



Wintersemester 2015/16

# Selected Topics in Efficient Algorithms

<http://www14.in.tum.de/lehre/2015WS/>

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# Organization

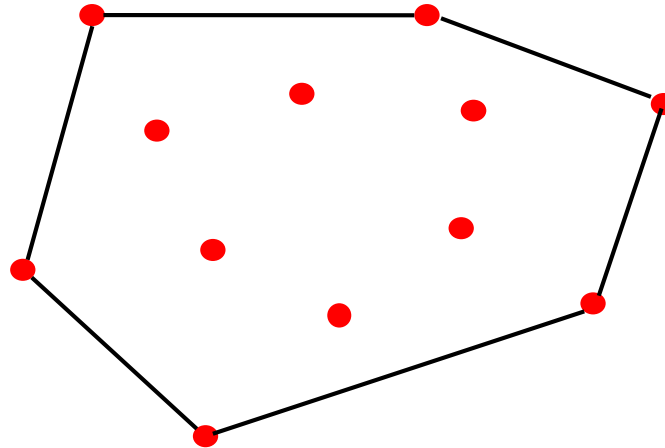
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Seminar Sessions: 2 SWS  
Mon 16:00–18:00, MI 03.11.018 ???

Duties: Presentation of 60 minutes  
Write-up of 8 to 10 pages

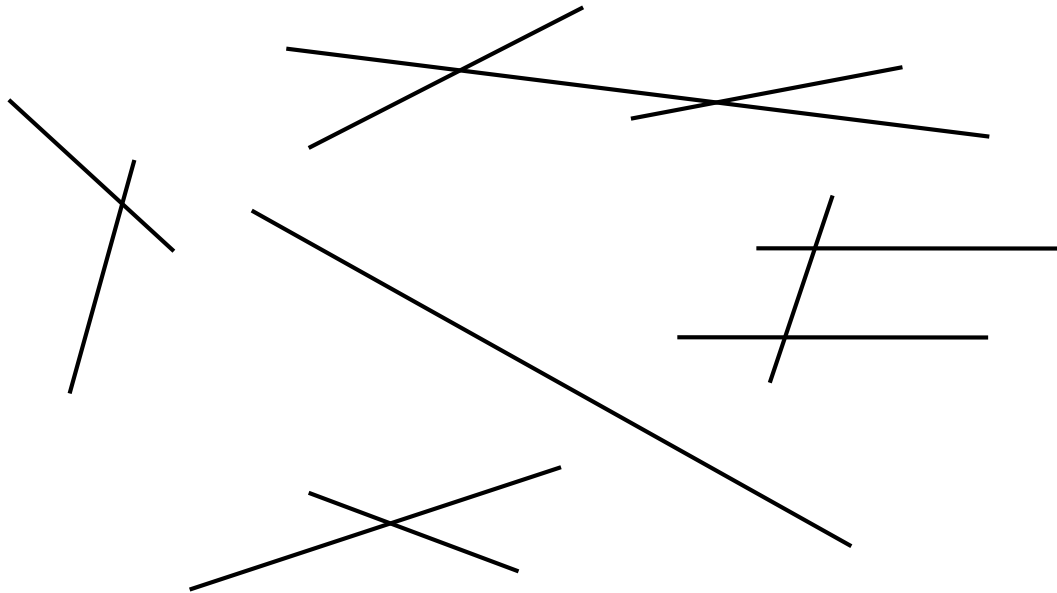
# 1. Computational geometry: Convex hulls



M. De Berg, O. Cheong, M. van Kreveld, M. Overmars.  
Computational Geometry. Chapter 1 & 11.

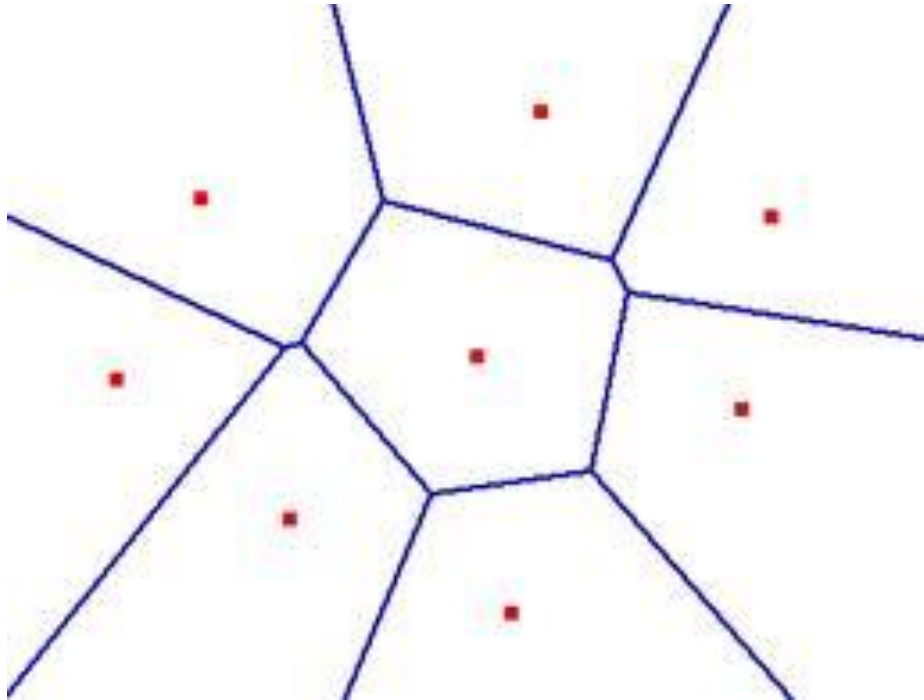
## 2. Comp. geometry: Line segment intersection

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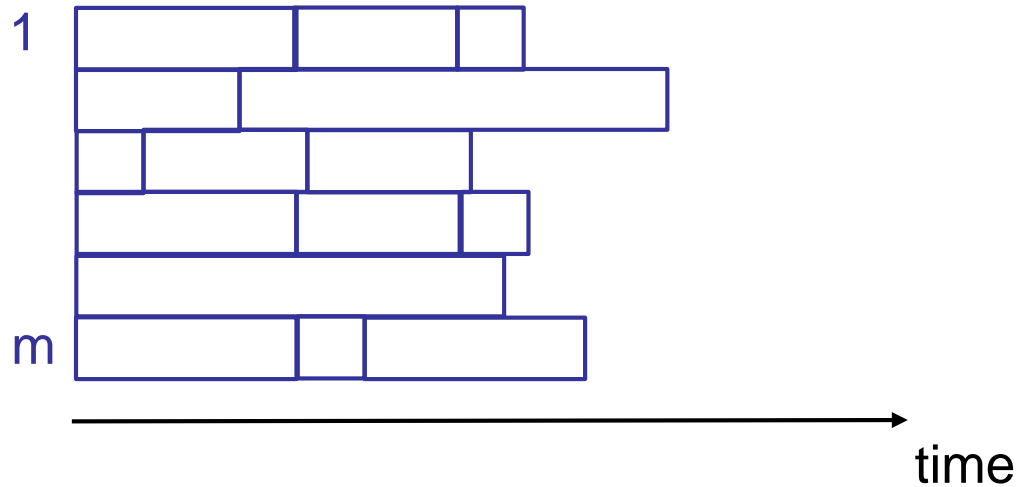
M. De Berg, O. Cheong, M. van Kreveld, M. Overmars.  
Computational Geometry. Chapter 2.

# 3. Comp. geometry: Voronoi diagrams



M. De Berg, O. Cheong, M. van Kreveld, M. Overmars.  
Computational Geometry. Chapter 7.

# 4. Scheduling: Makespan minimization



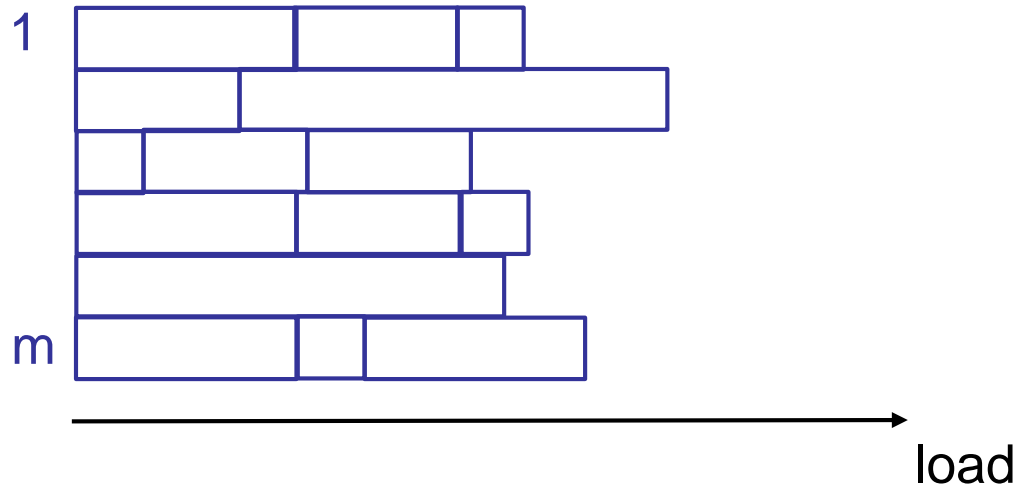
$m$  identical parallel machines

**Input portion:** Job  $J_i$  with individual processing time  $p_i$ .

**Goal:** Minimize the completion time of the last job in the schedule.

R. Graham. Bell Systems Techn. Journal 1965;  
SIAM J. Applied Math., 1969.

## 5. Scheduling: Load balancing game



Each job controlled by **selfish agent**.

**Cost of an agent** is the load of the selected machine.

**Social cost**: Makespan of the solution.

B. Vöcking. In: Algorithmic Game Theory, Chapter 20, 2007.

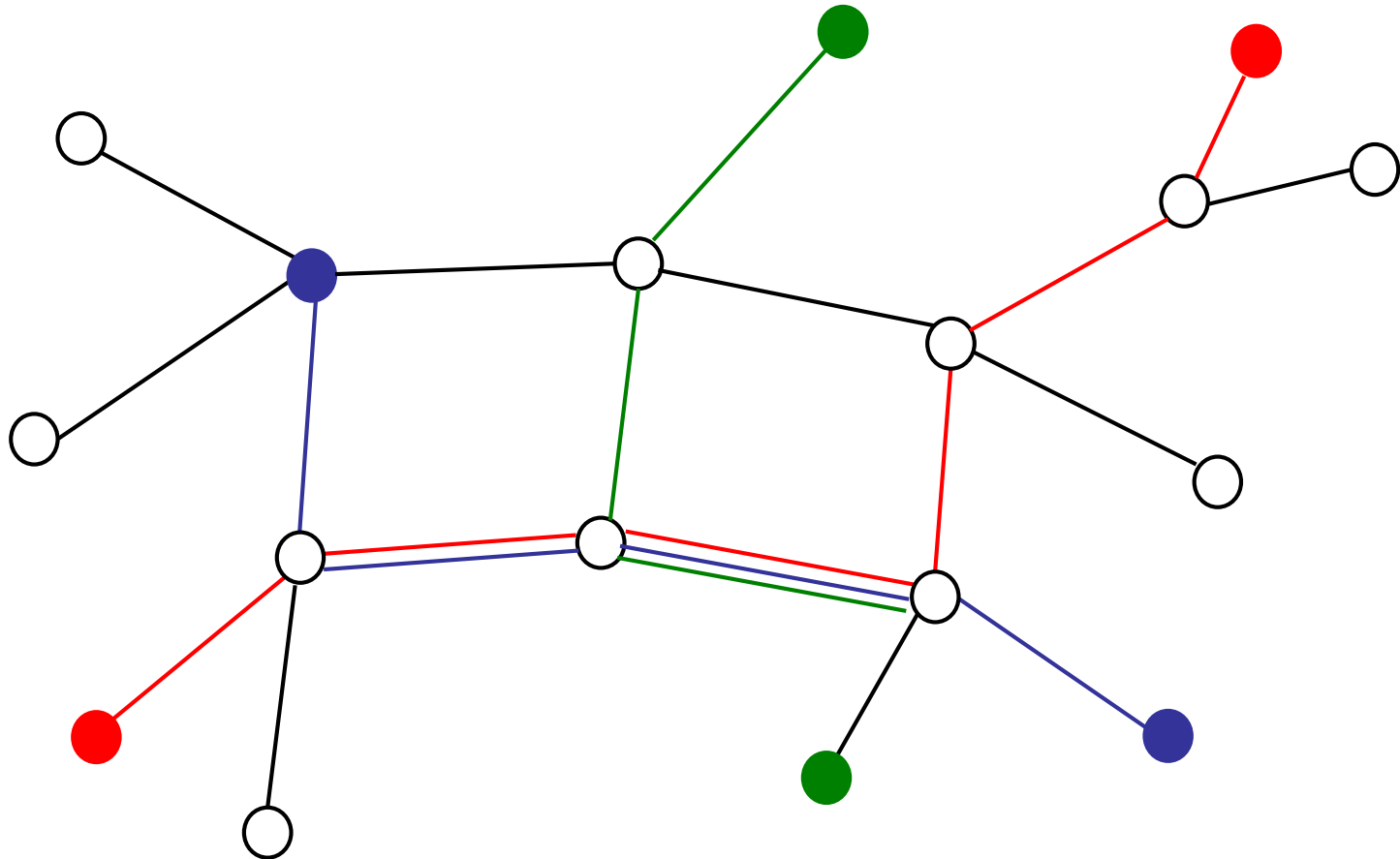
# 6.Scheduling: Story boarding

The screenshot shows the Yahoo! Finance website interface. At the top, there's a navigation bar with 'HOME', 'INVESTING', 'NEWS', 'PERSONAL FINANCE', 'MY PORTFOLIOS', 'EXCLUSIVES', and 'CNBC'. Below this is a search bar and a 'Sign In' button. The main content area features a 'STOCK WATCH' section with a headline 'Bassett Sinks; Int'l Speedway Rises; Noodles & Co. Surges'. A large article titled 'Market Turns Attention to Jobs' is prominent, with a sub-headline 'Breakout' and a brief summary: 'Stocks were slightly lower Wednesday as news of a major shake-up in Portugal's government, turmoil in Egypt, and more softness in Chinese manufacturing was offset by encouraging jobs data on the homefront.' Below this are several smaller articles, including 'The Company Steve Jobs Would've Bought: Wilcox' and 'Get Ready to Buy Ugly, Cheap Emerging Markets'. On the right side, there's a large advertisement for the Samsung Galaxy S4, featuring the text 'DAS SAMSUNG GALAXY S4 MIT ALLE-NETZE-FLATRATE' and a price tag of 'Nur 49,99 € mtl.'.

A. Dasgupta, A. Ghosh, H. Nazerzadeh, P. Raghavan SODA 2009.  
 S. Albers, A. Passen, ICALP 2013.



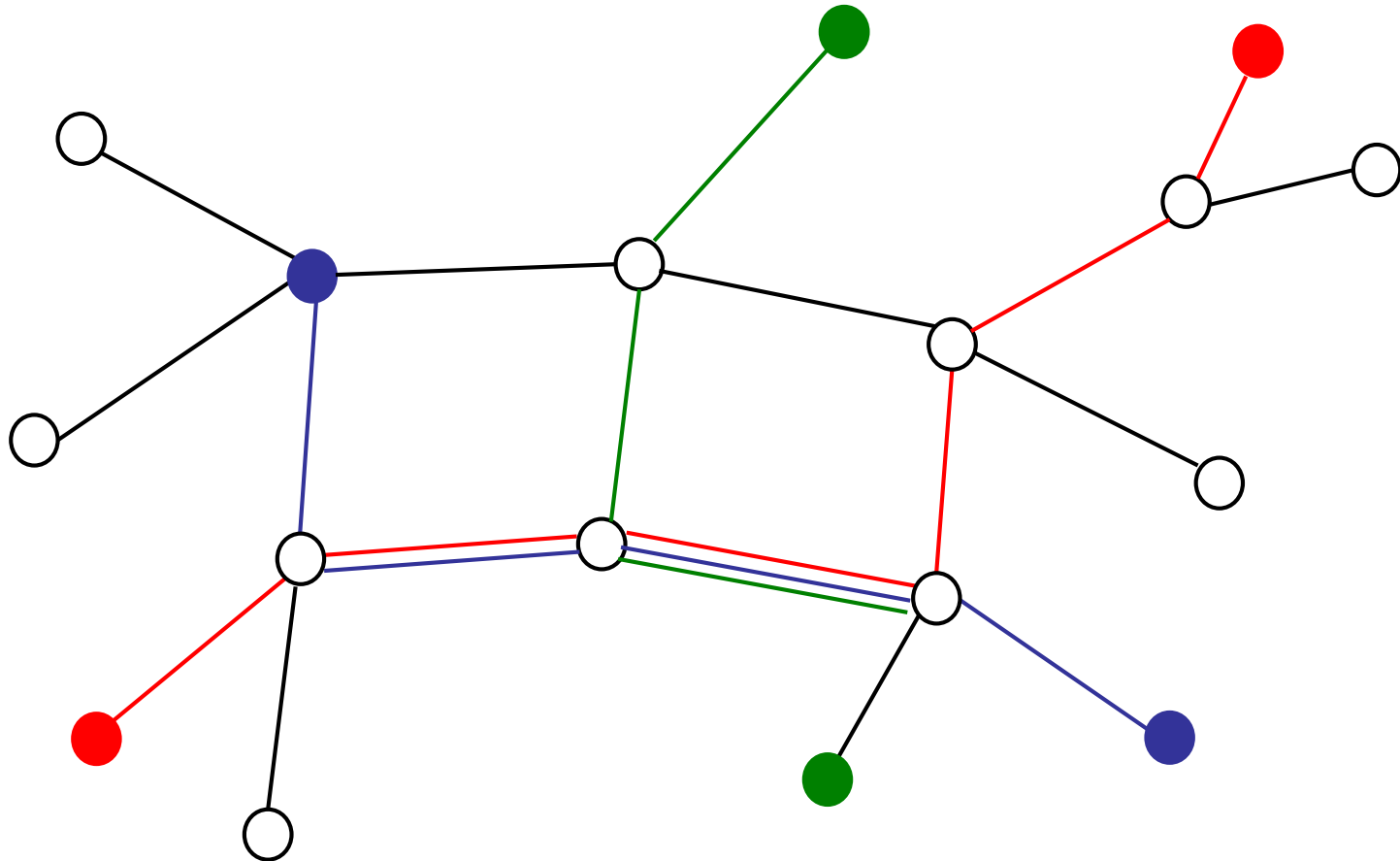
# 7. Network design: Fair cost allocation



$G=(V,E,c)$  pairs  $(s_i,t_i)$  If  $k$  agents use  $e$ , each pays  $c(e)/k$

Anshlevich, Dasgupta, Kleinberg, Tardos, Wexler. SICOMP 2008.

# 8. Network design: Arbitrary payments



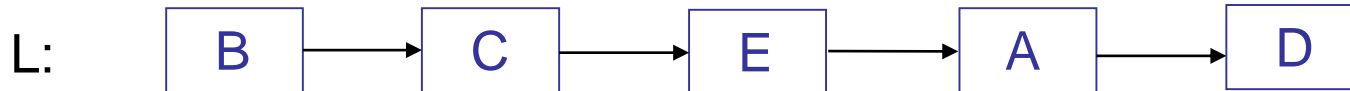
$G=(V,E,c)$  pairs  $(s_i,t_i)$  Cost of an edge may be split arbitrarily.

Anshlevich, Dasgupta, Tardos, Wexler. Theory of Computing, 2008.



# 10. Data structures: List update

Unsorted linear list



$\sigma = A A C B E D A \dots$

**Request:** Access to item in the list

**Cost:** Accessing the  $i$ -th item in the list incurs a cost of  $i$ .

**Goal:** Minimize cost paid in serving  $\sigma$ .

**Applications:** Data compression

S. Albers, S. Lauer. On list update with locality of reference. ICALP 2008.

# 11. Paging with locality of reference

Two-level memory system



small fast memory



large slow memory

$\sigma = A C B E D A F \dots$

**Request:** Access to page in memory system

**Goal:** Minimize the number of page faults

Panagiotou, Souza: On adequate performance measures for paging.  
STOC 2006.

# 12. Paging with locality of reference

Two-level memory system



small fast memory



large slow memory

$\sigma = A C B E D A F \dots$

**Request:** Access to page in memory system

**Goal:** Minimize the number of page faults

Albers, Frascaria: Quantifying competitiveness in paging with locality of reference. ICALP 2015.