**multi resource scheduling**

glaros.dtc.umn.edu/gkhome/fetch/papers/mr**schedule**.pdf

tetris: <https://www.cs.cmu.edu/~xia/resources/Documents/grandl_sigcomm14.pdf>

FCFS first come first serve

resource imbalance

multi-constraint graph partitioning and multi-capacity bin-packing

critical path scheduling

fragmentation and over allocation

bin packing – NP hard

<https://en.wikipedia.org/wiki/Job_shop_scheduling>

**LPT algorithm** (Longest Processing Time) - 4/3 - 1/(3m) **OPT**

Job shop scheduling

Objective function can be to minimize the makespan, the *[L](https://en.wikipedia.org/wiki/Lp_space" \o "Lp space)[p](https://en.wikipedia.org/wiki/Lp_space" \o "Lp space)* norm, tardiness, maximum lateness etc. It can also be multi-objective optimization problem

Temporal Constraint Problem or *TCP*

**classification**

<http://cs.stackexchange.com/questions/13219/classification-of-job-shop-scheduling-problems>

**Heuristic Methods for Solving Job-Shop Scheduling Problems**

<http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.143.5570>

*Basic-Depth-First Backtrack and Depth-First-withDCE* [9, 10]

backracking

N.M. Sadeh, *Lookahead techniques for micro-opportunistic jobshop scheduling*, Ph.D., CMU-CS-91-102, School of Computer  
Science, Carnegie Mellon University, Pittsburgh, (1991).  
[9] N.M. Sadeh, K. Sycara and Y. Xiong, ‘Backtracking techniques  
for the job-shop scheduling constraint satisfaction problem’,  
*Artificial Intelligence*, **76**, 455-480, (1995).  
[10] N.M. Sadeh and M.S. Fox, ‘Variable and value ordering heuristics  
for the job shop scheduling constraint satisfaction problem’,  
*Artificial Intelligence*, **86**, 1-41, (1996)

<http://www.slideshare.net/HadoopSummit/goodfit-multiresource-packing-of-tasks-with-dependencies-63956245>

**considerations:**

fairness

QoS

**Metrics:**

Scheduling efficiency can be defined for a schedule through the ratio of total machine idle time to the total processing time as below:

Makespan

**Books:**

Scheduling: **Theory, Algorithms, and Systems**

<https://books.google.com/books?id=EkpDak9kEs0C&hl=en>