Operating Systems – EDA093/DIT401

Course Introduction

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UNIVERSITY OF
GOTHENBURG

Agenda

- Course homepage & support team
- Main textbook
- Why study Operating Systems?
- What is this course about?
  - What is this course NOT about?
- Course organization
- Best practices
- Student representatives

Course homepage & support team

https://chalmers.instructure.com/courses/10138

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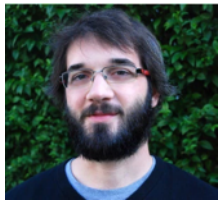

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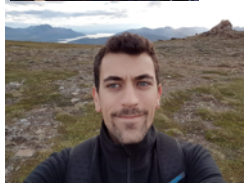

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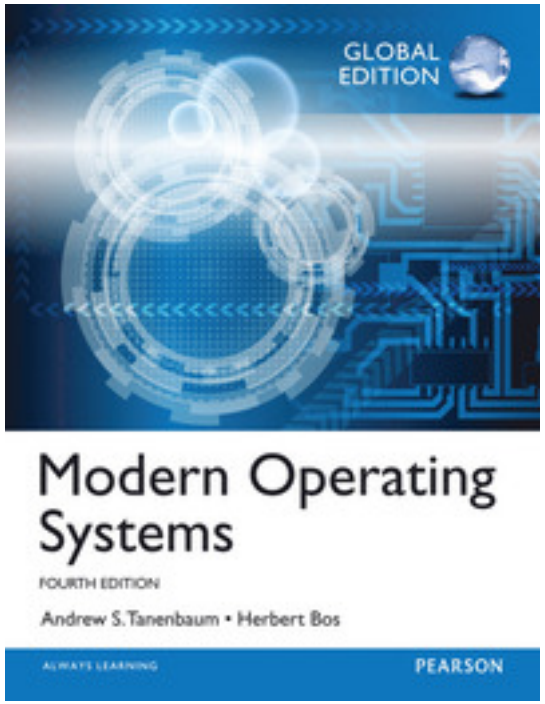
Main textbook

Modern Operating Systems by Andrew S. Tanenbaum (fourth edition)

ISBN: 9781292061429



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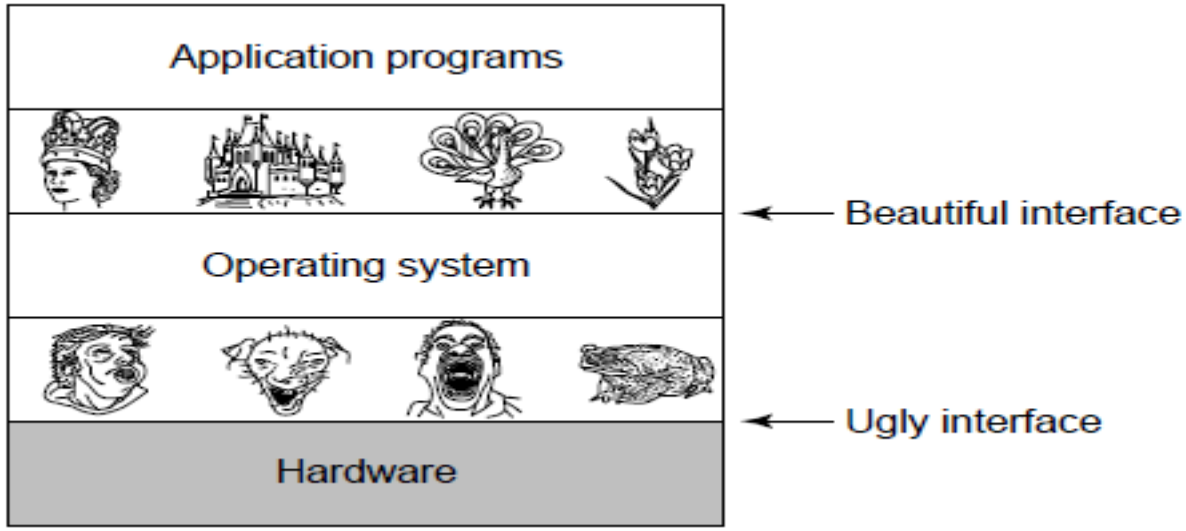
Why study Operating Systems?

- Where there are computers, there are operating systems…

Picture source: wikipedia

Why study Operating Systems?

- Provides services to system users
- "Shields" the user from the hardware
- Resource manager:
  - CPU(s)
  - memory
  - I/O devices
  - ….



Picture source: Modern OS, by A. Tanenbaum

Why study Operating Systems?

- To learn about system functionality and design
  - performance vs. simplicity, HW vs. SW, etc.
- To learn how to manage complexity through appropriate abstractions
- again: Because computers and OSs are everywhere!

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What is this course not about?

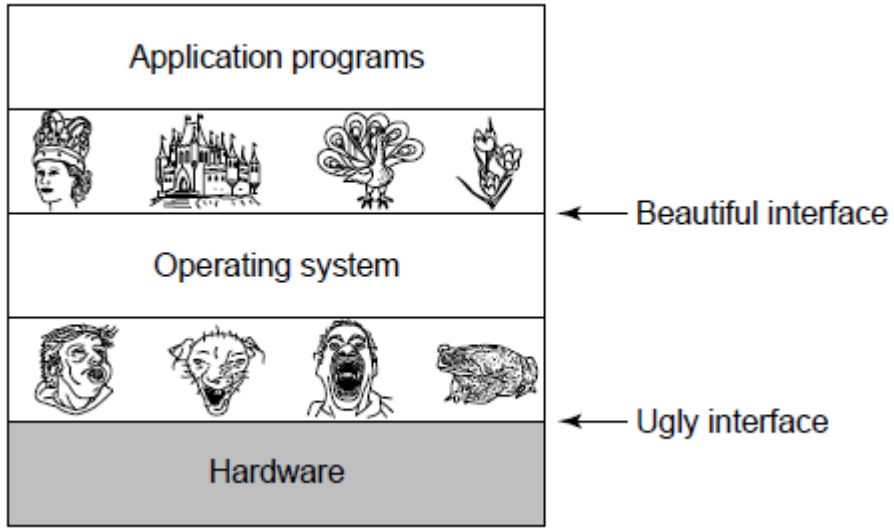
What is this course not about?

- Learn how to use Windows
- Learn how to use Linux
- Learn how to use OS X
- Learn how to program in C

What is this course about, then?

- **Introduction / System Structures**
- Processes / Threads
- Multithreaded Programming
- Process scheduling
- Synchronization
- Deadlocks
- Memory Management
- Virtual Memory
- File Systems
- I/O Systems
- Security / Protection

Need to decouple Applications/Users from Hardware



… need to build upon a basic instruction cycle

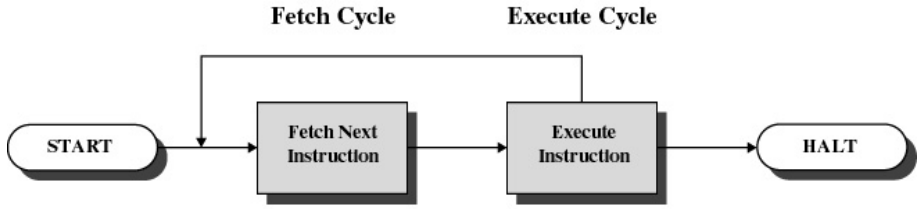


Figure 1.2 Basic Instruction Cycle

- Introduction / System Structures
- **Processes / Threads**
- Multithreaded Programming
- Process scheduling
- Synchronization
- Deadlocks
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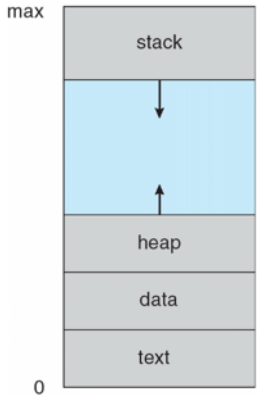
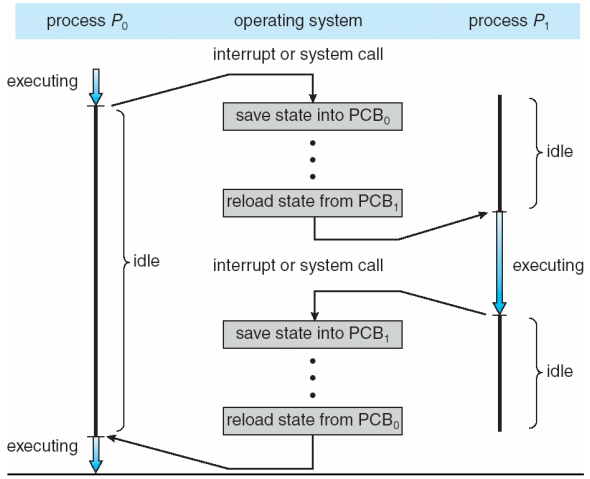
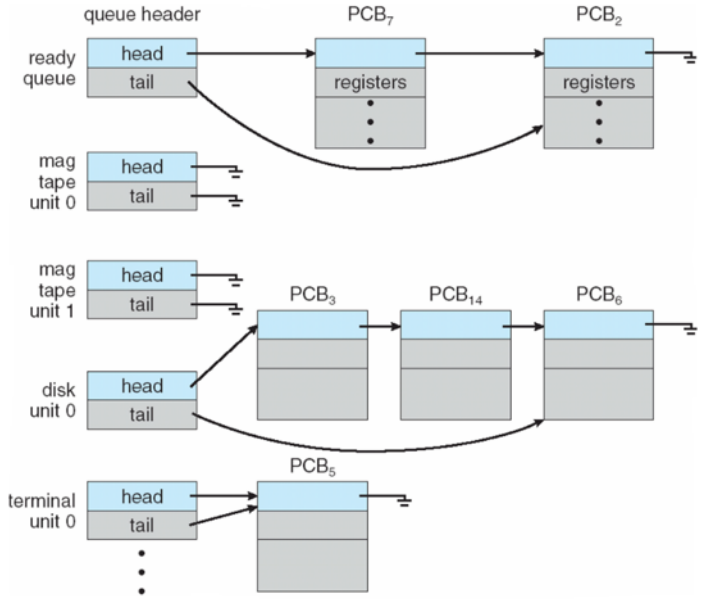
Need to maintain information about processes running in the OS



Need to switch between processes…



Need to organize processes and devices



- Introduction / System Structures
- Processes / Threads
- **Multithreaded Programming**
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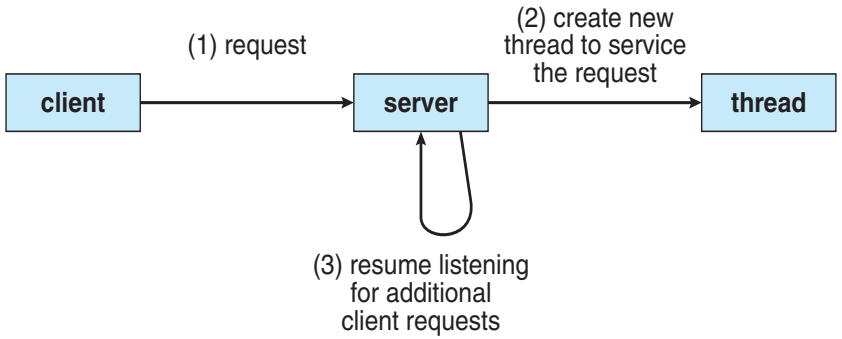
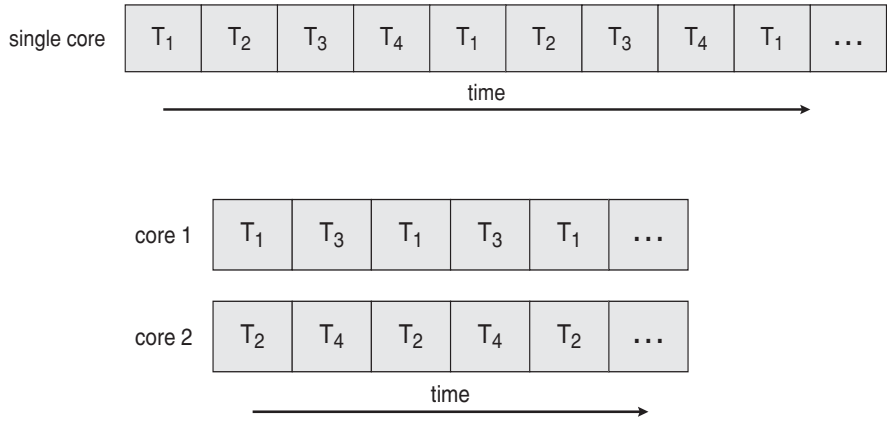
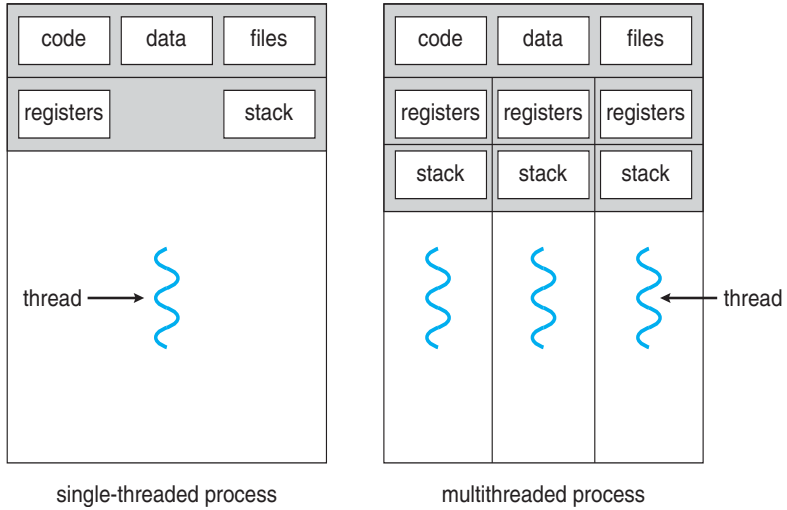
Need mechanisms to improve processes performance / take advantage of hardware

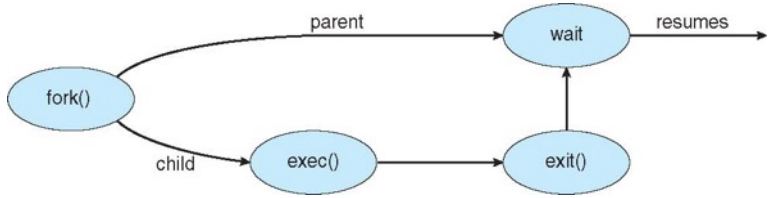




Need to maintain more information…



…and synchronize threads and processes



- Introduction / System Structures
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Need scheduling at different granularities

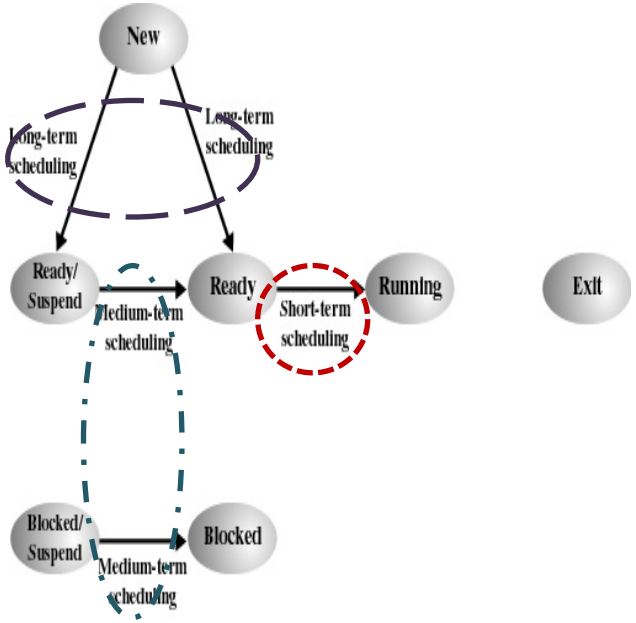

Figure 9.1 Scheduling and Process State Transitions

Need scheduling criteria

- CPU utilization
- Throughput
- Turnaround/Response time
- Fairness
- Overhead

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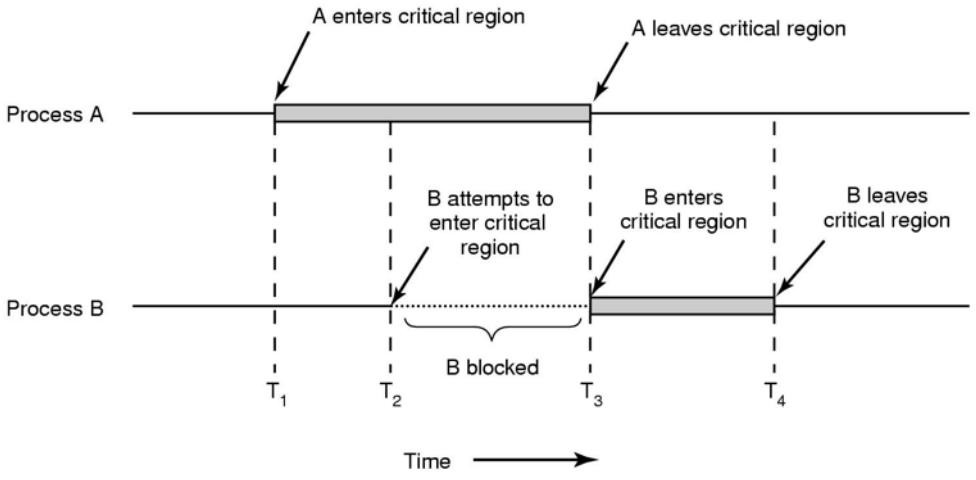
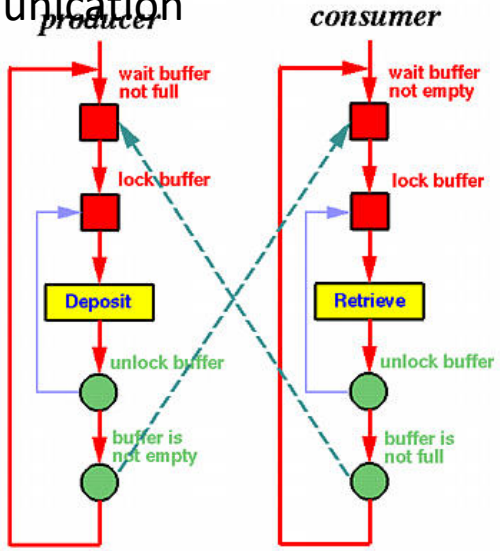
Need to prevent overlapping execution of critical sections



Need to synchronize threads communication



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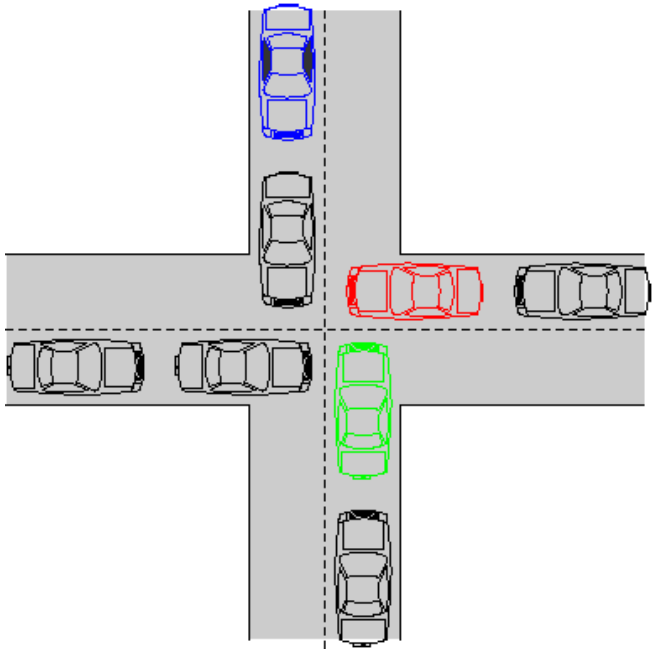
Need to avoid deadlocks



… which can be challenging

- Introduction / System Structures
- Processes / Threads
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- **Memory Management**
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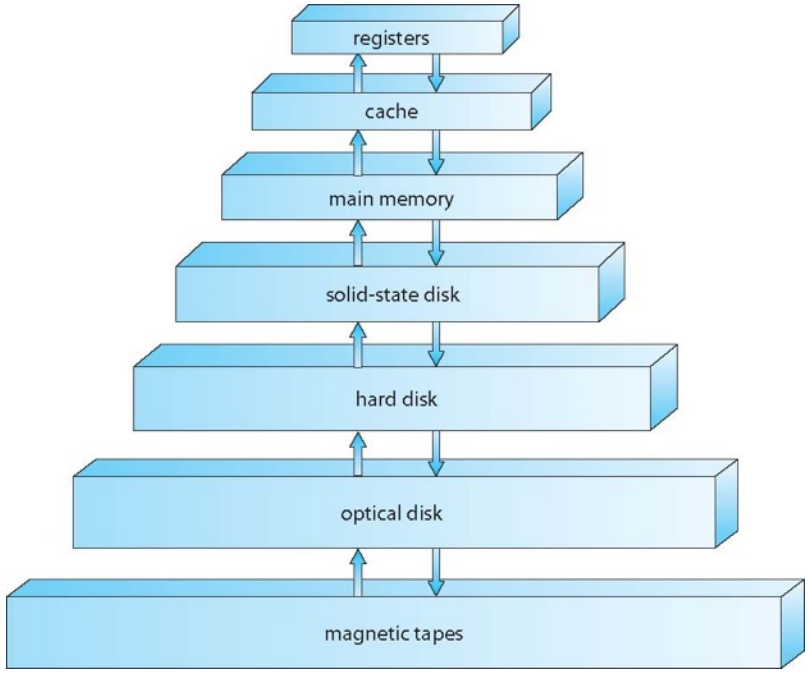
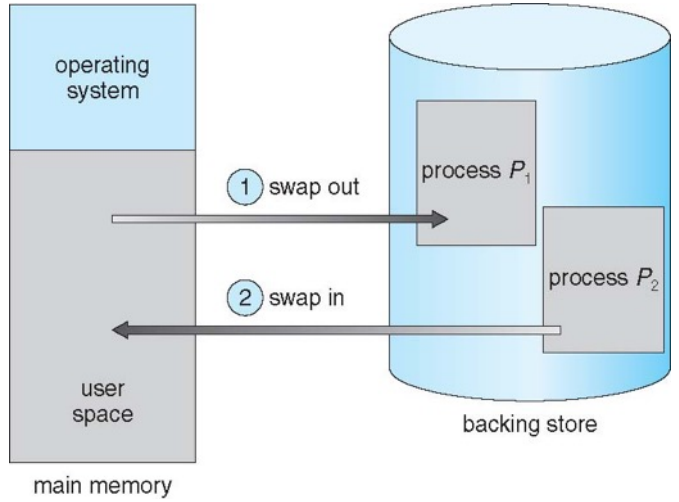
Need to manage information (read / write) based on the available hierarchy



E.g., by swapping processes…



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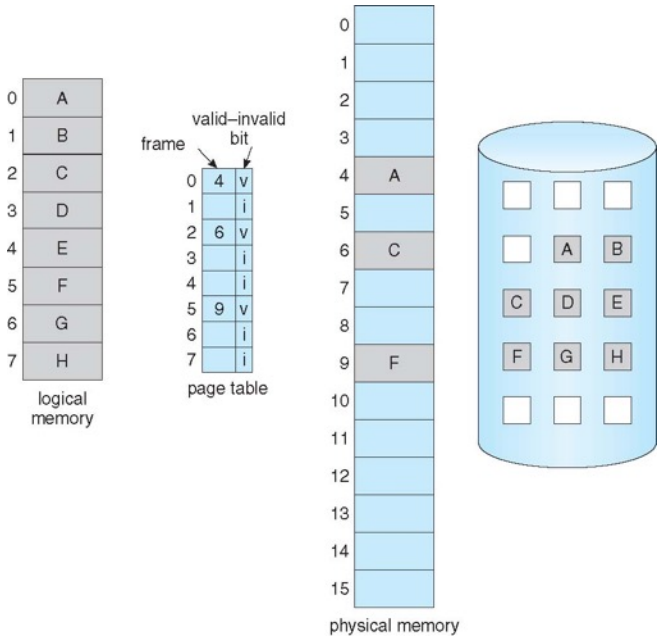
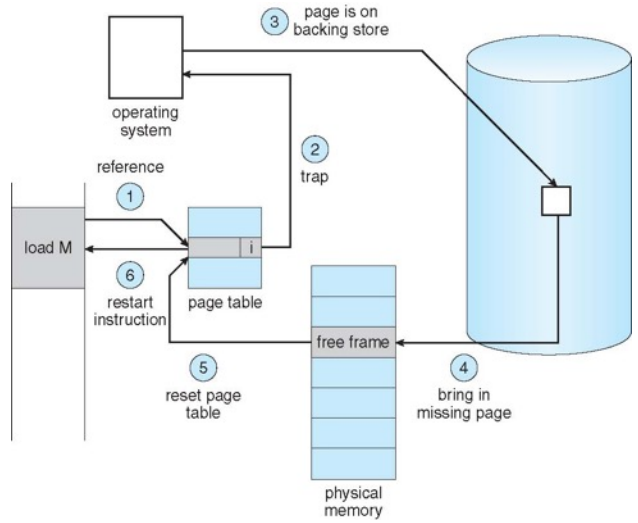
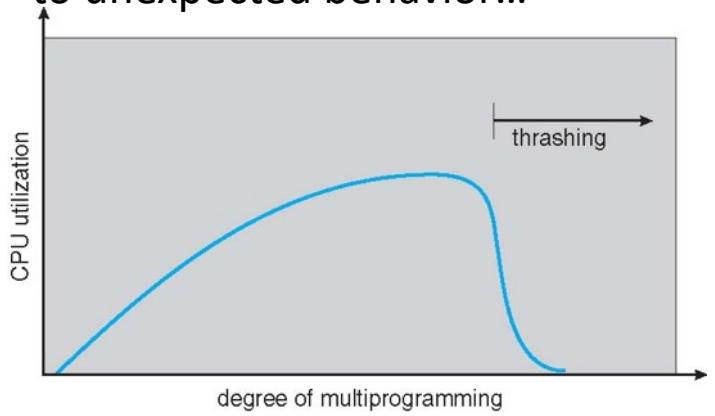
Need to provide more (virtual) memory than available



Need extra overhead to provide that…



Sometimes (hidden?) complexity leads to unexpected behavior…



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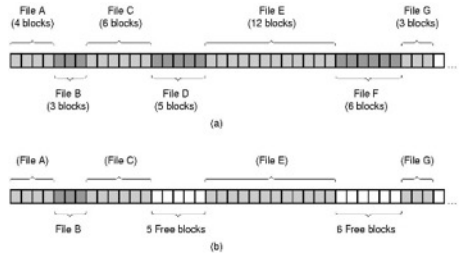
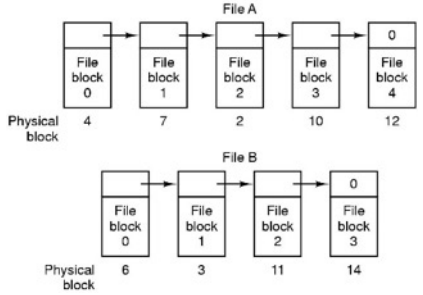
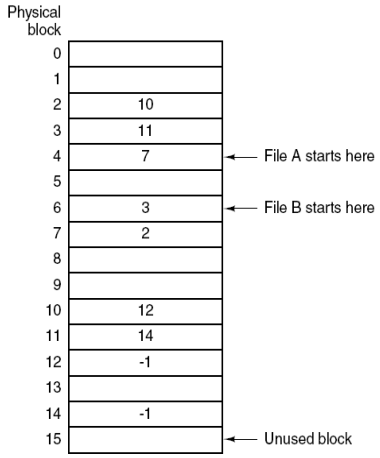
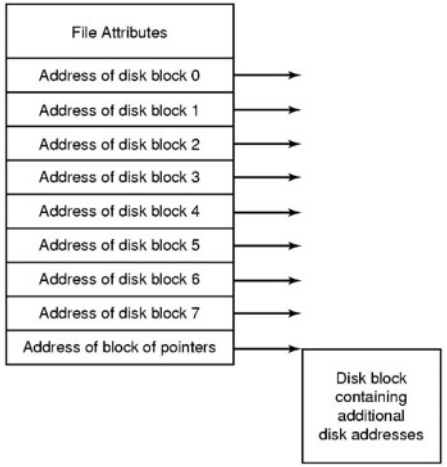
Need to keep track of where files are

Fig. Tanenbaum, Modern Operating Systems

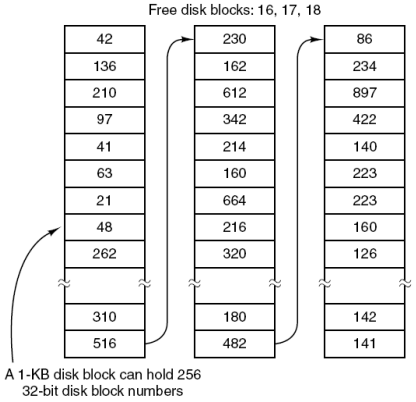


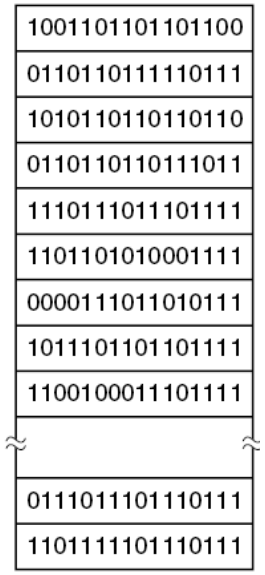




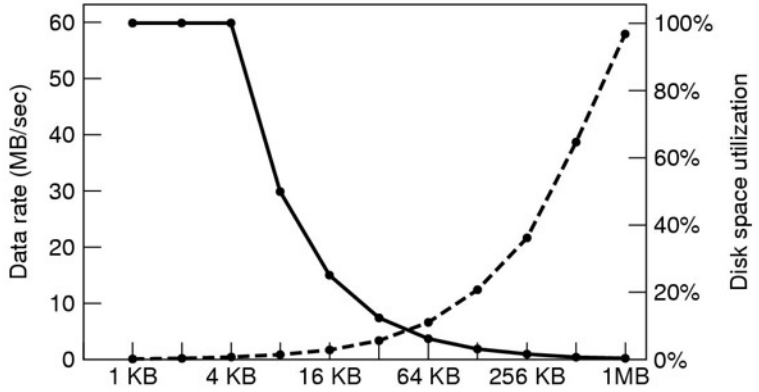


Need to keep track of free space





Need to decide how to use secondary storage



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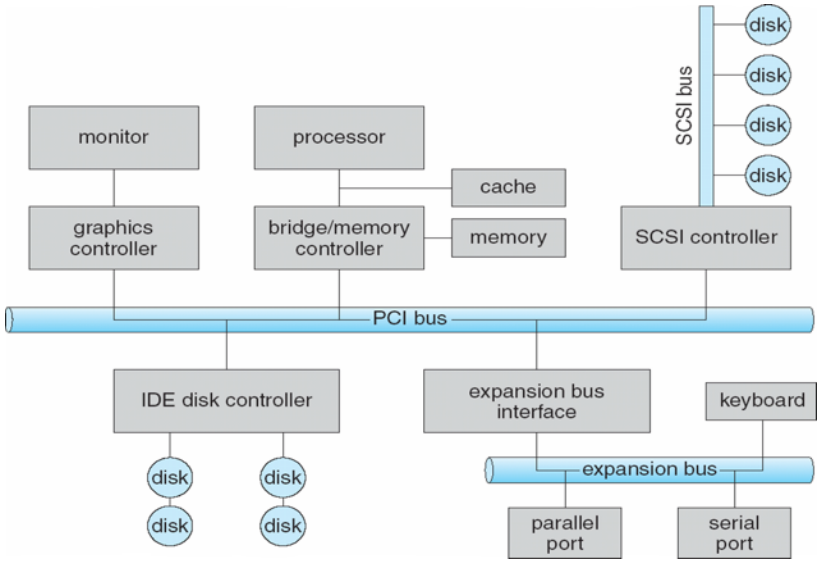
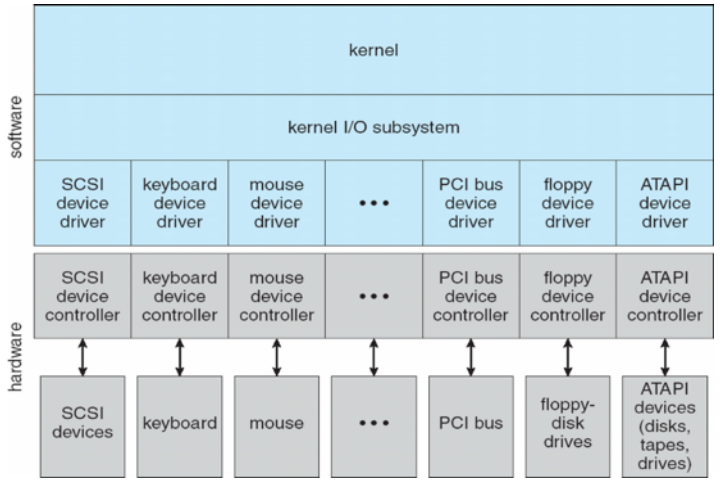
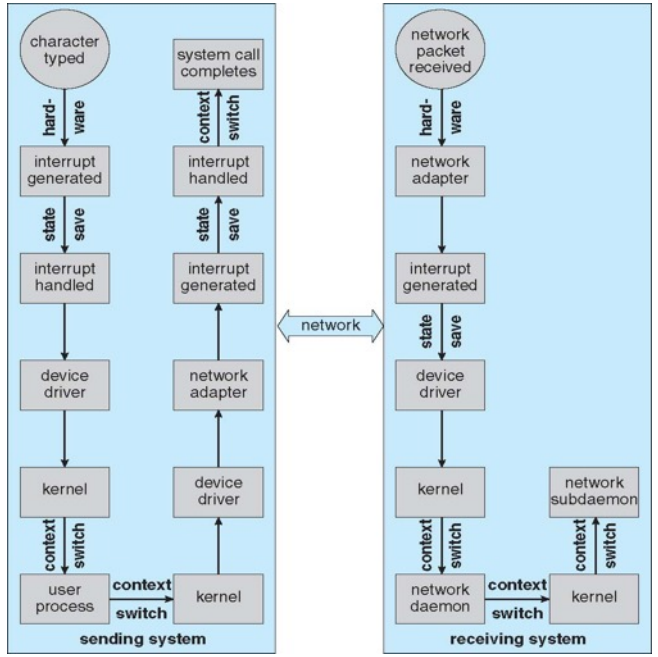
Need to communicate / exchange information with devices



Need to separate applications' and hardware's logic



Need good design to increase performance



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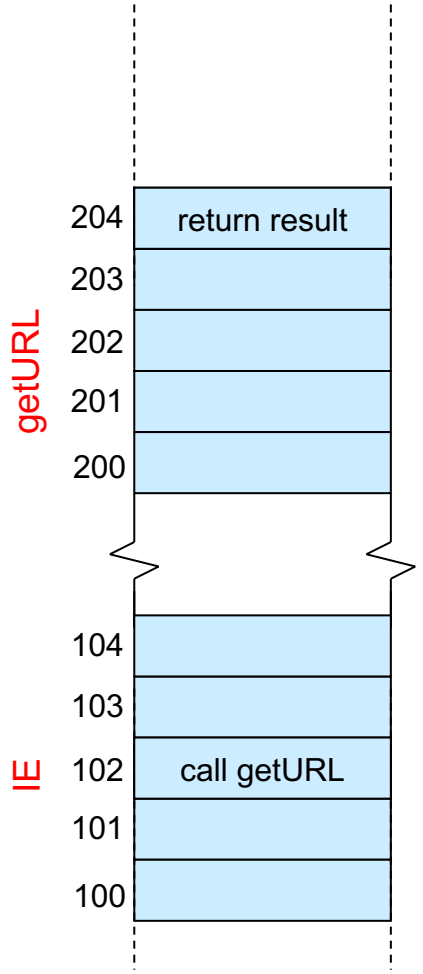
We need mechanisms to protect and share data…

Confidentiality

Integrity

Availability

… from programs' vulnerabilities (e.g., buffer overflows)



New material this year:

- New lecture about Virtualization
- Invited lecture from Yiannis Nikolakopoulos, from (about software-based memory compression technologies)

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Course organization

- Lectures, Tutorials, Exercises sessions
  - ”Lectures and Schedule” @ web page
  - Programming assignments
  - “Lab1, Lab2, Lab3” @ web page; **(more about this in the following)**
- Exam
  - 24th October 2020, 4th January 2020.

About this year’s arrangements because of COVID-19

- All activities will be performed remotely, using Zoom
- This applies to students’ collaboration for labs too
  - Meet periodically via Zoom (or any other tool you want to use)
  - Avoid physical meetings!

About the labs

About the labs

- Students are divided in groups of 2. Students can form groups themselves, but students that are not in groups of 2 will be grouped by the examiner before the first lab is officially introduced
- There will be 3 labs, about developing a simple shell, Pintos and batch scheduling. For each lab:
  - The material is made available in Canvas and presented in a specific session by TAs. To access the material, each group needs to pass a preparation test.
  - Groups must complete each lab using the remote11 or remote12 servers (links will be given). Groups can practice of course with other computers, but the TAs' final evaluation is carried out only for code that is compiled / run at those servers
  - a script will be provided for each lab to check (@ remote11/12) whether the lab compiles / runs / passes a certain set of tests
  - Successfully running the script does not imply the group has passed the lab. There will be manual inspection and groups might be asked to explain some of the decisions they took and/or modify their code in order to pass the lab. Passing the script is only an indication that the group is most likely ready to complete the lab

About the labs

... There will be 3 labs, about developing a simple shell, Pintos and batch scheduling. For each lab:

- Once the script for each lab runs successfully, groups are expected to upload to Canvas their source files, the message generated by the script **and a report**.
- Each lab has an internal deadline (2 weeks after the presentation, approximately).
- Each group must book at least one slot during the lab sessions (via Zoom), a doodle will be shared for each session to book.
- Each group books exactly 1 slot using the group id
- You can ask stuff to the TAs even if you do not book (if they are not booked when you want to ask) but if you just want to join the lab session and ask, then the best is to book
- If you have questions about previous labs, do not use booking, only enter and wait for a TA (priority is always given to the current lab)
- If a group fails the lab, the resubmission will be at the next re-exam (for that specific lab)

About the labs

- Groups can sometimes have problems. There is no “retroactive” handling of problems. If a group passes a lab, then there cannot be later discussions as “Student A did all the job for lab i, but we agreed student B was going to do all the job for lab i+1, and then (s)he did not...” All students are expected to participate equally in all labs. If a group has problems, it must share them before uploading any module.
  - Once you create a group, meet (virtually) and plan how you intend to proceed (how each student in the group is going to collaborate and be active in all labs).
- There are a lot of groups, so...
  - Come with a concrete question / doubt. Do not come with a piece of code and ask ”why does it not work?”
  - Check if the FAQ already contains an answer for you!
- For each lab session, we will share zoom link
  - There will be several rooms (one for TA).
  - Groups enter the respective room (depending on the booking)
  - Groups that do not book TAs can anyhow join a session by simply entering a room. TAs will nonetheless give priority to groups that have booked a slot

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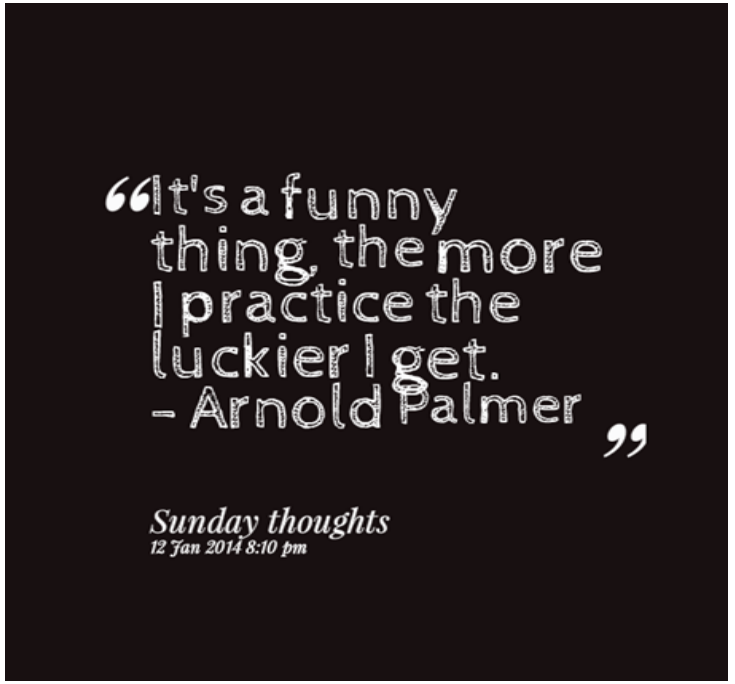
Best Practices

1. Participate to lectures, exercise sessions and labs
    1. Come to classes
    2. Ask when something is not clear
    3. Ask when you have some doubt about what is being discussed
2. Study at pace with classes, do the labs in time
3. Use the book and other material
    1. Read the book
    2. Try the exercises in the book
4. Be nice to future generations
    1. Provide feedback
    2. Evaluate the course!!!
5. Check the updates in the Canvas page
6. Look at messages in Canvas
7. SPECIAL RULE: PLAY WITH UNIX



Best Practices

- Do you know what this is?
  - ls
  - mv *filename1 filename2*
  - chmod *options filename*
  - man *commandname*
  - ls -l | grep "Aug" | sort -n
- Install a virtual machine (e.g., Virtual Box) → Install Unix OS (e.g., Ubuntu) → start playing with commands and system calls

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Student representatives

Can be found on the Canvas page

TASK: responsible for discussing about the course together with the examiner/course responsible and the program board of the program that gives the course, as follows:

1. The student representatives and the course responsible have **two informal meetings during the course**: one in the second study week (get acquainted) and one after approximately half the course (give feedback to the teacher on the progress of the course).
2. After the course, an evaluation questionnaire is sent out. The examiner will get an opportunity to add extra questions to the standard questionnaire.
3. In the middle of the next study period, there will be an **evaluation meeting**: the student representatives and the examiner/course responsible meet the board of the program who gives the course, discussing the course's advantages and potential for improvement.

The student representatives participating in the final meeting get a gift certificate valid at Cremona.

Academic integrity and honesty

Hans Hjelmgren, Head of program EE,
Associate Prof at MC2

Studies

- Incoming student 2016
- Tuition Fees and registration for fee paying students
- The academic year - dates and times
- Course Information
- Degree Certificate
- Examinations
- Incoming exchange students
- Joint rules and directives
- Master's Thesis
- Programme information
- Student work environment
- Study in an exchange programme
- Study results and certificates

Joint rules and directives for the undergraduate programmes

As a student at Chalmers you are covered by rights and rules related to your studies.

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The supreme decision-making body at Chalmers is its board, which on behalf of the University reaches final decisions in dealings between the student and the University.

For the undergraduate programmes, Chalmers has adopted Rules of Procedure and a Disciplinary Code. The President has also decided on guidelines, rules and other regulations for undergraduate programmes.

Swedish law has the principle of public access to official records. Briefly, this means that the public and the media have transparency in Chalmers' activities and have the right to inspect public documents.

Policy documents at Chalmers

- Academic integrity and honesty
- Admission Regulations for Bachelor's (undergraduate) and Master's level (graduate/advanced)
- Complaints
- Directions for the use of the IT-resources
- Guidelines for applying for recognition of entire courses
- Openess and insight
- Local regulations regarding scholarships
- Request for a change of examiner
- Regulations for teaching and research faculty
- Rules of Discipline
- Rules for examinations
- Rules for Master's Thesis
- Rules for payment of tuition fees
- Rules of procedure for undergraduate programmes
- Scholarship regulations

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Academic Honesty and Integrity at Chalmers –

What Are the Rules of the Game?

Academic integrity and honesty

- The document in the previous slide will give you examples of how to use and refer to the knowledge of others.
- We expect you to read the document on *Academic integrity and honesty* and hand it out today!
- In addition to this, we will give you some examples from the document in the following slides

Academic integrity and honesty

To study is to turn the knowledge of others into one's own knowledge.

- An important motivating force behind academic work is "getting the credit" for one's advances
- There are rules for how recognition is paid to the contributions of colleagues and predecessors
- Cheating can be collaborating on a certain assignment beyond the rules of the game, omitting trial experiments that do not "fit in", using aids for an examination assignment that have not been approved, plagiarism

Definition of Plagiarism

"Claiming someone else's work as your own work"

J. Carroll and C.-M. Zetterling,
Guiding students away from plagiarism, KTH, 2009.

Examples of plagiarism

- Hand in someone else's work as your own
- Copy words or ideas from someone else without referring to the source
- Not use quotation marks for words that are cited.
- Excessive borrowing of the structure of a text may also result in plagiarism. Even if you cite your source, do not produce a text that is identical to the original text.

Important

- As the writer you are responsible that your papers do not plagiarize the works of others
- It is customary to be able to discuss an assignment with one's classmates; however, every student must submit his or her answers individually
- For larger project assignments, it is customary that students divide the tasks and then assemble their separately written sections into one larger team report. However, every author is responsible for the *entire* report, i.e. the mistake of one of the authors affects everyone on the team.

URKUND

- Reports are checked for plagiarism in URKUND.
- You submit the report to the teacher’s account at URKUND.
- The teacher gets a report on sections of text that resembles text on the internet and other sources.

You are here to learn!

- You don’t need to know everything from the start
- Always ask your teacher if you are not certain
- You must be able to discuss your *draft* reports and hand-ins without running the risk of being accused of plagiarism and cheating.

Rules of Discipline

Rules of Discipline

- The purpose of the Rules of Discipline is to promote equality between students, good conduct, a good study and social environment and adherence to the rules and directives at Chalmers.

- The Rules of Discipline stipulate the type of conduct and actions that can lead to disciplinary action. In addition, they stipulate the grounds on which disciplinary action may be taken at Chalmers and the procedure for such action.

- You can find the Rules of Discipline and other rules and directives in the Student Portal

Studies

- Incoming student 2016
- Tuition Fees and registration for fee paying students
- The academic year - dates and times
- Course Information
- Degree Certificate
- Examinations
- Incoming exchange students
- Joint rules and directives
- Master's Thesis
- Programme information
- Student work environment
- Study in an exchange programme
- Study results and certificates

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The Disciplinary Committee

The Disciplinary Committee makes decisions regarding disciplinary action.

The Disciplinary Committee at Chalmers consists of:

- two members learned in the law, at least one of whom is a judge
- the Vice-President for undergraduate and master programs
- two faculty members
- two students

Disciplinary action

A student may be warned or suspended if he or she

- attempts to mislead in connection with an examination (=cheating)
- disturbs teaching or an examination
- insults the integrity of other student or employee at Chalmers
- otherwise breaches the Chalmers rules

The Disciplinary Committee can decide on expulsion in very serious case for example if the student is guilty of serious criminal activity

The Disciplinary Committee and its work

- Students, faculty members and other employees are jointly responsible for reporting the matter to the President without delay if there are grounds for suspecting an infringement or other misconduct.

- Once the report has been received by the President, the person to whom the report pertains shall be informed promptly in writing at his or her last known address.

- The student shall be given a copy of the report and have an opportunity to present his or her account of the matter. The student ombudsman shall be provided with a copy of the report and the material from the investigation.

The Disciplinary Committee and its work

- If the student wishes to present a verbal account of the case to the Disciplinary Committee, he or she shall be able to do so.

- The student shall also have the opportunity to be represented by a person whom he or she trusts. The student ombudsman should contact the student to inform him or her about the procedure and the assistance available to the student.

- The Disciplinary Committee should give reasons for any decision.

- The student may appeal to the Chalmers Board against a Disciplinary Committee decision regarding a warning, suspension or expulsion.

Thank you for your attention!

Questions?