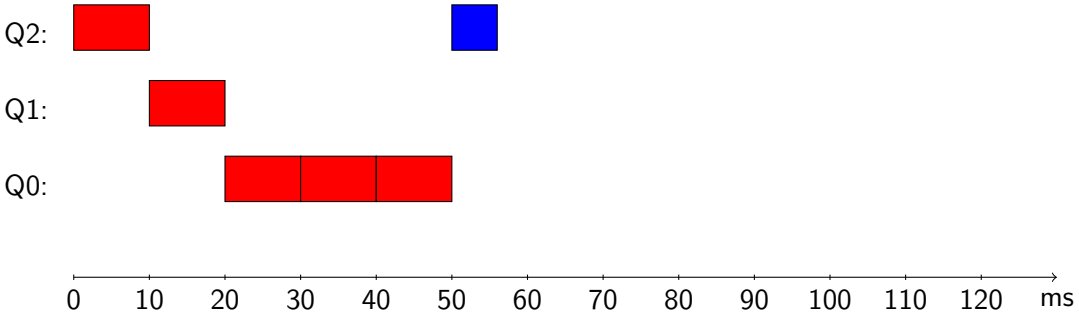

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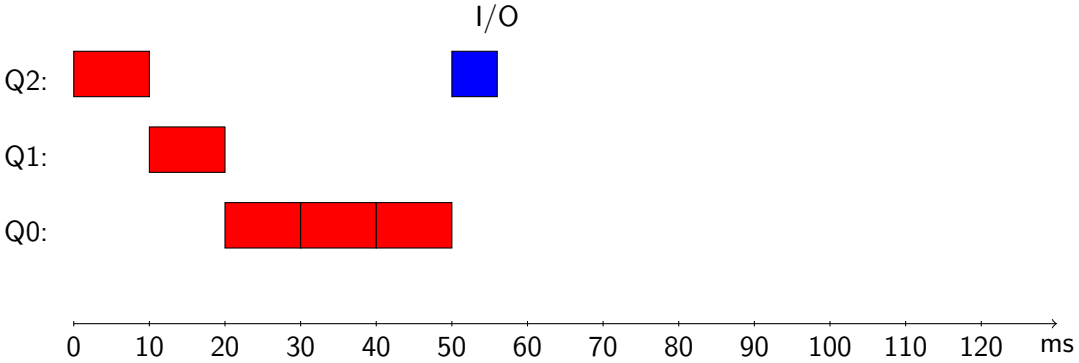

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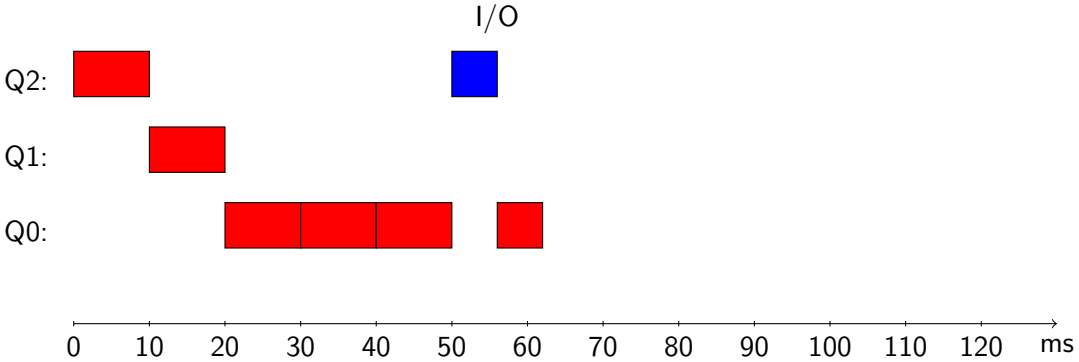

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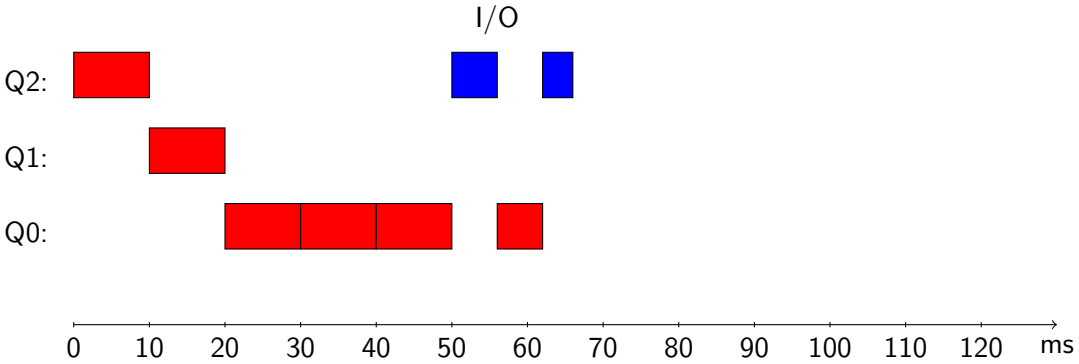

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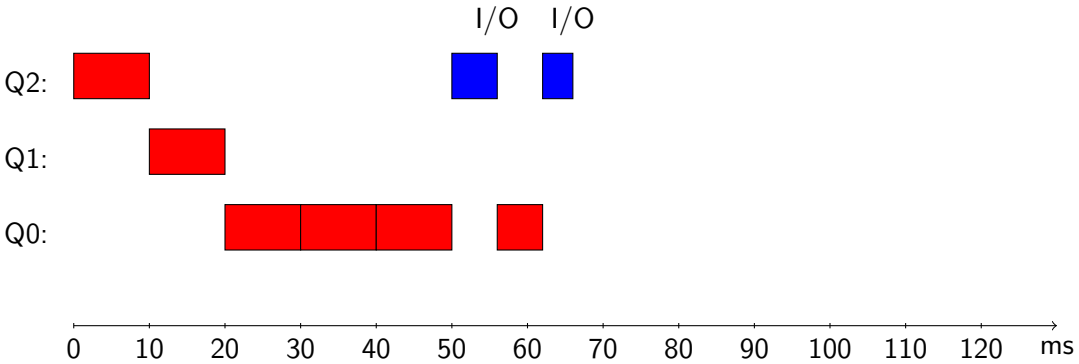

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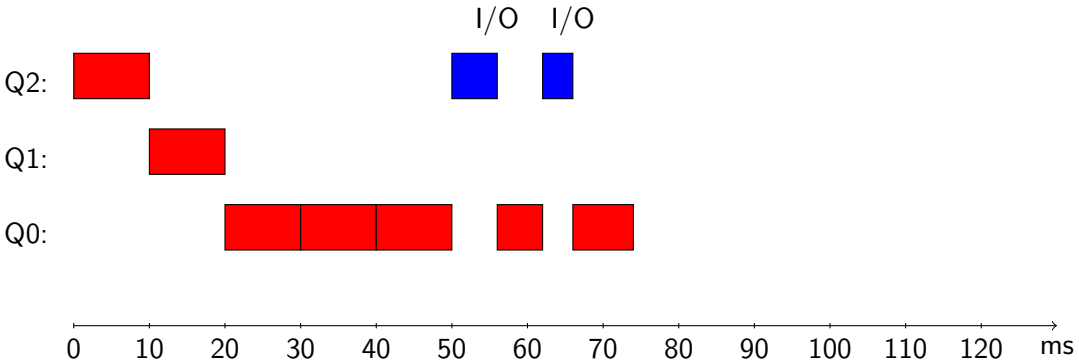

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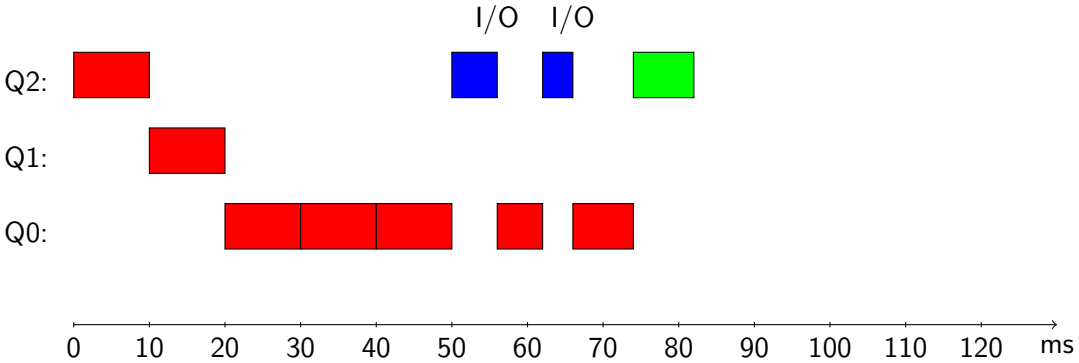

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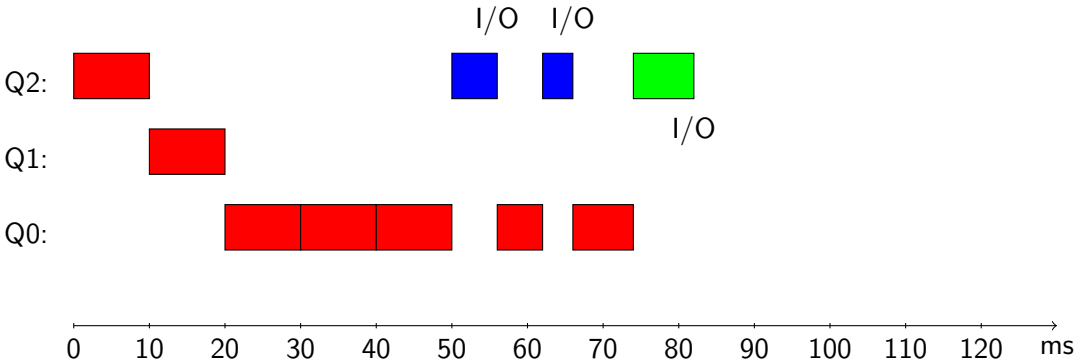

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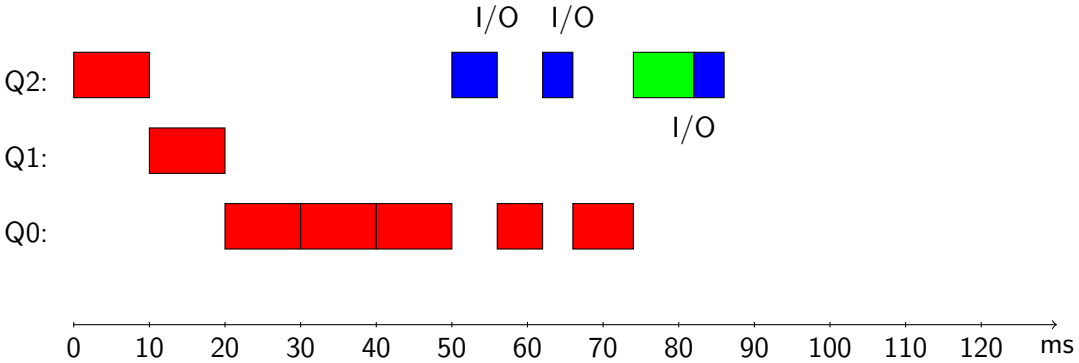

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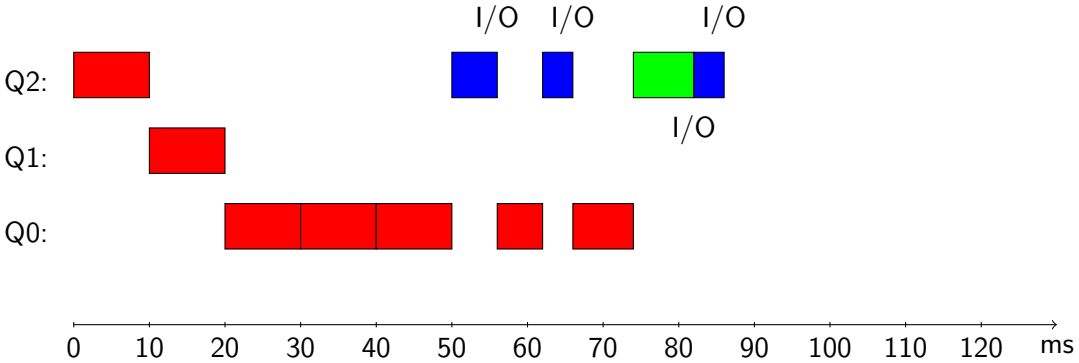

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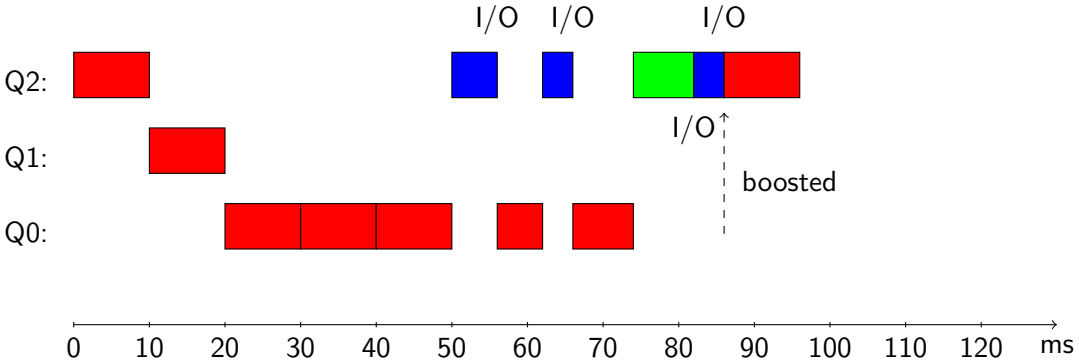

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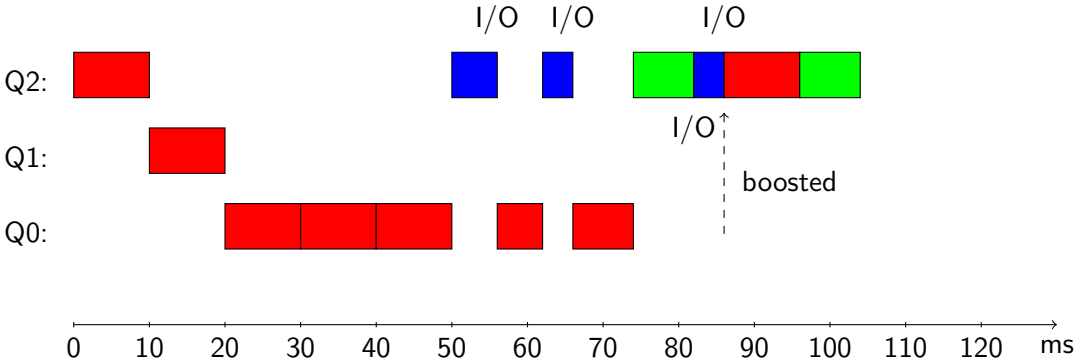

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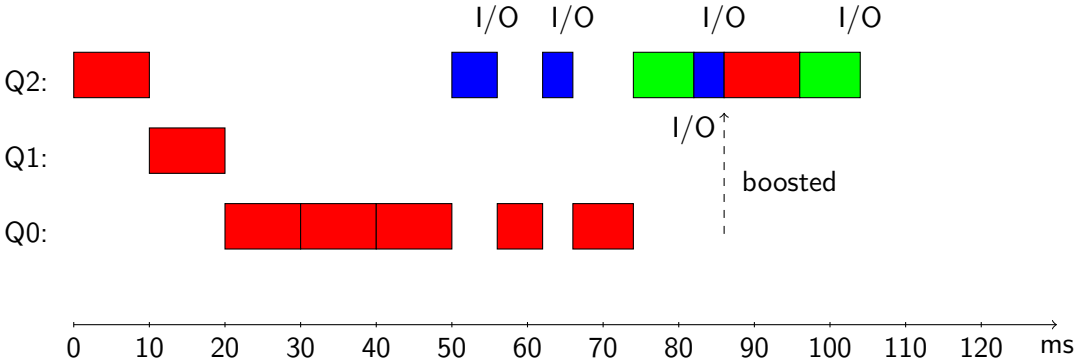

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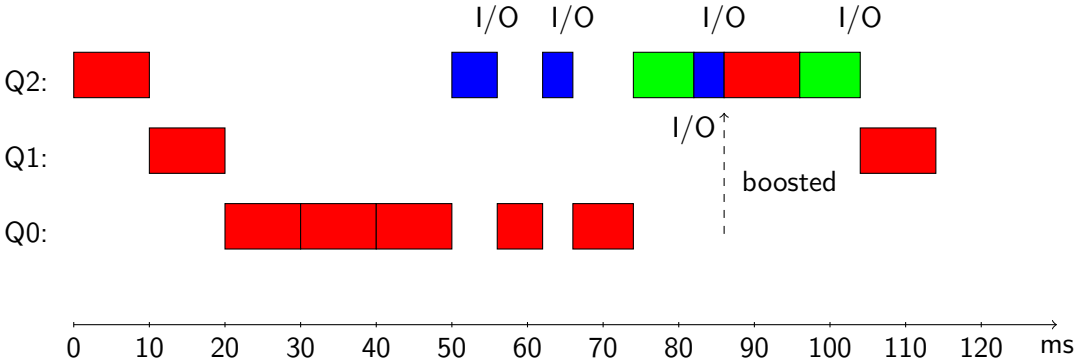

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- Rule 4b: a job that initiates a I/O-operation (or yields) remains on the same level.
- Rule 5: after some time, move a job to the highest priority.

# let's try this

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# tune the scheduler

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- How long is a time slice?
- How many queues should there be?
- How long time should a allotted time be in a specified queue?
- How often should a job be boosted to the highest priority?

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*Give each job fair share.*

# Give peace a chance

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- We can give a *user* a set of tickets and allow the user to distribute them among its jobs.
- Each user can have its local tickets and then have a local lottery.
- We could allow each user to create new tickets, i.e. inflation, if we trust each other.

*How to implement?*

# Stand in line

- Each job is given a number that represents the number of tickets it owns.
- All jobs are lined up i a row.
- Pick a random number from zero to the total number of tickets.
- Walk down the line and select the winner.


*How does this work?*

# Why random?

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*A low stride value will make it more likely to be scheduled soon again.*

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*We often have real-time requirements that are simply met since we happen to have the available resources.*

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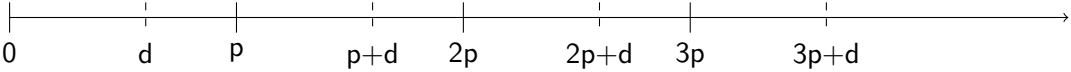

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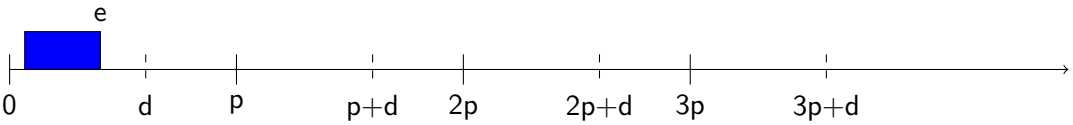

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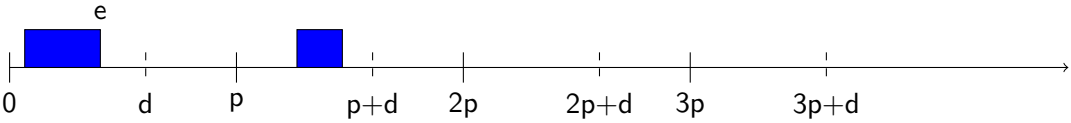

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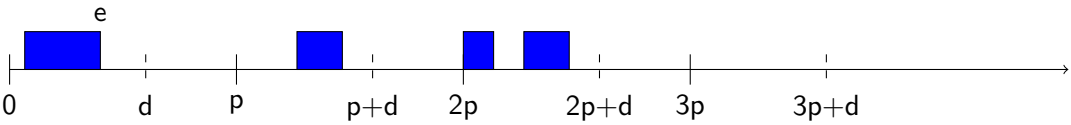


$d < p$ : *constrained*, $d = p$ *default*, $d > p$ *several out-standing*

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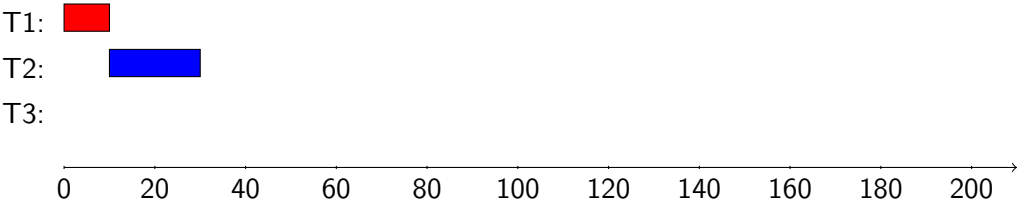

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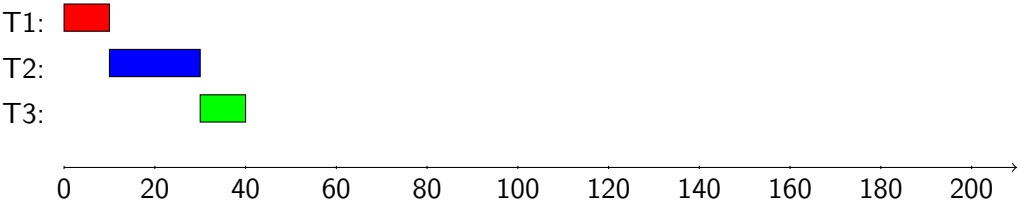

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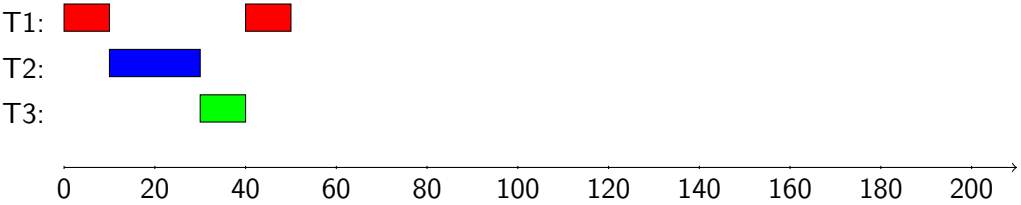

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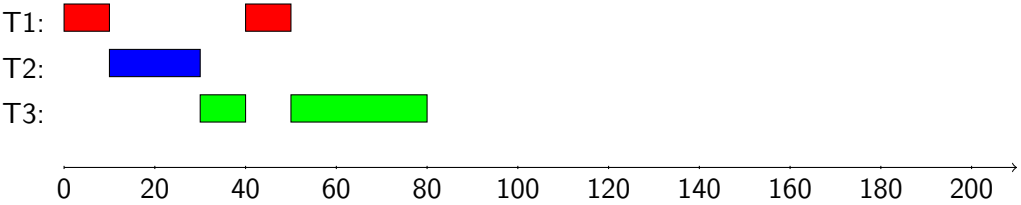

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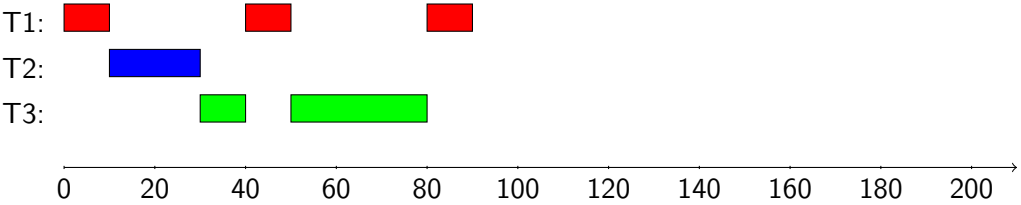

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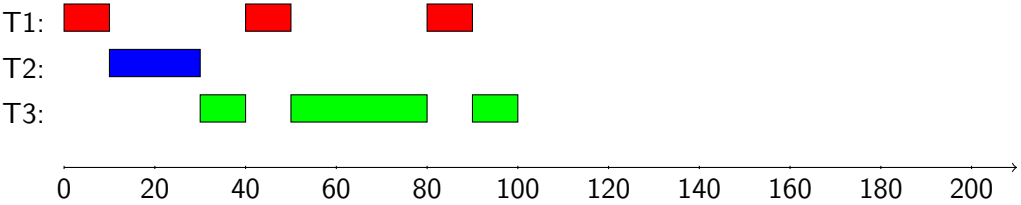

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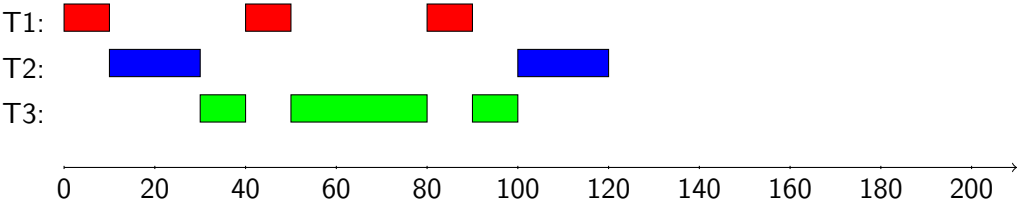

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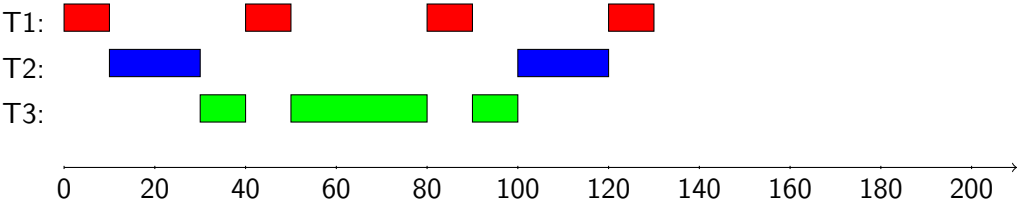

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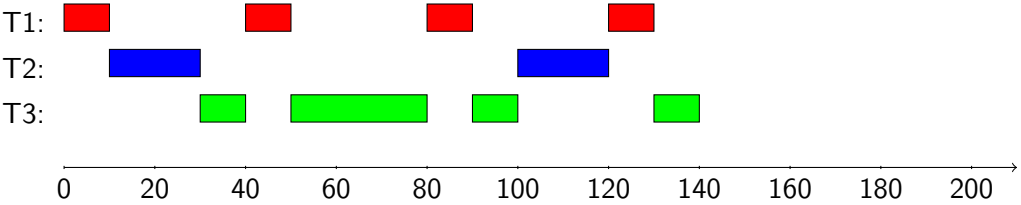

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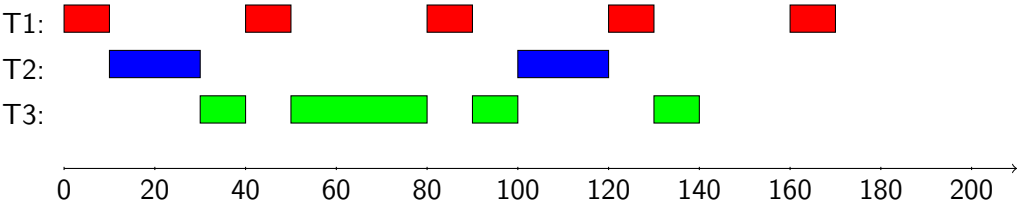

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*Scheduling could be decided/verified by simulation.*

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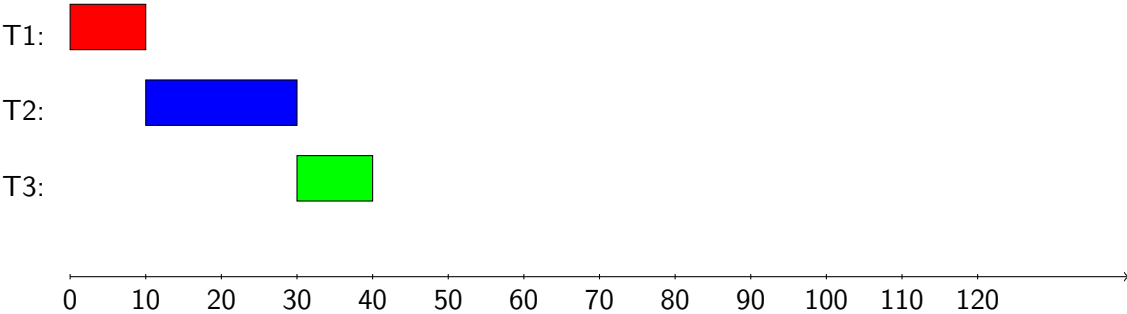

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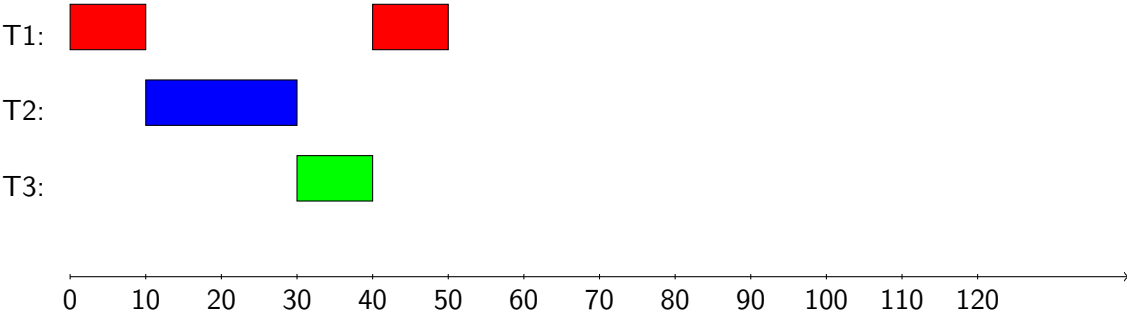

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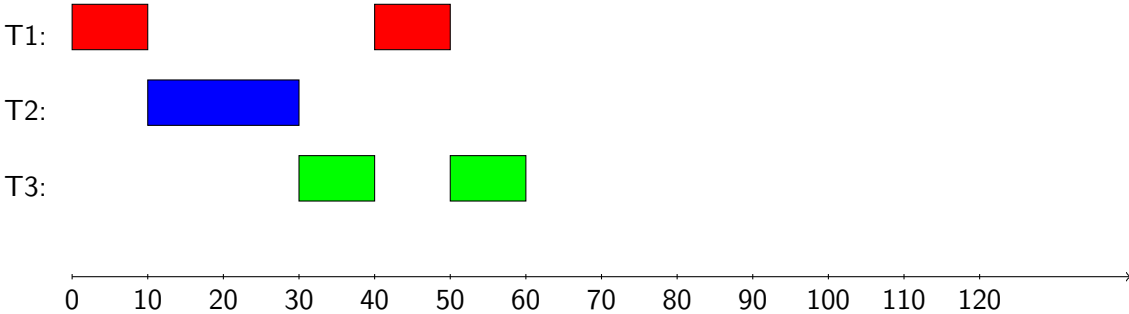

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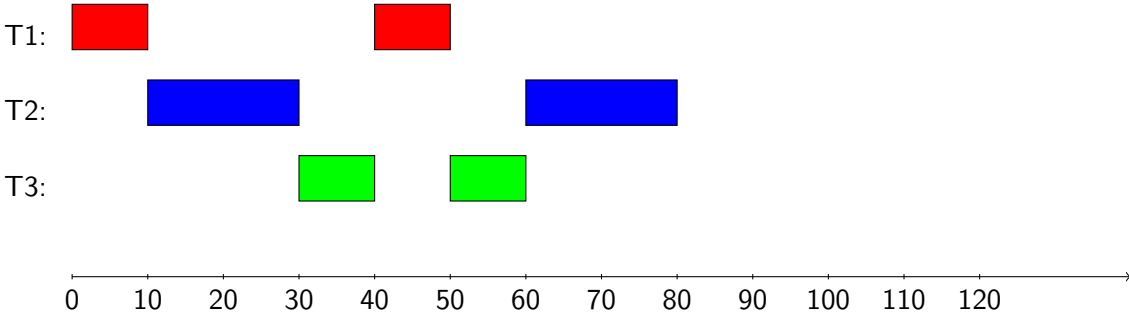

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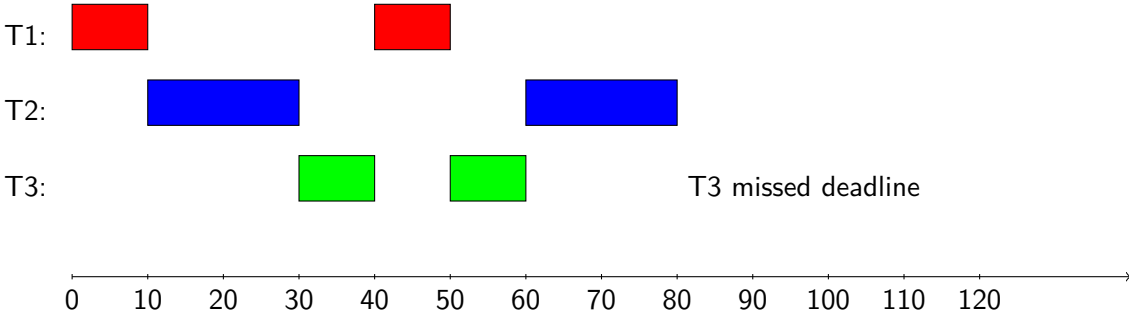

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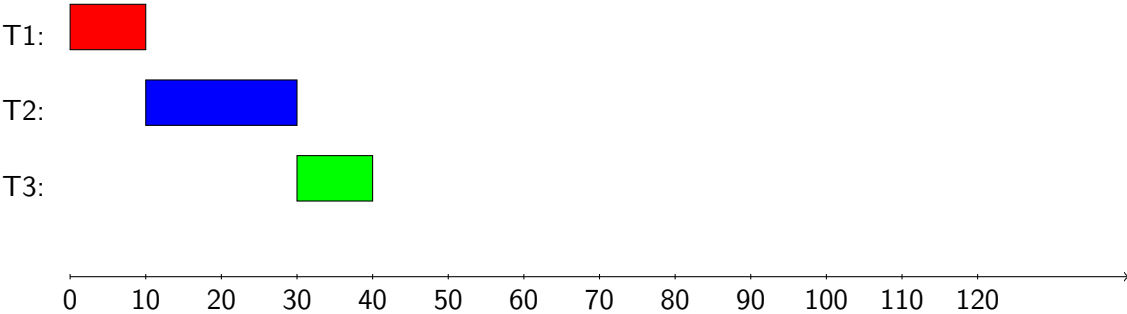

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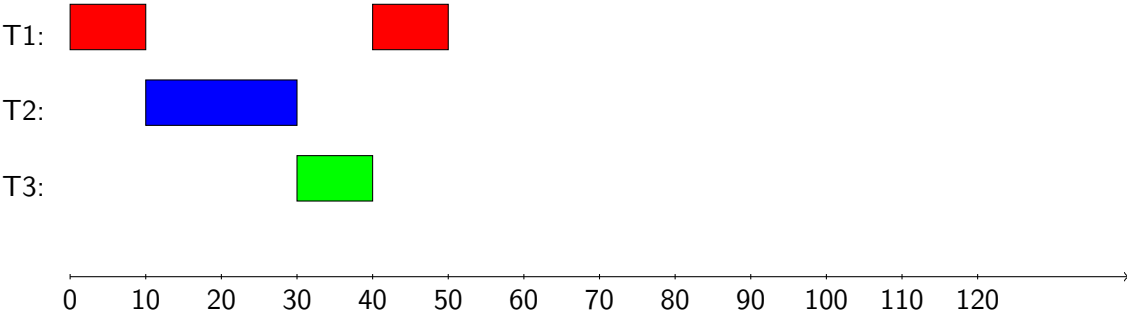

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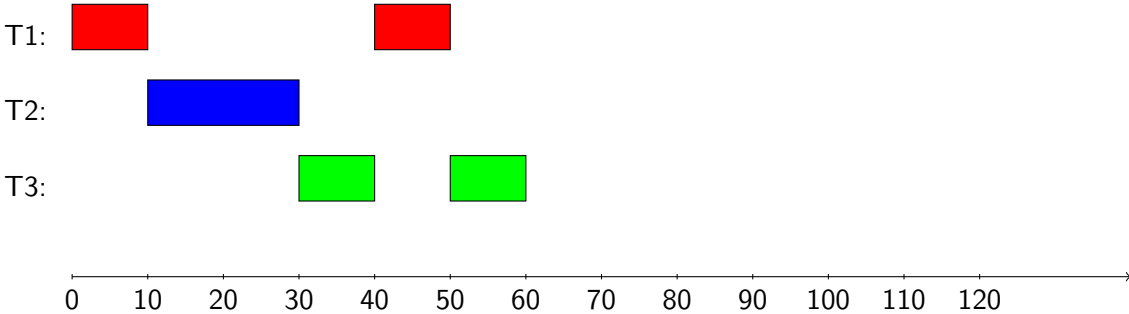

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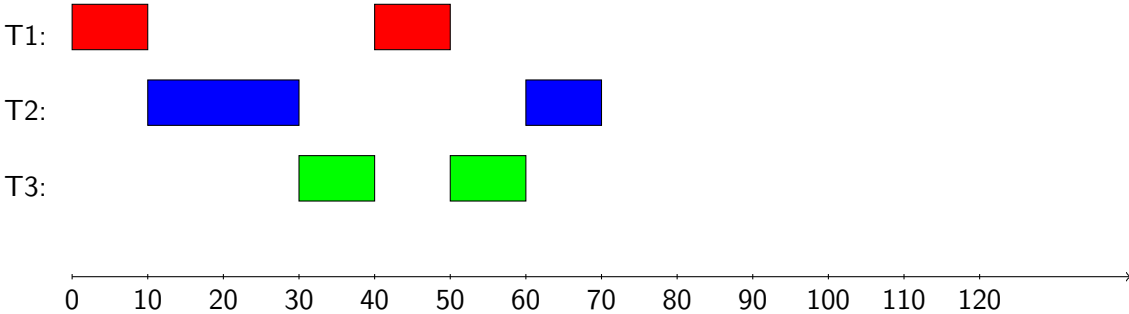

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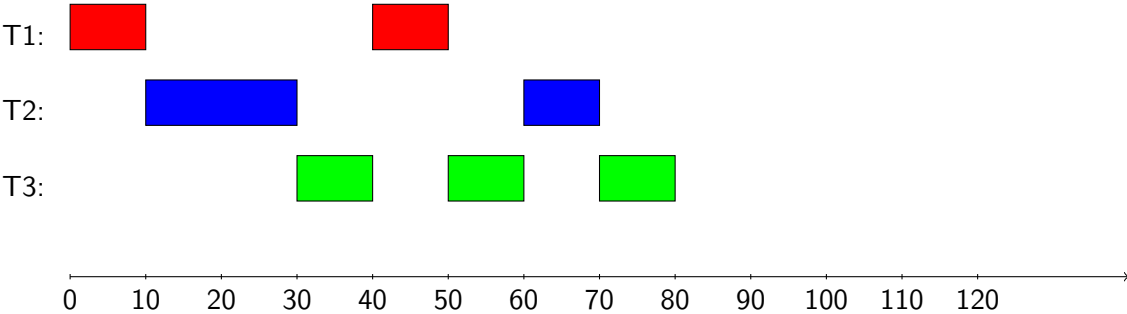

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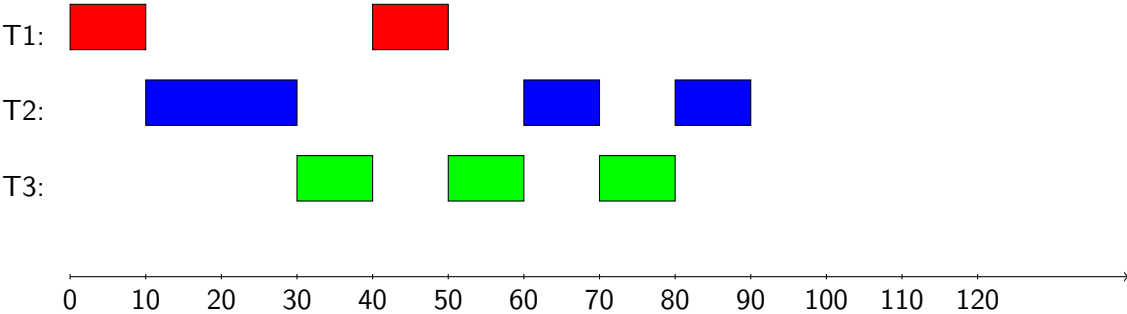

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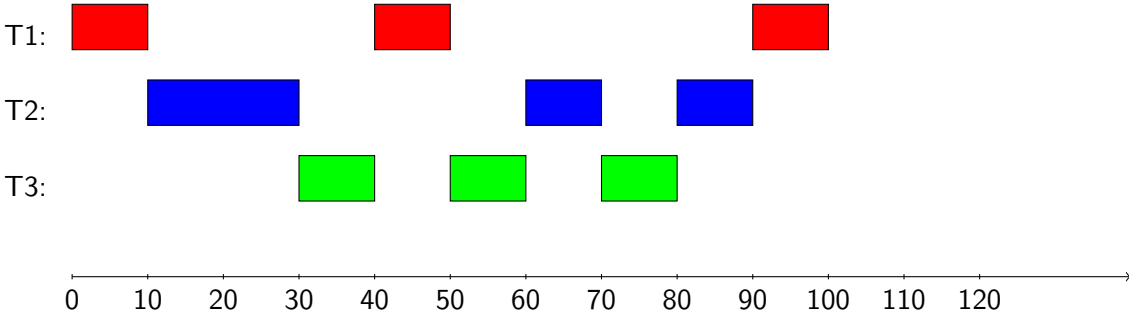

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Scheduling for a multi-core architecture more problematic (or rather more problematic to achieve high utilization).

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