## **Schedule**

Check out the [TimeEdit](https://cloud.timeedit.net/chalmers/web/public/ri1X50gQ0560YvQQ05Z6674Y0Zy6007335Y60Q515.html) for the classrooms. Notice that class time and place may change!

|  |  |  |  |
| --- | --- | --- | --- |
| **W** | **Tuesday:**  **15:15 - 17:00** | **Thursday:**  **15.15-17.00** | **Friday:**  **13.15-15.00** |
| 36 | (36.1.a)  Introduction  (36.1.b)  Review of Internet  Technologies  [Video Recording](https://chalmers.instructure.com/courses/10510/files/683712/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/683712/download?download_frd=1)[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896) | (36.2)  Review of Internet  Technologies  [Video Recording](https://chalmers.instructure.com/courses/10510/files/687242/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/687242/download?download_frd=1)[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896) | (36.3)  Review of Internet  Technologies  [Video Recording](https://chalmers.instructure.com/courses/10510/files/688943/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/688943/download?download_frd=1)[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896) |
| 37 | (37.1)  Review of Internet  Technologies  [Video Recording](https://chalmers.instructure.com/courses/10510/files/695366/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/695366/download?download_frd=1)[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896) | (37.2)  Algorithms  [Video Recording](https://chalmers.instructure.com/courses/10510/files/700201/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/700201/download?download_frd=1)[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896) | (37.3)  Algorithms  [Video Recording](https://chalmers.instructure.com/courses/10510/files/702486/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/702486/download?download_frd=1)[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896) |
| 38 | (38.1)  ~~Algorithms~~  no class | (38.2)  Algorithms  [Video Recording](https://chalmers.instructure.com/courses/10510/files/715455/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/715455/download?download_frd=1)[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896) | no class |
| 39 | (39.1)  Q&A session  (16:15 to 17:00) | (39.2)  Algorithms  [Video Recording](https://chalmers.instructure.com/courses/10510/files/733570/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/733570/download?download_frd=1)[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896) | (39.3)  Algorithms  [Video Recording](https://chalmers.instructure.com/courses/10510/files/736273/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/736273/download?download_frd=1)[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896) |
| 40 | (40.1)  Q&A session  (16:15 to 17:00) | (40.2)  Algorithms  [Video Recording](https://chalmers.instructure.com/courses/10510/files/751469/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/751469/download?download_frd=1)[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896) | (40.3)  Algorithms  [Video Recording](https://chalmers.instructure.com/courses/10510/files/753707/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/753707/download?download_frd=1)[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896) |
| 41 | (41.1)  Algorithms  [Video Recording](https://chalmers.instructure.com/courses/10510/files/762477/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/762477/download?download_frd=1)[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896) | (41.2)  Algorithms  [Video Recording](https://chalmers.instructure.com/courses/10510/files/768491/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/768491/download?download_frd=1)[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896) | no class due  to exam  resits for SP4 |
| 42 | (42.1)  Q&A session  (16:15 to 17:00) | (42.2)  **Algorithms**  **Summary**  [Video Recording](https://chalmers.instructure.com/courses/10510/files/789033/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/789033/download?download_frd=1)[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896) | (42.3)  Q&A session  (13:15 to 15:00) |
| 43 | (43.1)  Q&A session  (16:15 to 17:00) | (43.1)  Q&A session  (15:15 to 17:00) | (43.1)  Q&A session  (13:15 to 15:00) |

**Link to:**[**Schedule**](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896#Schedule)[**Review**](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896#deadlines)[**Advanced**](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896#Interconnections)[**Algorithms**](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896#Methods)

1 Introduction

Course overview (week 36)

[Lecture handouts](https://chalmers.instructure.com/courses/10510/files/683683/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/683683/download?download_frd=1)

2 Review of Internet Technologies

Lecture (week 36): TCP/IP review

This part, which builds on the fundamental TCP/IP courses (computer communications), aims to provide an in-depth knowledge of some topics of the core technology, services, and applications using the Internet. By that, students are expected to have basic knowledge about fundamental issues in networking and Internet technologies. The aim of this part is to provide deeper knowledge and skills to work in the area by learning new details about the most important Internet protocols and concepts deployed for the fundamental internetworking. Topic: TCP/IP

**Preparation:**[watch unit 4 about  (Links to an external site.)Congestion Control (Links to an external site.)](https://www.youtube.com/playlist?list=PLvFG2xYBrYAQCyz4Wx3NPoYJOFjvU7g2Z).

**Additional preparation**: [Van Jacobson: The Slow-Start Algorithm (Links to an external site.)](https://youtu.be/QP4A6L7CEqA).

[Lecture handouts](https://chalmers.instructure.com/courses/10510/files/647957/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/647957/download?download_frd=1)

Lecture (week 36): socket programing

This part reviews the programming of processes that communicate with each other using an application program interface (API) known as sockets. Some students may be very familiar with sockets already, as that model has become synonymous with network programming. Others may need an introduction to sockets from the ground up. The objective of this part is to offer guidance on network programming for beginners as well as advanced programmers, for those developing new network-aware applications as well as those maintaining existing code. By the end of this part, the student understanding of this area will include the ability to discuss in detail how the networking components of their system function as well as how to program them.

We would look into several code examples that use the sockets API. We focus on the usual partitioning of these network-oriented applications into client and server and write our own small examples that use TCP Client-Server and UDP Client-Server before looking into advanced socket programming.

Lecture 36.2 and 36.3 (week 36)

**Topic:**Sockets API

**Preparation (optional):** to read: Ch. 1 to 6 [Stevens'03]

[Lecture handouts](https://chalmers.instructure.com/courses/10510/files/687232/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/687232/download?download_frd=1)

**Link to:**[**Schedule**](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896#Schedule)[**Review**](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896#deadlines)[**Advanced**](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896#Interconnections)[**Algorithms**](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896#Methods)

3 Advanced Internet Technologies

Lecture 37.1 (week 37)

**Topic: DNS      IPv6**

**Preparation:**watch the following videos

DNS

IPv6

Lecture handouts: [DNS](https://chalmers.instructure.com/courses/10510/files/694501/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/694501/download?download_frd=1)and [IPv6](https://chalmers.instructure.com/courses/10510/files/694492/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/694492/download?download_frd=1)

**Link to:**[**Schedule**](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896#Schedule)[**Review**](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896#deadlines)[**Advanced**](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896#Interconnections)[**Algorithms**](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896#Methods)

 4 Algorithms for Computer Networks

Computer systems can be complex due to numerous factors including scale, decentralization, heterogeneity, mobility, dynamism, bugs, and failures. Deploying, operating, and maintaining such systems can be not only very difficult but also very costly. A flurry of recent activity has been directed at this problem whereby future computer systems are envisioned to be self-configuring, self-organizing, self-managing, and self-repairing, aka, self-\* properties.

Fault-tolerant computer systems that are self-stabilizing [Dijkstra 74] can recover after the occurrence of transient faults, which can cause an arbitrary corruption of the system state (so long as the program's code is still intact). The self-stabilization design criteria and its related concepts of self-\* properties liberate the application designer from dealing with low-level complications and provide an important level of abstraction. Consequently, the application design can easily focus on its task - and knowledge-driven aspects.

Lecture 37.2 (week 37)

**Topic: Introduction to self-stabilizing algorithms for computer networks**

* Computational Model, Complexity Measures and the Self-Stabilization Requirements (Ch. 1, 2.1 to 2.3)
* A Basic Leader Election Algorithm and Impossibility

**Preparation:**to read [Dolev, pp. 1 -11]

[The Computational Model](https://chalmers.instructure.com/courses/10510/files/689648/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/689648/download?download_frd=1)[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896)

[No deterministic self-stabilizing leader election algorithm](https://chalmers.instructure.com/courses/10510/files/689651/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/689651/download?download_frd=1)[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896)

[**Lecture handout**](https://chalmers.instructure.com/courses/10510/files/700190/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/700190/download?download_frd=1)

**Read after the lecture**:

[Important Properties of a Network (Links to an external site.)](http://my.safaribooksonline.com/book/networking/routers/0201634481/essential-networking-concepts/ch01lev1sec3) [Perlman, 99]

Lecture 37.3 (week 37)

**Topic:**Token ring networks (Ch. 2.6)

**Preparation:**to read [Dolev, pp. 16 - 22]

[Dijkstra’s Mutual Exclusion](https://chalmers.instructure.com/courses/10510/files/689672/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/689672/download?download_frd=1)[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896)

[**Lecture handout**](https://chalmers.instructure.com/courses/10510/files/700191/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/700191/download?download_frd=1)

**Read after the lecture**: [Dijkstra 74] Edsger W. Dijkstra: Self-stabilizing Systems in Spite of Distributed Control. [Commun. ACM 17 (Links to an external site.)](http://www.informatik.uni-trier.de/~ley/db/journals/cacm/cacm17.html#Dijkstra74)(11): 643-644 (1974). Can also be found [here (Links to an external site.)](https://cs.nyu.edu/courses/fall18/CSCI-GA.3033-002/papers/dijkstra-self-stable.pdf).

Lecture 38.2 (week 38)

**Topic:**Spanning-Tree Construction in networks (Ch. 2.5)

**Preparation:**to read [Dolev, pp. 12 - 16]

Shlomi Dolev, Amos Israeli, Shlomo Moran: [Self-Stabilization of Dynamic Systems Assuming Only Read/Write Atomicity (Links to an external site.)](https://dl.acm.org/citation.cfm?id=1081400). Distributed Computing 7(1): 3-16 (1993)

[Spanning-Tree Construction](https://chalmers.instructure.com/courses/10510/files/689675/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/689675/download?download_frd=1)[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896)

[**Lecture handout**](https://chalmers.instructure.com/courses/10510/files/714141/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/714141/download?download_frd=1)

Lecture 39.2 (week 39)

**Topic: Proof Techniques**

* Maximal Matching in Networks and Leader Election in an ID-based Network (Ch. 2.9)

**Preparation:**watch the videos about

[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896)

[Self-stabilizing Maximal Matching](https://chalmers.instructure.com/courses/10510/files/695667/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/695667/download?download_frd=1)[Play media comment.](https://chalmers.instructure.com/courses/10510/pages/lecture-schedule-topics-and-handout-materials?module_item_id=92896)

Also, read [Dolev, pp. 31 - 36]

**Read after the lecture:** Su-Chu Hsu, Shing-Tsaan Huang: [A Self-Stabilizing Algorithm for Maximal Matching (Links to an external site.)](http://www.sciencedirect.com/science/article/pii/002001909290015N). Inf. Process. Lett. 43(2): 77-81 (1992). Watch a video about [Switching Algorithm (Maximal Matching) (Links to an external site.)](https://youtu.be/GJHB5KW6JXY).

[**Lecture handout**](https://chalmers.instructure.com/courses/10510/files/751447/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/751447/download?download_frd=1)

Lecture 39.3 (week 39)

**Topic: Self-Stabilizing Algorithms for Model Conversions**

* Token-Passing: Converting a Central Daemon to read/write  (Ch. 4.1)
* Self-Stabilizing Ranking: Converting an Id-based System to a Special-processor System  (Ch. 4.3)
* Update: Converting a Special Processor to an Id-based Dynamic System  (Ch. 4.4)

**Preparation:**to read [Dolev, pp. 71- 98]

**Extra reading:** Shlomi Dolev, Elad Schiller: Communication Adaptive Self-Stabilizing Group Membership Service. IEEE Trans. Parallel Distrib. Syst. 14(7): 709-720 (2003)

[**Lecture handout**](https://chalmers.instructure.com/courses/10510/files/732607/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/732607/download?download_frd=1)

Lecture 40.2 (week 40)

**Topic:**Software Defined Networks [Canini et al ICDCS 2018]

**Read after the lecture:** Read the paper by Marco Canini, Iosif Salem, Liron Schiff, Elad Michael Schiller, Stefan Schmid, [*Renaissance: A Self-Stabilizing Distributed SDN Control Plane* (Links to an external site.)](https://arxiv.org/abs/1712.07697). 38th IEEE International Conference on Distributed Computing Systems, ICDCS 2018: 233-243.

[**Lecture handout**](https://chalmers.instructure.com/courses/10510/files/750443/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/750443/download?download_frd=1)

Lecture 40.3 (week 40)

**Topic: Convergence in the Presence of Faults**

* Digital Clock Synchronization (Ch. 6.1)
* Stabilization in Spite of Napping (Ch. 6.2)

**Preparation:**to read [Dolev, pp. 137 - 146]

**Read after the lecture:** Shlomi Dolev, Jennifer L. Welch: Wait-Free Clock Synchronization. Algorithmica 18(4): 486-511 (1997)

[**Lecture handout**](https://chalmers.instructure.com/courses/10510/files/750447/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/750447/download?download_frd=1)

Lecture 41.1 (week 41)

**Topic: Network coloring** (Ch. 7.1)

**Preparation:**to read  [Dolev, pp. 159 - 164]

**Read after the lecture:** Shlomi Dolev, Ted Herman: Superstabilizing Protocols for Dynamic Distributed Systems. Chicago J. Theor. Comput. Sci. 1997 (1997)

[**Lecture handout**](https://chalmers.instructure.com/courses/10510/files/761767/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/761767/download?download_frd=1)

Lecture 41.2 (week 41)

**Topic:**Data Link Algorithms (Ch. 2.10, 3.1, 3.2, and 4.2)

2.10 Pseudo-Self-Stabilization

3.1 Initialization of a Data-Link Algorithm in the Presence of Faults

3.2 Arbitrary Configuration Because of Crashes

4.2 Data-Link Algorithms: Converting Shared Memory to Message Passing

[Lecture handout](https://chalmers.instructure.com/courses/10510/files/767608/download?wrap=1)[download](https://chalmers.instructure.com/courses/10510/files/767608/download?download_frd=1)

5 Review and Summary

**Topic: Conclusions (week 43)**

* Frequently Asked Questions about Self-Stabilization (Ch. 3.3)

**Read before the lecture**: [Dolev, pp. 137 -142]