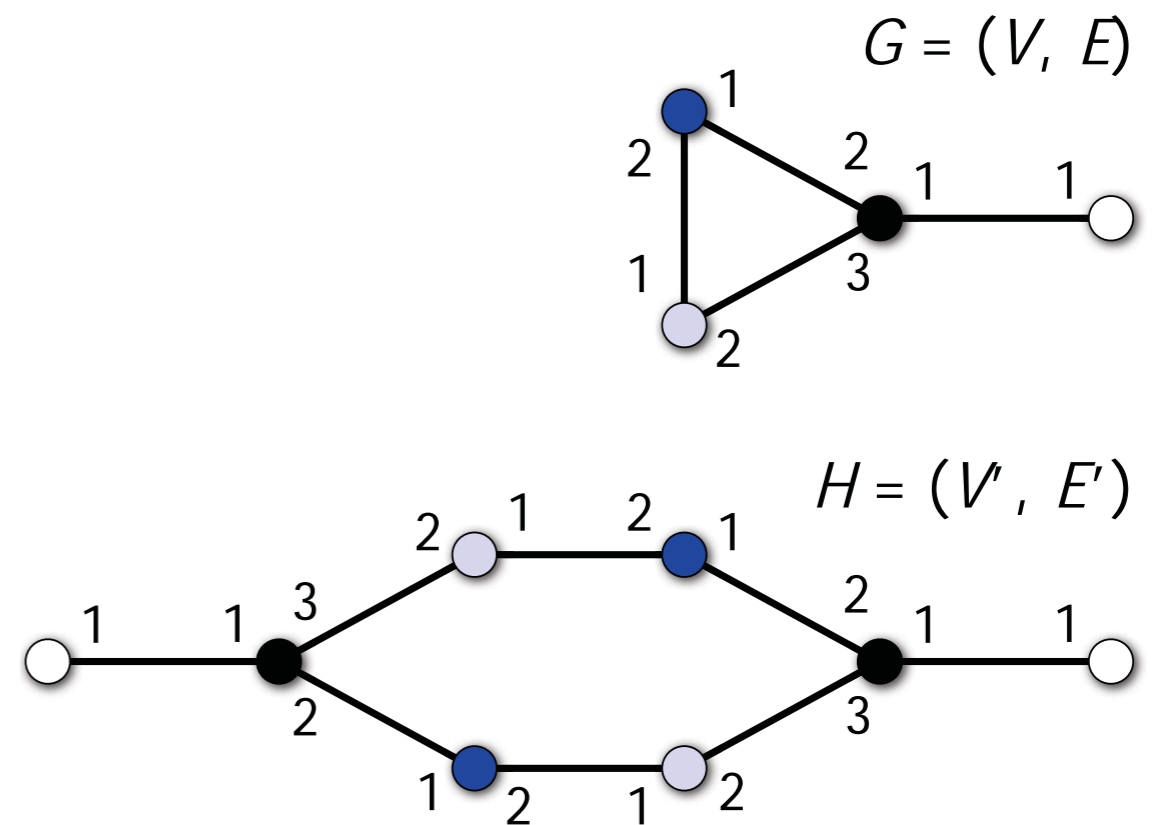# Deterministic Distributed Algorithms

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Intensive course 10–21 May 2010

DDA 2010, lecture 0:
About the course

- What and for whom

What?

- Distributed algorithms
    - several computers, communication links

- Restrictive models of distributed computing
    - everything is deterministic: no randomness
    - as little extra information as possible

- Graph problems
    - e.g., graph colouring

What?

- Fast algorithms for extremely large networks

  - time = number of communication rounds

  - worst-case analysis

- Sending information across the network takes much more time than running these algorithms!

  - i.e., running time ≪ diameter of the network

- How is this even possible…?

What?

- Emphasis on theoretical aspects
- Upper-bound results:
  - e.g., there exists an algorithm that is so-and-so fast
- Lower-bound results:
  - e.g., no algorithm is so-and-so fast
- When possible, matching upper and lower bounds:
  - e.g., this is the fastest possible algorithm

What?

- Not only classical results but also recent research

  - you'll be up-to-date and well prepared
    if you'd like to write an MSc thesis in this area

- Mathematical tools

  - in particular, Ramsey's theorem

  - useful in other areas of computer science, too

  - nice result, too few computer science students know it

Objectives

- Good understanding of the models that we study

  - what is easy, what is possible, what is impossible

  - what kinds of techniques work, what doesn't

  - what is not yet known

- You know how to program computers,
  here you'll learn how to program networks

  - entirely different way of thinking, new bag of tricks

For whom?

- Advanced course, so you are expected to have BSc in computer science (or equivalent)

  - No specific courses required, basic knowledge of discrete mathematics is enough

  - If you don't know proof by induction, you'll be in trouble

  - If you don't know the basic concepts of graph theory, you'll need to do some extra reading on your own

  - If you have never heard of distributed algorithms, **don't worry**, I'll explain everything

Practicalities

- **Read the web page**!
  - http://www.cs.helsinki.fi/jukka.suomela/dda-2010/
  - Don't assume anything, this isn't a typical lecture course
- 7 lectures, 2 exercise session, final report
  - 3 credits, no exam, pass/fail
- Ask if anything is unclear — emails are welcome
  - If you use IRC, you can try to join #dda-2010 on IRCnet

How much…?

- 3 credits ≈ 2 weeks of full-time study!

  - e.g., 2 hours of lectures + **6 hours** of self-study each day

- Exercises are open-ended, calibrate it yourself!

  - **doing more**: solve by yourself first, then look it up, then take part in discussions, then revise your solution, then write it up nicely, solve some optional exercises …

  - **doing less**: don't worry if you can't solve everything before the exercise session, don't try to give the best possible answer but something that is easy to prove, …

Final report

- The final report should demonstrate that

    - you understand the basic concepts

    - you have done your quota of self-study

- I can tell the difference between
  a 2-week report and a 1-night report

- Remember: this time *you can use sources*,
  but you must use appropriate citations

    - see the web page for links to some sources I have used